“Mitigating corruption in humanitarian logistics: The moderating role of social media in Pakistan’s disaster relief operations”

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MITIGATING CORRUPTION IN HUMANITARIAN LOGISTICS: THE MODERATING ROLE OF SOCIAL MEDIA IN PAKISTAN'S DISASTER RELIEF OPERATIONS

Abstract

Corruption in humanitarian logistics and supply chain management remains a serious issue, especially during disaster relief operations, because it disrupts the fair distribution of aid and increases the hardships of affected communities. This study examines how social media can help reduce corruption in humanitarian logistics and supply chain management during disaster relief operations following the devastating 2022 flood in Pakistan. Using a quantitative research design, data were collected through a structured survey conducted between March and June 2023 targeting 380 individuals across three major flood-affected provinces in Pakistan. The participants included staff and volunteers from local NGOs, government agencies, and international relief organizations directly involved in the flood relief operation. This group was chosen for its firsthand experience in managing and delivering aid during the 2022 floods, making the sample both relevant and informed. The results were analyzed using SmartPLS and SPSS software. The findings show that corruption in HLSCM has a significantly negative impact on the effectiveness of flood relief operations ($\beta = -0.561$; t-value = 9.765; p-value = 0.000). However, social media played a moderating role in this relationship ($\beta = -0.060$; t-value = 1.217; p-value = 0.022), acting as a helpful tool for spreading information, increasing public involvement, and promoting transparency. These insights are useful for donors, disaster management authorities, and aid organizations seeking to improve relief outcomes. This study adds to the current research by showing how social media can help reduce corruption and improve the delivery of aid in the humanitarian logistics of disaster relief operations.

Keywords corruption, logistics, social media, transparency, floods, relief, Pakistan

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INTRODUCTION

Corruption remains an enduring and deeply embedded challenge across various sectors, with detrimental effects acutely evident in humanitarian logistics and supply chain management (HLSCM) (Martin et al., 2023). Humanitarian responses, particularly during large-scale disasters, rely heavily on the rapid and efficient delivery of aid to affected populations. However, corruption undermines this mission, obstructing the smooth functioning of supply chains, distorting resource allocation, and ultimately reducing the effectiveness and timeliness of life-saving interventions (Armijo & Rhodes, 2017). The scientific problem addressed in this study lies in the persistent vulnerability of HLSCM to corrupt practices, particularly during disaster relief operations, and the lack of robust mechanisms to counteract them in high-risk, resource-constrained settings.

The scholars have acknowledged the need for more empirical exploration of the specific manifestations of corruption in HLSCM, including

how it operates at different stages of the supply chain and how its impact can be mitigated (Castro et al., 2020; Guo et al., 2021; Hotho & Girschik, 2019). Corruption in humanitarian operations can take multiple forms, such as bribery in procurement, favoritism in aid allocation, embezzlement of funds, and personal profiteering from donated supplies (Masibo, 2021; Wirtz, 2017). These malpractices not only divert resources away from vulnerable populations but also erode trust in humanitarian organizations and hinder long-term development efforts.

Pakistan presents a particularly relevant context for investigating this issue. In 2022, Pakistan faced one of the most catastrophic floods in its history, driven by unprecedented monsoon rainfall and accelerated glacier melt (Shah et al., 2022). These floods resulted in over 1,700 deaths, displaced more than 8 million people, and caused economic losses exceeding USD 30 billion (The World Bank, 2022). Despite substantial international support, numerous allegations of corruption emerged, especially on social media, regarding the misuse of relief funds and resources. The recurrence of corruption during disaster response is not unique to Pakistan; similar incidents have been reported in Bangladesh, Nigeria, and other parts of South Asia (Shah et al., 2020). These challenges signal a broader need for institutional reform and greater transparency in humanitarian aid delivery.

In this context, social media has emerged as a decentralized tool for public engagement and real-time communication (Guo et al., 2021; Pande & Asthana, 2024). Platforms such as Facebook, Twitter, and Instagram allow affected communities, volunteers, and relief organizations to share updates, coordinate activities, and expose irregularities in aid distribution (Tim et al., 2017). They also provide a space for citizens to demand accountability and spotlight corrupt practices that might otherwise remain hidden.

