The Role of ICT MNCs in Climate Adaptation Through Disaster Response: Motivations, Technology, and Climate Security Implications

by

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Author's Declaration

This thesis consists of material all of which I authored or co-authored: see Statement of Contributions included in the thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Statement of Contributions

Joe Yousr Battikh was the sole author of Chapters 1 and 5, which were written under the supervision of Dr. Michael O. Wood and were not written for publication.

This dissertation consists of three co-authored manuscripts, Chapters 2, 3, and 4, which were written for publication. As the lead author of these three chapters, I was responsible for the conceptualization of the research and theoretical framework, methodology design, data collection and analysis, and manuscript writing and visualization. My co-authors undertook a supervisory and support role throughout all research stages, including providing critical feedback, data validation, methodological guidance, and review of all original and revised drafts.

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Abstract

Climate change is intensifying the frequency and severity of natural disasters with devastating effects, particularly in developing countries where vulnerabilities are amplified, while traditional disaster management and governance systems are increasingly overstretched. These climate-driven crises, which cost billions and displace millions annually, demand urgent adaptation to mitigate their catastrophic impacts on fragile societies. Multinational corporations (MNCs), especially those from the Information and Communications Technology (ICT) sector, are emerging as critical actors in disaster response, leveraging their resources and expertise to support relief and recovery efforts. This dissertation examines the role of ICT MNCs in addressing natural disasters, and explores their interventions, motivations, and potential to mitigate climate security risks by enhancing resilience in vulnerable regions. Through a multi-method approach, including bibliometric analysis, content analysis of sustainability reports, and a qualitative case study, this research reveals the growing involvement of ICT MNCs in disaster response by utilizing their technological capabilities to bridge critical gaps. However, a concerning geographical disparity is identified with declining corporate engagement in developing countries, despite their increased vulnerability. The case study of ICT MNCs' response to the 2024 Cyclone Hidaya floods in Kenya proposes the empirically grounded TEC Response framework (Triggering response–Engagement motivation–Championing technology), illustrating how corporate interventions are triggered by local presence, driven by a complex interplay of corporate social responsibility (CSR), ethical imperatives, and strategic interests, and implemented by leveraging core technological competencies. This dissertation affirms established CSR theory and contributes novel empirical insights to private governance scholarship by providing empirical evidence of the strategic and ethical dimensions of MNC involvement in disaster contexts and by highlighting their voluntary, uneven, and often unaccountable role in disaster governance, including their capacity to mitigate or inadvertently reinforce climate-induced vulnerabilities. The findings offer practical insights for policymakers and MNCs, emphasizing the importance of cross-sector collaboration, technological integration, and long-term resilience-building to enhance equitable and sustainable disaster management and climate adaptation efforts while addressing critical gaps in mitigating climate-induced vulnerabilities in fragile settings.

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List of Abbreviations

Artificial Intelligence	AI
Corporate Social Responsibility	CSR
Disaster Management	DM
Disaster Risk Management	DRM
Disaster Risk Reduction	DRR
Disasters triggered by natural hazards	DTNH
Fortune Global 500	FG500
Geographic Information Systems	GIS
Gross Domestic Product	GDP
Human Development Index	HDI
Information Communication Technology	ICT
Intergovernmental Panel on Climate Change	IPCC
Multinational Corporations	MNCs
Non-Governmental Organizations	NGOs
United Nations	UN
United Nations Framework Convention on Climate Change	UNFCCC

Chapter 1

Introduction

Climate change is intensifying the frequency and severity of extreme weather events, driving a surge in cyclones, floods, droughts, and wildfires that strain global societies and economies. These events, costing billions annually and displacing millions, act as a "threat multiplier", exacerbating vulnerabilities, particularly in developing nations where 83% of disaster-affected individuals reside (UNDRR, 2020). With traditional disaster governance and response systems overstretched, Multinational Corporations (MNCs), particularly from the Information and Communications Technology (ICT) sector, are emerging as critical actors, leveraging their resources and expertise to support relief and recovery efforts. However, as their engagement expands beyond traditional corporate social responsibility (CSR) into governance-like roles, ICT MNCs increasingly influence response coordination and resource allocation without being formally embedded in disaster governance systems, raising critical questions about accountability, legitimacy, and equity (Cutler et al., 1999; Green, 2014). Initially, this dissertation was conceived to examine the extent of the role of MNCs in mitigating security threats related to climate change and natural disasters through their participation in disaster management and emergency response activities in developing countries. This reflects a growing body of literature on how environmental stressors amplify security risks in fragile regions (Berrebi & Ostwald, 2013). However, as the research deepened with greater scope and rigor, a significant gap emerged in understanding how ICT MNCs contribute across the broader spectrum of disaster management, as defined for this dissertation in the section below, highlighting the need for a thorough investigation to build a solid foundation that connects their actions to broader climate security challenges. This research addresses this gap by examining the evolving corporate–disaster–security nexus, emphasizing the motivations, mechanisms, and governance implications of ICT MNC involvement in disaster contexts. This dissertation thus explores the role of ICT MNCs in addressing natural disasters by examining their technological interventions, partnerships, and geographical focus. It builds an empirical foundation for understanding how ICT MNCs' actions within integrated disaster management

frameworks intersect with global climate adaptation and security agendas in vulnerable regions. Ultimately, it offers a conceptual and empirical contribution to the study of corporate social responsibility, disaster management, and climate security, positioning ICT MNCs as consequential actors in shaping resilience, accountability, and equity in an era of accelerating climate change.

1.1 Research Background

There is increasing evidence that climate change is intensifying the frequency and magnitude of extreme weather events, which has profound implications for global stability and resilience. As articulated in reports such as the IPCC's Sixth Assessment Report (2023), scientific consensus underscores how rising global temperatures drive more frequent and severe cyclones, floods, droughts, and wildfires. Warmer ocean surfaces, for instance, fuel the intensification of tropical cyclones, while increased atmospheric moisture capacity exacerbates rainfall and flooding. These phenomena significantly strain societies and economies, displacing populations, disrupting livelihoods, infrastructure, and food security on an unprecedented scale. For example, in 2024, global natural disaster events driven by hurricanes and severe convective storms caused economic losses of $ 368 billion (AON, 2025). Socially, the repercussions are equally severe. According to the Internal Displacement Monitoring Centre (2024), over 26.4 million people were internally displaced in 2023 alone because of weather-related disasters. Furthermore, the number of people living in flood-prone areas increased by 20-24 percent worldwide between 2000 and 2015 (Tellman et al., 2021). This natural disaster, in particular, greatly endangers public health because of infectious waterborne disease outbreaks, such as cholera (Lynch et al., 2025), and disproportionately affects vulnerable populations, particularly low-income areas with insufficient infrastructure and limited healthcare access (Acosta-España et al., 2024). These events are not isolated anomalies but part of a broader trend where climate change acts as a "threat multiplier," exacerbating existing vulnerabilities, introducing new challenges to human and ecological systems worldwide, and presenting significant and profound security implications for individuals, future generations, international institutions, and states, demanding urgent attention to the interplay of environmental degradation and human vulnerability (Hardt et al., 2023).

In the context of developing countries, natural disasters have profound consequences, primarily due to their heightened vulnerability and limited capacity to respond effectively. These nations experience a disproportionate impact, suffering greater human and economic losses compared to developed countries. According to the UNDRR (2020), 83% of disaster-affected individuals resided in developing nations. Moreover, when considering economic losses as a percentage of Gross Domestic Product (GDP), there is a significant disparity, with low-income countries experiencing losses three times higher than high-income countries. These events exacerbate existing challenges, such as food and water scarcity, infrastructure damage, and economic instability, potentially leading to social unrest and conflict. Despite contributing minimally to global greenhouse gas emissions, developing countries bear a disproportionate burden of the consequences of climate change, often lacking the adaptive capacity to recover swiftly or mitigate future risks. Effective disaster management becomes essential to prevent further destabilization and loss as these vulnerabilities intensify. Furthermore, in conflict-affected areas, where institutions and essential services are weakened and communities are marginalized, climate change compounds the existing challenges. Conflicts not only disrupt people's coping mechanisms but also cause environmental damage, which limits their ability to adapt to climate change. This vulnerability is reflected in the ND-GAIN Index (2024), which summarizes countries' vulnerability and readiness to adapt to climate change. According to the International Committee of the Red Cross (ICRC, 2022), 14 of the 25 most climate-vulnerable and least ready to adapt to climate change countries are in conflict-affected situations. These countries face heightened risks due to weakened societal foundations, undermining their capacity for climate adaptation and response.

Country	**Conflict-Affected?**	**Country**	**Conflict-Affected?**
Afghanistan	Yes	Liberia	Yes
Angola	No	Madagascar	No
Bangladesh	No	Malawi	No
Benin	No	Mali	Yes

Burundi	Yes	Micronesia, Federated States of	No
Central African Republic	Yes	Niger	Yes
Chad	Yes	Papua New Guinea	No
Comoros	No	Sierra Leone	No
Congo	No	Somalia	Yes
Congo, the Democratic Republic of	Yes	Sudan	Yes
Eritrea	Yes	Yemen	Yes
Guinea-Bissau	Yes	Zimbabwe	No
Haiti	Yes		

Table 1.1: Countries that are most vulnerable and least ready to adapt to climate change - (Source: ICRC, 2022)

Traditionally tasked with disaster response, governments and humanitarian organizations in these regions are increasingly overstretched, grappling with limited resources and the capacity to meet escalating demands (Barnett & Walker, 2015; Cairns, 2012). Disasters are becoming more frequent and complex, outpacing the capacity of traditional response mechanisms (Kent, 2006; Suarez, 2015). As a result, the gap between the funds available for humanitarian aid and estimated global needs continues to increase. According to Barnett & Walker (2015), in 2013 the gap between the funds available for humanitarian aid and estimated global needs reached $4.5 billion, leaving at least one-third of the demand unmet. Ten years later, by 2023, the gap between needs and available funding had increased to nearly $32 billion (OCHA, 2023; Tridimas, 2025). This downward trend in funding is likely to continue as the costs of disaster response rise with the increasing severity of climate change impacts, particularly extreme weather events.