While the general utility of social media in disaster management is increasingly recognized, its specific role in combating corruption within HLSCM remains underexplored. Although prior studies suggest that social media can promote transparency and reduce corruption by enhancing civic oversight (Janning et al., 2020; Tim et al., 2017), there is a lack of empirical research on its moderating effect, particularly in disaster-prone, high-risk contexts like Pakistan.

By focusing on this intersection, this study offers insights into how digital platforms may influence the integrity and effectiveness of disaster response systems, enrich scholarly understanding, and inform strategies for aid organizations and policymakers alike.

1. LITERATURE REVIEW

Corruption in the HLSCM context is commonly defined as the misuse of delegated power or resources for personal gain, particularly during emergencies when transparency and efficiency are critical (Tunley et al., 2018). It is widely recognized as a major impediment to the effective delivery of humanitarian aid, particularly in low- and middle-income countries where institutional oversight and accountability mechanisms are often weak (Iqbal & Ahmad, 2022). Corruption can manifest in various forms such as bribery, favoritism, embezzlement, and diversion of resources (Silvestre et al., 2018). These practices frequently result in the misallocation of critical supplies, delays in service delivery, and the exclusion of vulnerable populations (Khan et al., 2022). Such challenges become especially acute during large-scale disasters, when the urgency of response, the influx of resources, and limited scrutiny provide fertile ground for corrupt activities.

Prior research has documented the impact of corruption on humanitarian operations in diverse contexts, including conflict zones, refugee crises, and natural disasters. Case studies from Ukraine and Syria have illustrated how political interference, fraudulent procurement, and lack of transparency distorted aid distribution (BouChabke & Haddad, 2021; Martin et al., 2023). Similar patterns have been reported in South Asia, particularly in Pakistan, where previous flood and earthquake relief efforts were marred by nepotism, fa-

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voritism in resource allocation, and manipulation of beneficiary records (Iqbal & Ahmad, 2022; Khan et al., 2022). The persistence of such misconduct is often explained using a framework such as the corruption triangle: opportunity, pressure, and rationalization (Klitgaard, 1988).

In parallel, there is increasing scholarly interest in the role of digital technologies, especially social media, in promoting transparency and accountability in disaster relief efforts (Kumar et al., 2022). Social media platforms enable real-time communication, participatory monitoring, and public reporting, thereby helping reduce information gaps and enhancing visibility into relief operations (Jha & Sarangi, 2017). Empirical studies suggest that such tools can improve situational awareness, facilitate coordination among stakeholders, and amplify the voices of marginalized communities (Kumar et al., 2022; Ogie et al., 2019). More importantly, they may deter corruption by allowing citizens to expose malpractices and pressure authorities to act. During the 2022 floods in Pakistan, for example, digital platforms such as Facebook, Twitter, and YouTube were used to document irregularities in aid delivery, resulting in public outcry and, in some cases, administrative interventions (Iqbal & Ahmad, 2022).

Despite this growing recognition, the interaction between corruption and social media in humanitarian contexts remains underexplored. While it is well understood that corruption can impair the effectiveness of relief operations and that social media can improve transparency, limited empirical evidence exists on how the latter might mitigate the adverse effects of the former. Understanding this interaction is critical, particularly in disaster-prone regions such as Pakistan, where effective humanitarian logistics are vital to minimizing human suffering and economic disruption.

To summarize, the literature identifies two significant but independently studied phenomena: the detrimental impact of corruption on humanitarian logistics, and the potential of social media to foster transparency and civic engagement. However, research examining how social media might moderate the harmful effects of corruption remains limited. By integrating these themes, this study addresses a critical gap in the literature on disaster relief governance and digital accountability.

Therefore, this study aims to investigate the impact of corruption on the effectiveness of humanitarian flood relief operations in Pakistan, with a particular focus on the moderating role of social media. The objective is to determine whether and how social media can weaken the negative effects of corruption in humanitarian logistics by enhancing transparency, accountability, and stakeholder coordination.

To explore this objective, the study builds on existing literature to develop its hypotheses. Corruption in humanitarian logistics undermines trust, reduces the effectiveness of aid delivery, and disproportionately harms vulnerable populations (Transparency International, 2021). In contrast, social media platforms enhance transparency and accountability by enabling real-time information sharing, public scrutiny, and feedback mechanisms (Ogie et al., 2019). During the 2022 floods in Pakistan, citizens used digital platforms to expose corruption, highlight inefficiencies, and mobilize support, prompting corrective actions (Iqbal & Ahmad, 2022). Emerging research suggests that social media may moderate the negative effects of corruption by functioning as a watchdog, narrowing the space for misconduct and improving humanitarian outcomes (Guo et al., 2021; Saroj & Pal, 2020). Based on this foundation, the study proposes the following hypotheses:

H1: Corruption in humanitarian logistics and supply chain management negatively impacts the effectiveness of flood relief operations.

H2: Social media positively influences the effectiveness of flood relief operations.

H3: Social media moderates the association between corruption in humanitarian logistics and supply chain management and the effectiveness of flood relief operations.

Together, these hypotheses form the foundation for the study's conceptual framework. As illustrated in Figure 1, the framework is grounded in principal-agent theory, which explains how power and information imbalances between principals (e.g., donors, organizations) and agents (e.g., local implementers) can incentivize corrupt behavior (Tacconi & Williams, 2020; Walton & Jones,

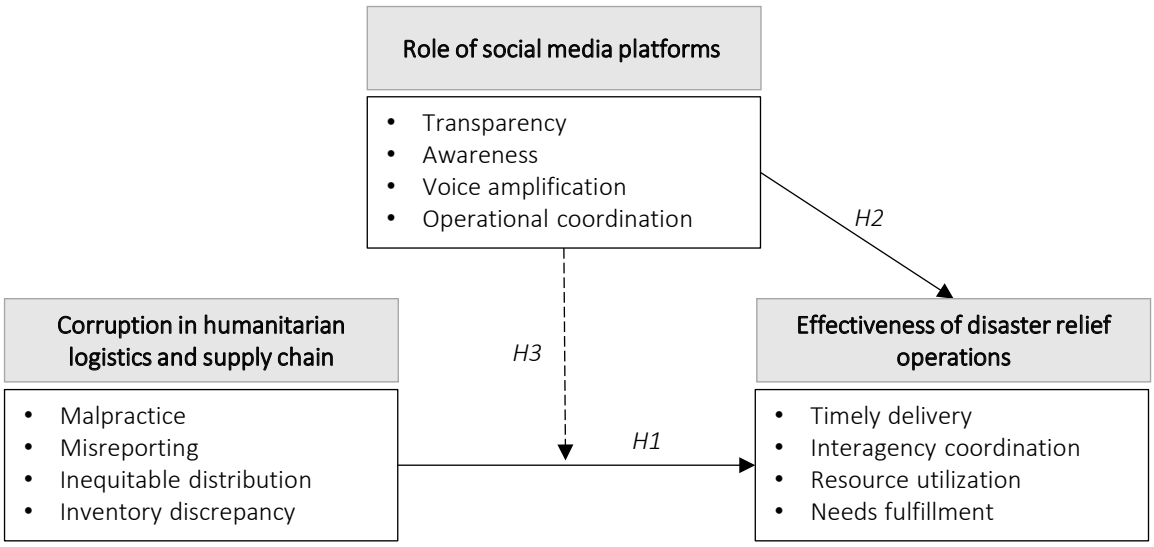

Figure 1. Conceptual framework

2017). In the context of humanitarian logistics, such agency problems may lead to the misuse of resources and undermine relief outcomes. The framework positions corruption in HLSCM as the independent variable affecting the effectiveness of flood relief operations, while social media serves as a moderating factor. Drawing on prior research, social media is seen as a tool that can enhance transparency, facilitate public scrutiny, and improve coordination, thus potentially weakening the adverse effects of corruption.

2. METHODOLOGY

This section outlines the research design, sampling strategy, data collection procedures, instrumentation, and data analysis techniques used in this study. It also covers ethical considerations and provides a demographic profile of the respondents.