In this context, multinational corporations are gradually becoming noticeable actors, expanding their involvement across the disaster management spectrum, from preparedness and response to recovery and risk reduction, often partnering with governments and NGOS (Haigh & Sutton, 2012; Izumi & Shaw, 2015; Johnson et al., 2011; Lüttenberg et al., 2025). With their

substantial financial resources, technological expertise, and global networks, MNCs bring unique capabilities to disaster response, including swift resource mobilization and operational reconfiguration (Ballesteros, 2019). Driven by various motivations including social values, disaster sensitivity, and perceived benefits, their participation has been shown to accelerate disaster relief and enhance national recovery (Ballesteros et al., 2017). This shift reflects a broader evolution in disaster management dynamics, where private sector involvement is no longer supplementary but integral to multi-actor, whole-of-society approaches promoted by frameworks such as the Sendai Framework for Disaster Risk Reduction (UNISDR, 2015), particularly in regions where climate change amplifies both environmental and security challenges (Johnson & Abe, 2015; Murphy et al., 2022; Pulhin-Yoshida et al., 2021).

This dissertation aims to identify and evaluate the role of multinational corporations in disaster response, particularly those from the ICT sector. More specifically, this research explores ***how*** MNCs address the immediate impacts of natural hazards, their type of interventions (the '***what***'), and their motivations (the '***why***'). By analyzing academic literature, corporate sustainability reports, and through a case study from a recent disaster event, this research will try to assess the effectiveness of corporate contributions to affected regions. Furthermore, it will consider whether these efforts have the potential to mitigate climate security risks by strengthening community resilience, improving access to critical resources, or enhancing government capacity. This work aims to provide a contribution to understanding the intersection of corporate action, disaster management, and security, offering insights into how MNCs can be leveraged to build a more secure and resilient future in climate-vulnerable contexts.

1.2 CSR

This dissertation employs interdisciplinary concepts to enhance the understanding of MNCs' roles as stakeholders in responding to natural disasters to mitigate climate security. Interdisciplinary research, defined as the integration of knowledge, methods, and perspectives from multiple academic disciplines, enables a comprehensive analysis of complex challenges (Klein, 1990). Specifically, this dissertation examines the intersection of CSR, disaster management, and climate security, drawing on theoretical and empirical insights from these

fields to clarify the strategic and operational roles of MNCs' disaster response efforts and their broader implications for climate resilience.

The field of CSR evolved, transitioning from a focus on profit maximization to an ethical, social, and strategic necessity that is integral to modern business practices, influenced by changing societal expectations (Latapí Agudelo et al., 2019). Early debates, such as Friedman's (1970) profit-maximization principle, set the stage for CSR's development, followed by Freeman's (1984) stakeholder theory that reframed firms' obligations to include various groups like communities and employees (Cochran, 2007). In the context of humanitarian crises and natural disasters, CSR assumes greater importance, moving beyond discretionary philanthropy to become a strategic imperative. While frameworks like Carroll's (1991) pyramid of corporate social responsibility positioned philanthropic activities as a discretionary layer of corporate responsibility, the escalating impacts of disasters have blurred the lines between ethical obligations, strategic interests, and societal expectations (Bansal & Song, 2017). Porter and Kramer's (2006) shared value framework suggests that addressing societal needs, such as disaster resilience, can create competitive advantages, thus aligning social responsibility with business objectives (Lee, 2008). As CSR becomes integral to core business strategies, influenced by stakeholder theory and ethical considerations, the literature has evolved from "whether to" implement CSR to "how to" do so effectively, emphasizing practical mechanisms like stakeholder engagement and sustainability metrics (Croker & Barnes, 2017). This evolution underscores the growing recognition that corporations can play a critical role in addressing profound disruptions, such as those caused by natural disasters (Crane et al., 2008; Hotho & Girschik, 2019; Marrewijk, 2003). This strategic evolution of CSR increasingly intersects with private governance literature, where MNCs exercise authority in public-good provision domains such as Disaster Risk Reduction (DRR) without formal public delegation, raising critical concerns about accountability and legitimacy (Cutler et al., 1999; Green, 2014).