2.1. Research design and sampling strategy

This study adopted a quantitative, cross-sectional design to examine the role of social media in mitigating corruption and enhancing the effectiveness of humanitarian logistics during the 2022 floods in Pakistan. Data were collected through a structured survey distributed to relief workers and volunteers actively involved in flood response efforts. These individuals were selected due to their direct exposure to logistical processes and insights into corruption-related challenges.

The 2022 floods displaced over 8 million people and affected six major regions: Baluchistan, Sindh, Khyber Pakhtunkhwa, Gilgit-Baltistan, Azad Kashmir, and Southern Punjab, resulting in approximately 1,700 deaths and damages exceeding USD 30 billion (The World Bank, 2022). The relief operation included thousands of volunteer relief workers from local communities, national and international non-governmental organizations (NGOs), and the workforce of the National Disaster Management Authority (NDMA).

Given the absence of a formal sampling frame and the prevalence of informal volunteer participation, a purposive sampling strategy was adopted. Based on estimated relief personnel participation of 1,400 Red Crescent volunteers (IFRC, 2023), 1,973 army troops, 340 air force members, and 200 navy members (OCHA, 2022), a sample of 900 respondents were targeted, distributed equally across the six regions (150 per region). Data were collected using an online survey administered between March and June 2023. Participation was voluntary and anonymous.

To determine the minimum sample size required for structural equation modeling, Hair et al. (2017) recommended the 10:1 ratio rule, which involves collecting 10 responses per indicator. This criterion has been employed by numerous researchers in multivariate analysis. Thus, a minimum sample size of 120 responses was deemed appropriate for this study.

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2.2. Questionnaire development

The questionnaire was designed following the guidelines by Saunders et al. (2016). It comprised four sections: demographic data and three latent constructs, namely corruption in humanitarian logistics, social media engagement, and effectiveness of flood relief operations. These constructs were selected based on theoretical and practical relevance to the objectives of this study, which was to understand how social media can mitigate corruption and improve the effectiveness of humanitarian logistics. The measurement scales for the latent variables were adapted from prior validated scales, and all items were adapted to reflect the flood-relief context in Pakistan and reviewed for face validity. Modifications included changing terminology to match local disaster relief terms, incorporating culturally relevant examples, and simplifying language for clarity among respondents with varying education levels. A total of four items per construct were retained to ensure content validity while avoiding respondent fatigue. Specifically, the scale for corruption in humanitarian logistics was developed based on the relevant study by BouChabke and Haddad (2021); the scale for flood relief operations effectiveness has been extracted from Khan et al. (2019) and Han et al. (2019); and the role of social media has been adapted from Crumbly and Carter (2015) and Kumar et al. (2022). All items were measured on a five-point Likert scale, ranging from 1 ("strongly disagree") to 5 ("strongly agree"). This format is widely used in social science research for its ability to capture varying intensities of perception while remaining user-friendly for participants. The specific items used are presented in Table 2.

Prior to final distribution, the survey instrument was assessed for face and content validity by three supply chain management experts. A pilot test with 20 respondents led to refinements in item clarity and structure. The reliability and validity of all the scales were confirmed in the final data analysis. The reliability was assessed through factor loading, Cronbach's Alpha, and composite reliability during confirmatory factor analysis. While the convergent validity of the scales was ensured through the comparison of average variance extracted and composite reliability, the discriminant validity was assessed through the Heterotrait-Monotrait Ratio of Correlations (HTMT). The reliability and validity results are presented in section 4.

The final dataset was analyzed using SPSS and SmartPLS. SPSS was utilized for examining demographic and descriptive statistics, as well as testing data normality. The results of the normality test revealed a non-normal distribution of the data. In such instances, Hair et al. (2017) recommend employing the Partial Least Squares (PLS) approach to Structural Equation Modelling (SEM), known for its effectiveness in handling non-normally distributed datasets. This approach has been employed by numerous other scholars.

Of 900 respondents, 380 complete responses were received, resulting in a response rate of 42.2%. This sample size is considered suitable as it exceeds the minimum requirement. The demographic statistics of the respondents are presented in Table 1.

Table 1. Demographic analysis

Attributes	Distribution	Frequency	Percent
Gender	Male	256	67.4%
	Female	124	32.6%
Age	18-26 years	71	18.7%
	27-35 years	117	30.8%
	36-50 years	129	33.9%
	Above 50 years	63	16.6%
Qualification	High school or below	27	7.1%
	Secondary education	94	24.7%
	Bachelor's degree	147	38.7%
	Master/PhD	112	29.5%
Experience	Less than 2 years	60	15.8%
	2-5 years	89	23.4%
	6-10 years	134	35.3%
	More than 10 years	97	25.5%
Organization	Government agency	141	37.1%
	Local NGO	101	26.6%
	International NGO	46	12.1%
	Volunteer	92	24.2%
N		380	100%

Table 1 presents the demographic profile of the 380 respondents involved in humanitarian flood relief operations in Pakistan. The sample was predominantly male (67.4%) and primarily within the 27-50 age range. The relatively lower female participation (32.6%) in relief efforts aligns with the study's context, where men predominantly manage humanitarian logistics (Aamer, 2022). Most participants held at least a bachelor's degree (68.2%), with nearly one-

third (29.5%) holding a master's or doctoral qualification. In terms of experience, a majority had over five years of professional involvement in the field. Respondents represented a diverse range of organizations, including government agencies (37.1%), local NGOs (26.6%), international NGOs (12.1%), and volunteer groups (24.2%), reflecting a broad cross-section of actors engaged in humanitarian logistics.

2.3. Ethical considerations

This study involved human participants and was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Ethical approval was granted by the Institutional Review Board of Imam Abdulrahman Bin Faisal University (Certificate No. IRB-2024-14-303). Participation was voluntary, with all respondents providing informed consent before beginning the survey. Anonymity and impartiality were ensured by avoiding the collection of identifiable data and maintaining confidentiality throughout the study. Respondents were informed of their right to withdraw at any point without consequence.

3. RESULTS

The final data analysis was performed in two essential steps: measurement model assessment, and path model assessment. The measurement model assessment involved scrutinizing the reliability and validity of the scales, while the path model assessment centered on hypotheses and overall model testing.

3.1. Reliability and validity of measurement scales

According to Hair et al. (2017), establishing the validity and reliability of measurement scales for each latent construct is a critical prerequisite for conducting path model assessments in multivariate analysis. In this study, reliability is demonstrated through factor loadings greater than 0.70, Cronbach's Alpha values exceeding 0.60, and Composite Reliability (CR) scores above 0.70. Convergent validity is confirmed by Average Variance Extracted (AVE) values above 0.50 and by ensuring that CR values surpass their corresponding AVEs. Discriminant validity is assessed using the Heterotrait-Monotrait (HTMT) ratio of correlations, which provides a robust criterion for evaluating the distinctiveness of the constructs.

3.2. Convergent validity

Table 2 presents the reliability and convergent validity statistics. It is observed that both the factor loadings and Cronbach's Alpha values for all latent variables surpass the threshold values, indicating the reliability of the measurement scales. Furthermore, the composite reliability and AVE scores also exceed their respective threshold values (0.70 and 0.50), and all CR values are greater than the corresponding AVE score. This establishes the convergent validity of the latent variables, confirming that each indicator of the measurement scales effectively measures its corresponding variable.

3.3. Discriminant validity

The discriminant validity was ensured through the HTMT criterion introduced by Henseler et al. (2015), which is more effective and stringent than traditional methods like Fornell and Larcker (1981). According to this criterion, for each latent variable, the value should be below 0.85 to establish the discriminant validity of the measurement scales. Table 3 displays the HTMT values of la-

Table 2. Convergent validity and reliability

Measurement scales		Outer loadings	Cronbach's Alpha (α)	Composite Reliability (CR)	Average Variance Extracted (AVE)
Corruption in HLSCM					
CLS1	I am aware of complaints from beneficiaries reporting malpractices in relief operations.	0.752	0.835	0.873	0.578
CLS2	I have observed discrepancies between recorded and actual stock levels in the inventory.	0.766			
CLS3	I believe the distribution of aid is inequitable among all beneficiaries.	0.877			
CLS4	I think reports on aid distribution appear to be manipulated.	0.871			

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Table 2 (cont.). Convergent validity and reliability