1.3 Disaster Management

The United Nations defines a natural disaster as a "serious disruption to the functioning of society, causing widespread human, material, or environmental losses which exceed the ability of affected society to cope using only its own resources" (United Nations, 1992, p. 27). Since

then, the definition evolved from natural disaster to natural hazard (Montz et al., 2017; UNDRR, 2020), despite the fact that scholars consistently noting the absence of consensus on what constitutes a disaster (Oliver-Smith, 2005; Perry, 2007). This shift in terminology reflects a significant change in understanding and management of these events. Rather than being viewed as environmental events, disasters are now recognized as the outcome of hazards interacting with human vulnerability, shaped by social, economic, and political conditions (Blaikie et al., 2005; UNDRR, 2022; White et al., 2001). This paradigm shift marks a movement away from event-focused and physical cause explanations to a comprehensive understanding of disasters as socially constructed phenomena resulting from poorly managed risk. Natural hazards are classified into six categories: 1) geophysical (e.g., earthquake, volcanic activity), 2) hydrological (e.g., flood, landslide), 3) meteorological (e.g., storm, extreme temperature), 4) climatological (e.g., drought, wildfire), 5) biological (e.g., animal incident, disease), and 6) extraterrestrial (e.g., impact) (EM-DAT, 2023; IRDR, 2014). In this dissertation, the terminology "natural disaster" will be reserved for natural hazards-related disasters, excluding biological and extraterrestrial disasters, and will be used since it is the term that is widely used in corporate sustainability reports.

Early scholarship and practice in the field of disaster management (DM) focused on the processes associated with preparing for, responding to, and recovering from disasters after they occur (Gunn, 1992). This reactive approach often prioritizes immediate response, mostly involving emergency services and immediate recovery efforts. While such approaches are essential in delivering immediate relief, they have been criticized for being reactive, resource-intensive, and unsustainable because they often address the symptoms of disasters rather than their systemic causes (Sawalha, 2023). This reactive framing, while critical for immediate relief, positioned governments as the central and often sole actors in disaster response. As demands grew, this model increasingly revealed limitations in sustainability, legitimacy, and capacity. Significant disasters and the rising frequency and scale of climate-related events have highlighted that vulnerabilities arise not only from natural hazards but also from societal factors. This recognition prompted a shift towards a more proactive and holistic approach that focuses on reducing risks and vulnerabilities before disasters occur by addressing their

underlying causes, such as risk assessment, mitigation strategies, and community resilience (Coetzee & Niekerk, 2012; O'Brien et al., 2010).

Following these challenges, the field has evolved and undergone a shift in perspective from reactive disaster management to proactive DRR and Disaster Risk Management (DRM). DRR aims at "preventing new and reducing existing disaster risk and managing residual risk, all of which contribute to strengthening resilience", while DRM represents the "application of disaster risk reduction policies and strategies to prevent new disaster risk, reduce existing disaster risk and manage residual risk, contributing to the strengthening of resilience and reduction of disaster losses" (United Nations Office for Disaster Risk Reduction (UNDRR), 2017). This includes identifying hazards, assessing vulnerabilities, and implementing measures to prevent or mitigate the impacts of these risks. DRM is a broader concept that includes elements of DRR while also considering the management aspect that integrates prevention, preparedness, response, and recovery (Ahmad Basri et al., 2021; Rajabi et al., 2022). This evolution was codified in international policy frameworks, most notably the Sendai Framework for Disaster Risk Reduction, which outlines strategies and commitments aimed at reducing disaster risk globally for the period 2015-2030 (Henstra & Thistlethwaite, 2017). The primary goal of the Sendai Framework is to achieve a "substantial reduction in disaster risk and losses in lives, livelihoods, health, and the economic, physical, social, cultural, and environmental assets of individuals, communities, and countries" (UNISDR, 2015, p. 12). To achieve this objective, the framework promotes a "whole-of-society" approach and outlines four key priorities: (1) understanding disaster risk in all its dimensions (e.g., exposure, vulnerability, and capacity); (2) strengthening disaster risk governance to manage risk; (3) investing in disaster risk reduction for resilience; and (4) enhancing disaster preparedness for effective response and to "Build Back Better" in recovery (UNISDR, 2015, p. 21).



Figure 1.1: Disaster Risk Management Cycle (UNDRR, 2017)

In this dissertation, the term "disaster management" is used as an overarching concept encompassing the full disaster cycle, including the phases and practices associated with Disaster Management, Disaster Risk Management, and Disaster Risk Reduction. While each term carries specific operational or strategic connotations, this integrative usage reflects the holistic, whole-of-society perspective advanced in the Sendai Framework (UNISDR, 2015). Unless otherwise specified, "disaster management" therefore refers collectively to these interlinked processes of prevention, preparedness, response, recovery, and resilience-building.