	Measurement scales	Outer loadings	Cronbach's Alpha (α)	Composite Reliability (CR)	Average Variance Extracted (AVE)
Flood relief operations effectiveness					
	During the flood relief operation ...		0.855	0.856	0.594
FRO1	Essential supplies were delivered to affected people on time.	0.801			
FRO2	The government, NGOs, local authorities, and international organizations cooperated well.	0.745			
FRO3	Resources were managed well to ensure maximum reach.	0.721			
FRO4	The basic needs of the affected population (food, clean water, shelter, and medical care) were successfully met.	0.812			
Role of social media					
	During the flood relief operation...		0.843	0.851	0.579
RSM1	Social media platforms helped in coordinating relief efforts efficiently.	0.792			
RSM2	Social media campaigns raised awareness about the needs of the affected population.	0.843			
RSM3	Social media provided a platform for affected individuals to voice their concerns.	0.722			
RSM4	Social media helped bring transparency to the operations due to regular public updates.	0.714			

Table 3. Discriminant validity through HTMT

	Latent variables	1	2	3	4
1	Corruption in HLSCM				
2	Flood relief operation	0.577			
3	Role of social media	0.316	0.338		
4	Role of social media x corruption in HLSCM	0.372	0.182	0.289	

tent variables, with the highest value being 0.577. Importantly, all HTMT values are considerably below the threshold value of 0.85, confirming the discriminant validity of the measurement scales and indicating that the model does not suffer from collinearity issues.

3.4. Path model analysis

Path model analysis focuses on evaluating the structural relationships among latent variables and the proposed hypotheses. The credibility of this analysis depends on the established reliability and validity of the measurement model. Key indicators used in this evaluation include the coefficient of determination (R^2) and path coefficients (β), capturing both direct and moderating effects. The R^2 value reflects the extent to which the model explains variation in the dependent variable. As shown in Table 4, corruption in HLSCM, along with the role of social media, accounts for approximately 37% of the variance in the effectiveness of flood relief operations. R^2 values below 10% are considered weak, values above 10% are modest, those above 50% are moderate, and values exceeding 75% indicate strong explanatory power. In this study, corruption negatively influences the effectiveness of relief efforts, while social media plays a moderating role in mitigating this adverse impact. It is worth noting that without the presence of this moderating effect, the model's explanatory power might have reached a moderate or high level.

Table 4. Coefficient of determination through R^2

	R^2	Variance explained
Flood relief operations effectiveness	0.374	37%

Path coefficient analysis, presented in Table 5, evaluates the causal relationships between independent and dependent variables using regression weights. It is used to test the research hypotheses and assess the overall model by examining the influence of the predictors. The significance of the standardized path coefficients is determined by

Table 5. Hypotheses testing

Hypothesized paths	Path coefficient (β)	t-statistics	p-values	Decision
H1: Corruption in HLSCM → Flood relief operation effectiveness	–0.561***	9.765	0.000	Supported
H2: Role of social media → Flood relief operation effectiveness	0.191***	3.194	0.001	Supported
H3: Role of social media x Corruption in HLSCM → Flood relief operation effectiveness	–0.060**	1.217	0.022	Supported

Note: ** indicating significance at 5%, *** indicating significance at 1%.

their corresponding t-values and p-values within specific confidence intervals. At the 90% confidence level, a t-value of ±1.64 with $p < 0.10$ is considered significant; at the 95% level, a t-value of ±1.96 with $p < 0.05$; and at the 99% level, a t-value of ±2.58 with $p < 0.01$ indicates statistical significance.

The path analysis results provide clear evidence supporting all three hypothesized relationships in the study. First, the analysis confirms that corruption in humanitarian logistics and supply chain management significantly and negatively affects the effectiveness of flood relief operations ($\beta = -0.561$, $t = 9.765$, $p < 0.001$). This strong negative path coefficient indicates that higher levels of corruption are associated with a substantial decline in the quality and success of relief efforts. Second, the role of social media shows a statistically significant and positive influence on relief operation effectiveness ($\beta = 0.191$, $t = 3.194$, $p = 0.001$), suggesting that social media contributes meaningfully to improving coordination, awareness, and transparency in relief processes. Third, the interaction effect between social media and corruption reveals a small but significant moderating role ($\beta = -0.060$, $t = 1.217$, $p = 0.022$). This indicates that while corruption adversely impacts relief outcomes, the presence and effective use of social media can help reduce this negative effect, likely by enhancing oversight, public accountability, and information flow. Collectively, these findings underscore the critical dual role of social media in both directly enhancing operational effectiveness and indirectly mitigating the detrimental effects of corruption in crisis management contexts.

4. DISCUSSION

This study aimed to examine the impact of corruption in HLSCM on the effectiveness of flood relief operations in Pakistan and to explore the moderating role of social media in this relationship. Given the frequency and intensity of natural disasters in the region and the persistent issues of corruption and weak governance, the research sought to generate empirical insights into how these factors interact and influence humanitarian outcomes. The results confirm that corruption in HLSCM significantly undermines the effectiveness of flood relief operations ($\beta = -0.561$, $p < 0.01$), while social media plays a dual role: positively influencing relief outcomes directly ($\beta = 0.191$, $p < 0.01$) and moderating the adverse effects of corruption ($\beta = -0.060$, $p = 0.022$).

These findings support our first hypothesis and align with earlier empirical research suggesting that corruption has wide-ranging negative effects across social, economic, political, and environmental domains (Armijo & Rhodes, 2017; BouChabke & Haddad, 2021; Tawiah et al., 2024). In our context, corruption led to inefficiencies such as delays, misallocation of resources, and reduced public trust, all of which constrained relief operations. This supports the assertions of prior studies that have emphasized the detrimental role of corruption in HLSCM (Khan, 2018; Maxwell et al., 2012). Specifically, our findings echo Iqbal (2020), who identified a lack of transparency as a core issue in ineffective humanitarian responses, and Francis and Armstrong (2011), who highlighted how corruption damages the credibility of humanitarian organizations.

The results further validate our second and third hypotheses by demonstrating the positive influence of social media in both improving operational effectiveness and mitigating corruption's impact. This confirms Guo et al. (2021) argument that social media campaigns can expose and combat corruption in real time. Our data suggest that where social media is active, it facilitates public scrutiny, encourages transparency, and enables

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more efficient distribution of relief services. This interpretation is consistent with Enikolopov et al. (2018), who found that social media increases public awareness and disseminates unfiltered information, enhancing oversight of relief operations. Similarly, Ogie et al. (2019) emphasized how digital engagement allows affected communities and observers to understand and respond to needs such as evacuation, food, shelter, and medical care. These parallels reinforce our conclusion that social media serves as an important mechanism for transparency in flood response efforts.

Our findings also resonate with Bennet (2015), who noted that social media enables citizens to report irregularities and demand accountability from authorities. Likewise, Jha and Sarangi (2017) showed how social media enhances donor confidence by improving information quality and transparency, which is essential in environments where corruption is prevalent. These studies offer strong support for our claim that social media not only enhances the visibility of corruption but also contributes to more effective relief outcomes by pressuring stakeholders to act responsibly.

However, our findings also reflect some limitations in the influence of social media, particularly in regions with limited connectivity. Ullah et al. (2020) observed that restricted internet access in remote areas of Sindh and Baluchistan hinders the full potential of social media to expose corruption and support transparency. This contextual constraint aligns with our observation that the effectiveness of social media as a moderating tool is uneven across geographic areas.

Overall, while our results are largely in line with the existing literature, they also offer new empirical evidence from a high-corruption, disaster-prone context like Pakistan. By directly linking corruption in HLSCM to relief outcomes and demonstrating how social media moderates this relationship, this study contributes to both theoretical understanding and practical strategies for improving humanitarian operations in complex environments, as discussed further.

This study highlights the pivotal role of social media in mitigating corruption and enhancing the effectiveness of HLSCM during flood relief operations in Pakistan. Given the significant negative impact of corruption on relief outcomes and the moderating effect of social media observed in our results, it is essential for government bodies and disaster response organizations, particularly the National Disaster Management Authority, to institutionalize the use of social media as a tool for transparency and accountability. Relief agencies should establish official, verified social media platforms and real-time communication centers to facilitate two-way engagement with the public. These channels can be instrumental in enabling whistleblowing, sharing real-time updates, and documenting irregularities during relief operations. However, to minimize misinformation risks, it is imperative to implement robust content verification systems, potentially supported by AI-based fact-checking tools.