This shift from reactive to proactive reflects an important reconfiguration of responsibilities: from governments as the primary disaster managers to a distributed governance model involving multiple stakeholders, including the private actors, to reduce systemic risks and foster sustainable development. This reconfiguration toward risk-based, multi-actor governance is also a recognition that governments alone cannot manage the increasing frequency, cost, and complexity of disasters (Driessen et al., 2018; Tierney, 2012). This model improves proactive measures by pooling diverse resources for prevention and mitigation. For example, private actors can deploy scalable technologies faster than overwhelmed public systems, enabling targeted risk reduction before events escalate. Such distributed governance

enhances resilience by diversifying capabilities across scales, improves efficiency through cost–benefit allocation, and strengthens legitimacy by involving multiple stakeholders in decision-making (Driessen et al., 2016; Driessen et al., 2018). Importantly, while private actors increasingly participate in these governance arrangements, their involvement remains voluntary and outside formal accountability structures, creating both opportunities and governance risks. However, critics caution that this shift risks becoming a form of privatization of disaster governance, where states offload responsibilities without ensuring adequate mechanisms of accountability or legitimacy, particularly in developing countries (Biersteker & Hall, 2002; Driessen et al., 2016; Valente & Crane, 2010).

The integration of private actors into disaster management reflects a broader geopolitical shift toward private governance, which represents the delegation of traditional public regulatory and service functions to non-state actors, including corporations, through voluntary standards, partnerships, and market mechanisms (Cutler et al., 1999; Green, 2014). Therefore, this private governance perspective provides a conceptual bridge between CSR-driven motivations and the broader DRR systems, within which corporations increasingly operate. While such arrangements may promote innovation and efficiency, they also risk reinforcing global inequalities. Resource prioritization is often concentrated in markets of strategic or reputational importance, leaving the most vulnerable regions underserved (Ballesteros & Useem, 2016; Bommer et al., 2022; Muller & Whiteman, 2009; Oh et al., 2020). Moreover, reliance on corporate initiatives means that engagement can be withdrawn when strategic incentives fade, raising questions about sustainability and democratic legitimacy (Clapp & Thistlethwaite, 2012; Valente & Crane, 2010). Within this landscape of private governance, MNCs have emerged as key players in shaping disaster governance frameworks, often acting as regulators or implementers of resilience measures (Jensen et al., 2015; Tierney, 2012). Therefore, their growing involvement demands that we move beyond traditional CSR and raises critical questions about whether their contributions represent genuine commitments to societal resilience or primarily strategic market-driven engagements.

The literature has increasingly conceptualized the role of the private sector, especially MNCs, in disaster relief, recovery, and resilience building. Initially, corporate involvement

was often viewed through the lens of philanthropic donations (Bruch & Walter, 2005). However, a more nuanced understanding has emerged, recognizing MNCs as significant actors with unique resources, technological capabilities, and global reach that can complement the efforts of traditional responders like governments and non-governmental organizations (Ballesteros et al., 2017). Studies highlight the diverse mechanisms through which corporations engage, including direct cash and in-kind donations, leveraging their core competencies, employee volunteering, fundraising initiatives, and forming strategic partnerships with humanitarian organizations (e.g., Johnson et al., 2011; McKnight & Linnenluecke, 2016). However, debates persist regarding the motivations behind corporate involvement. Critics argue that CSR in disaster response is sometimes driven more by reputational management and market expansion than by genuine humanitarian concerns (Frynas, 2005). Others have challenged the sustainability of these efforts, suggesting that short-term relief does not always translate into long-term community resilience unless aligned with broader development goals (Bansal & Song, 2017). Beyond questions of motivation, scholars have highlighted that corporate engagement is frequently uneven, privileging markets of strategic importance over the most vulnerable regions. Reliance on voluntary CSR initiatives also raises concerns about fragility and equity, as firms retain the discretion to disengage once reputational or commercial incentives diminish. In this sense, ICT MNCs can be seen not only as resource providers but also as potential disruptors of disaster governance, simultaneously offering technological solutions and introducing new risks of dependency, legitimacy deficits, and market-driven governance.

1.4 Climate Security

The concept of climate security has emerged as a critical interdisciplinary domain, recognizing the complex linkages between climate change, environmental stress, and various dimensions of security. Evolving from early concerns about resource scarcity and interstate conflict, the literature now broadly encompasses environmental security, focusing on the direct impacts of environmental degradation; human security, emphasizing the vulnerabilities of individuals and communities to climate-related threats like displacement and food insecurity; and national security, which examines how climate change can destabilize states, exacerbate

existing tensions, and act as a 'threat multiplier' (Dalby, 2014; Homer-Dixon, 1994; Homer-Dixon et al., 2011a). The increasing frequency and intensity of extreme weather events underscore the tangible ways in which climate change poses multifaceted security challenges, particularly for already vulnerable countries (Berrebi & Ostwald, 2011; Pacillo et al., 2024).