Furthermore, enhancing digital infrastructure in remote and underserved regions (e.g., parts of Sindh and Baluchistan) is crucial to ensure equitable access to these digital tools and maximize social media's anti-corruption potential. The findings also support integrating advanced technologies such as artificial intelligence and big data analytics into relief logistics for predictive resource allocation, anomaly detection, and operational optimization. Besides, the promotion of gender-inclusive practices, such as increasing women's participation in planning and executing relief operations, can improve responsiveness and reduce corruption vulnerabilities by fostering more representative and transparent decision-making.

This study extends the theoretical discourse on HLSCM by empirically examining the adverse effects of corruption on flood relief operations within a high-risk, governance-challenged context. While previous literature has discussed corruption in humanitarian settings, few studies have quantitatively assessed its operational impact in disaster-prone regions like Pakistan. By doing so, this research fills an important empirical and contextual gap. A key theoretical contribution of this study lies in identifying social media as a significant moderating mechanism that mitigates the negative relationship between corruption and relief effectiveness. This finding introduces a novel dimension to the HLSCM literature, suggesting that digital platforms can serve as tools for insti-

tutional accountability and transparency. In contrast to prior work that treats communication technologies as peripheral, our results position social media as a central variable influencing humanitarian outcomes.

Lastly, by focusing on a developing-country context characterized by recurring natural disasters, this study lays the groundwork for comparative theoretical work across different governance systems and disaster types. Future research could build on this by exploring how other digital tools (e.g., blockchain, and open data platforms) interact with institutional variables to shape disaster relief effectiveness.

Despite offering meaningful insights, this study has several limitations that provide directions for future research. First, it focused only on the role of social media in addressing corruption during flood relief operations in Pakistan. Future studies could explore other disaster types or examine similar issues in different countries to improve the generalizability of findings. Second, the research covered selected flood-affected regions, including Baluchistan, Sindh, Khyber Pakhtunkhwa, Gilgit Baltistan, Azad Kashmir, and southern Punjab. A broader national study involving more diverse regions could offer deeper insights into regional variations. Third, although the sample size of 380 was sufficient, future research could include a larger and more diverse group of respondents, such as disaster victims, aid workers, donors, and officials, to enhance representativeness. Finally, the model explains 37 percent of the variation in relief operation effectiveness, suggesting that other factors also play a role. Future studies should examine additional variables using qualitative or quantitative methods to develop a more comprehensive understanding.

CONCLUSION

This study explored how corruption within humanitarian logistics and supply chain management (HLSCM) impairs the effectiveness of flood relief operations in Pakistan and assessed the moderating role of social media in this dynamic. Using survey data from 380 professionals engaged in relief activities across flood-affected provinces, the findings offer empirical validation that corruption significantly hampers aid delivery, operational efficiency, and equitable resource allocation. At the same time, social media emerged as a crucial enabler, both directly improving relief effectiveness and weakening the adverse impact of corruption. These results emphasize the dual function of social media as a coordination platform and an accountability mechanism. By facilitating real-time information sharing, mobilizing public oversight, and amplifying citizen voices, digital platforms contribute to greater transparency, responsiveness, and trust in humanitarian operations. The study contributes theoretically by applying principal-agent theory to a disaster logistics context, illustrating how power and information asymmetries create space for corruption, while technology can rebalance these dynamics.

Practically, the findings underscore the need to institutionalize the use of social media in disaster response frameworks. Policymakers and humanitarian agencies should invest in digital infrastructure and integrate social media strategies into operational protocols to monitor aid flow, deter misconduct, and engage stakeholders proactively. Future research should adopt longitudinal and mixed method approaches to assess how these dynamics evolve across different disaster types and geopolitical contexts. Further exploration of complementary technological tools, such as blockchain or AI-powered monitoring systems, could also advance anti-corruption efforts in humanitarian supply chains.

AUTHOR CONTRIBUTIONS

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