Climate-induced disasters, such as floods and cyclones, are increasingly framed not merely as humanitarian crises but as events with significant security implications. The disruption of essential services, displacement of populations, and strain on governmental resources can create power vacuums, exacerbate social grievances, and potentially be exploited by non-state actors (Battikh et al., 2022; Berrebi & Ostwald, 2011; Pacillo et al., 2024). This framing influences the responses of states, which may prioritize security measures alongside humanitarian aid. Multilateral organizations, which are international entities formed to address shared challenges, coordinate policies, and promote cooperation, are also increasingly integrating climate risk into their security and stability agendas (Barnhoorn, 2023; Bremberg et al., 2022; Scartozzi, 2022). Notably, the private sector, particularly MNCs, has emerged as a significant, though often under-theorized, actor in responding to these disasters, driven by a complex interplay of corporate social responsibility, strategic interests, and ethical imperatives (Ballesteros et al., 2017; Johnson & Abe, 2015; McKnight & Linnenluecke, 2016). Discussions on climate security continue to offer limited attention to the role of the private sector. While the business implications of climate change are increasingly recognized, the role of corporate actors, particularly MNCs, in responding to and potentially mitigating climate security risks in disaster contexts is underexplored (Averchenkova et al., 2016; Pulhin-Yoshida et al., 2021).

1.5 Research Gaps

The current academic literature presents a growing recognition of the significant role MNCs play in disaster response and recovery efforts (Arora & Chakraborty, 2021; Ballesteros et al., 2017; Johnson et al., 2011; McKnight & Linnenluecke, 2017; Nielsen et al., 2023; Oh & Oetzel, 2022). This recognition is especially pronounced in the context of developing countries, where vulnerabilities to climate change, such as intensified natural disasters, resource scarcity, and infrastructural fragility, amplify the need for effective intervention (Auzzir et al., 2014; Naoaj, 2023). While considerable academic attention has been given to

certain private sector actors, such as insurance and reinsurance for their roles in disaster risk management and financing, the contributions of ICT MNCs remain comparatively underexplored (Cummins & Mahul, 2009; Keskitalo et al., 2014; Schuster, 2013; Thistlethwaite et al., 2020). Thus, a significant research gap persists in providing a cohesive and comprehensive understanding of the multifaceted nature of corporate responsiveness, particularly for ICT MNCs (Ghadge, 2023; Nachappa et al., 2023).

The ICT sector is significant in addressing disaster response because of its core technological capabilities and expertise. Technologies such as telecommunications infrastructure, satellite imagery, Geographic Information Systems (GIS), Artificial Intelligence (AI), data analytics, and cloud computing are fundamental for effective disaster management across all stages, especially during the critical response phase (Buzzelli et al., 2014; Nachappa et al., 2023). These tools enable timely information dissemination and coordination among responders, rapid damage assessment by analyzing imagery and data, real-time monitoring, predictive modelling, optimization of resource distribution, and overall enhanced situational awareness (Gallarno et al., 2024; Gomes et al., 2016; Karaman et al., 2024). Moreover, by leveraging their specific technological strengths, ICT firms can contribute to early warning systems proven to reduce fatalities, streamline logistics, empower affected populations, and lay the groundwork for recovery (M. Kaur et al., 2022; Toya & Skidmore, 2015; Yulianto et al., 2020). This deployment of core technological expertise is particularly vital in developing regions facing acute vulnerability and limited resources, making the ICT sector an essential partner capable of bridging critical gaps and enhancing the overall effectiveness of humanitarian aid (Aggarwal et al., 2024; Ghadge, 2023; LU et al., 2020). Nevertheless, the strategic drivers beyond response motivations (Ali, 2023), the equitable geographical distribution (Oh et al., 2020), and the long-term impact of their interventions (Wu & Chang, 2018) remain underexplored and fragmented across existing scholarship.

First, while the literature highlights MNCs' potential contributions, it often frames their involvement through the lens of philanthropy or CSR (Ballesteros & Magelssen, 2022; Cha & Rajadhyaksha, 2021; Johnson et al., 2011; Tilcsik & Marquis, 2013). This oversimplification overlooks the strategic drivers that may underpin their actions, such as market expansion (Carroll & Shabana, 2010), reputational capital (Chernev & Blair, 2015; Singh et al., 2023), or

long-term operational resilience in climate-vulnerable regions. For example, an ICT firm deploying resources post-disaster might aim not only to aid recovery but also to secure future contracts or test innovative technologies in real-world settings. These motivations, which extend beyond altruism, remain underexplored, creating a considerable gap in understanding why and how MNCs prioritize certain disaster contexts over others (Nielsen et al., 2023).

Second, disaster management research has traditionally focused on government and humanitarian actors responding reactively to natural disasters (Wolbers et al., 2021). The evolution toward DRM/DRR, reinforced by the Sendai Framework, emphasizes a proactive, whole-of-society approach (Driessen et al., 2016). However, the literature has paid limited attention to how MNCs, particularly those from the ICT sector with unique technological capacities, operate within and across both paradigms. Moreover, existing research offers limited insight into the accountability and legitimacy implications of this expanding private role. The role of ICT MNCs as actors, including response and resilience-building, is under-theorized (Oh & Oetzel, 2022; Sakurai & Murayama, 2019a).

Third, emerging evidence of geographical disparities in MNC disaster response, potentially favouring developed nations or regions proximate to corporate headquarters, raises critical questions about equitable aid distribution (Ballesteros & Useem, 2016; Bommer et al., 2022; Muller & Whiteman, 2009; Oh et al., 2020). Current literature has not sufficiently investigated the underlying determinants of these biases and their implications for the most vulnerable populations in developing countries, where the impact of natural disasters is often disproportionately severe (Ballesteros et al., 2017).

Fourth**,** while immediate relief efforts by MNCs are often documented (Ballesteros & Useem, 2016), the long-term impact and sustainability of these interventions on community resilience, economic recovery, and local capacity building in developing countries remain largely understudied (Jamali, 2010; Sharifi, 2016). Evidence suggests that corporate efforts can yield immediate benefits, such as restored communication post-floods. However, questions remain about who benefits and for how long. Do short-term fixes (e.g., temporary network restoration) translate into sustainable recovery or do they exacerbate dependency on external actors? Research needs to move beyond assessing short-term outputs to evaluating the

enduring effects of corporate engagement and whether these efforts contribute to sustained vulnerability reduction and enhanced adaptation to the escalating impacts of climate change.

Finally, the intersection of MNC disaster response activities with the imperative to mitigate the security-related effects of climate change in developing countries requires more direct and integrated scholarly attention. While the literature acknowledges the potential for natural disasters to create vulnerabilities in developing countries, the specific role and impact of MNCs, through their disaster response strategies in addressing these security risks, remain largely unexamined. This includes understanding how corporate interventions can contribute to strengthening local governance, fostering trust in institutions, and reducing vulnerabilities in the aftermath of disasters. Addressing these interconnected gaps is crucial for developing a more comprehensive and nuanced understanding of the multifaceted roles of MNCs in disaster response within the critical context of climate change and its security ramifications in developing countries.

1.6 Research Questions

This dissertation seeks to contribute to the literature on strategic CSR and disaster management by exploring how the private sector, especially the ICT industry, can contribute to enhancing the resilience of communities against climate change in developing countries and also in fragile and conflict-prone areas. Typically, the discourse on disaster response is limited to government and humanitarian organizations (Barnett & Walker, 2015; Cairns, 2012; Dick & Elo, 1991). Therefore, this dissertation seeks to fill this research gap by exploring the role of the private sector, particularly multinationals from the ICT sector, in responding to natural disasters. The overarching research question of this dissertation is as follows:

How are natural disasters and global security interconnected, and what motivates and drives the disaster response efforts of multinational corporations?

This dissertation aims to address this overarching research question by examining the specific inquiries outlined in the three papers presented in the following section.

1.7 Organization of the Dissertation and Sub-Research Questions

This dissertation is organized in a manuscript-based format and is composed of three manuscripts (Chapters 2, 3, and 4). Chapter 1 includes the introduction to the main purpose of this research, the research questions, and a brief description of each of the three manuscripts. Chapter 2 provides an exploratory review of the literature on the relationship between disasters triggered by natural hazards (DTNH) and terrorism and/or conflict. This paper addresses two central research questions: 1) *What are the key areas of focus most frequently examined in this cross-disciplinary field?* and 2) *What is the structure of the network of scholars contributing to this research?* Utilizing term co-occurrence and co-citation network analyses of 1,027 academic publications from 1976 to 2017, the research identifies two primary research themes, security and trauma, and four distinct scholarly communities: political studies, economics, psychology, and sociology. This study postulates that research on the implications of climate-related disasters for economic development and political risks is still emerging and requires further scholarly inquiry. The study also argues that limited collaboration among these communities underscores the pressing need for greater interdisciplinary integration and holds potential relevance for broader disaster response and security studies.

Chapter 3 explores the disaster response efforts of Fortune Global 500 ICT multinational corporations in developing countries from 2015 to 2019, based on content analysis of their sustainability reports. This study seeks to answer the following question: *What is the role of Fortune Global 500 MNCs from the ICT sector in responding to natural disasters in developing countries?* The results reveal the growing involvement of ICT MNCs in disaster response throughout the research period, utilizing their technological expertise to achieve this. However, they prioritize their response efforts to places near their headquarters, mainly in developed countries, more than far-off developing countries that need it the most. This chapter underscores the critical influence of ICT MNCs on disaster relief, highlighting their strategic adaptability and the potential need for policy adjustments to enhance support in vulnerable developing regions, offering transferable insights for global disaster management practices.

Chapter 4 examines the motivations and role of ICT MNCs in responding to natural disasters. Using a qualitative case study approach combining interviews and document analysis, this study examines *why* and *how* big tech companies participated in disaster response efforts

during the devastating floods in Kenya caused by Cyclone Hidaya in 2024. This case study explores two research questions: *Why do some MNCs in the ICT sector choose to respond to natural disaster emergencies, and how are emergency response interventions identified and implemented by MNCs from the ICT sector?* Driven by the collected data, this case study presents a novel empirically grounded TEC Response framework (Triggering response – Engagement motivation – Championing technology) that describes the mechanisms through which ICT MNCs can enhance humanitarian action while aligning with their corporate objectives. This framework emphasizes that responses are triggered by local presence and government liaisons, driven by a combination of CSR, ethical imperatives, strategic interests, and business synergies**,** and are implemented by leveraging their technological strengths. This approach has the potential to redefine the conceptual framework of how the private sector contributes to disaster management.

Chapter 5 concludes the dissertation and provides an overarching synthesis of the conclusions and key outcomes of doctoral research. It outlines how this dissertation addresses the scholarly arguments and gaps revealed in the literature. It then discusses academic contributions to the field of sustainability management. Finally, the chapter reflects on the limitations of the research and recommends areas for future work.

Chapter 2

Disasters Triggered by Natural Hazards and Terrorism: A Bibliometric Network Analysis into The Intellectual Structure of a Cross-Disciplinary Research Field

Contents of this chapter are published in:

Battikh, J. Y., Bodolica, V., & Wood, M. O. (2022). Disasters triggered by natural hazards and terrorism: A bibliometric network analysis into the intellectual structure of a cross-disciplinary research field. *International Journal of Disaster Risk Reduction*, *77*, 103045. https://doi.org/10.1016/j.ijdrr.2022.103045

Abstract

The relationship between disasters triggered by natural hazards (DTNH) and terrorism is attracting renewed public and academic interest. This review article aims to unveil the key areas of focus and assess the structure of the network of scholars along with the academic communities that are producing research on the topic. We applied term co-occurrences and co-citation network analysis methodologies to a sample of 1027 academic documents on DTNH and terrorism that were published over a four-decade period. Two areas of focus (security and trauma) and four scholarly communities (political studies, economics, psychology, and sociology) emerged at the juncture of DTNH and terrorism. Due to an observed lack of collaboration between select communities, a promising future research agenda is proposed for achieving knowledge cross-fertilization and developing a truly cross-disciplinary research field. As the increasing occurrence of DTNH makes the stricken regions more vulnerable to terrorist acts, this literature review is timely and critical for cumulative knowledge building on DTNH and terrorism.

MANUSCRIPT BEGINS

2.1 Introduction

In December 2017, Typhoon Kai-tak was the deadliest storm to hit the Philippines that year, resulting in 83 fatalities. Some days later, a rebel group – the military arm of a communist movement – ambushed a convoy of the Philippine Army that was carrying relief aid (Tominaga & Lee, 2021). Consistent with a recent analysis of the literature on the nexus between climate change and terrorism (Asaka, 2021a), there might be a relationship between that devastating natural event and the ambush in the Philippines. According to the Intergovernmental Panel on Climate Change (2021) and other studies (Clarke et al., 2021; NAS, 2016; Stott, 2016), the frequency and magnitude of extreme weather events is likely to increase under a changing climate. Seas are rising (Church & White, 2011; Nerem et al., 2018; Slangen et al., 2016), crops are dwindling (FAO, 2021; Hasegawa et al., 2021; Trnka et al., 2014), water is growing scarce (Gosling & Arnell, 2016; Schewe et al., 2014), and people are forced to migrate to new places (Clement et al., 2021; Robinson et al., 2020; Stoler et al., 2021). Consequently, disasters triggered by natural hazards (DTNH) will continue to have a devastating effect on countries and populations, creating vulnerable situations and further insecurity (Mach et al., 2019; Nagy et al., 2018).

The US Department of Defense (2019) considers climate change as a 'threat multiplier' that could aggravate the global challenges that humanity is confronting today, from pandemics to terrorism. Entire nations may face instability and conflicts from the impacts of climate change, such as problems accessing food and water, damaged infrastructure and economic activity disruption (Homer-Dixon et al., 2011; Sygna et al., 2013). These risks are even more significant for developing countries with weak governments and limited resources that will have difficulties in addressing climate change (J. Barnett & Adger, 2007; Burrows & Kinney, 2016; Elliott, 2015; Mach et al., 2019; McGlade et al., 2017).

Currently, the relationship between DTNH and terrorism is generating renewed scholarly (Ide, Brzoska, et al., 2020; Ide et al., 2021; von Uexkull & Buhaug, 2021) and non-academic interest (International Military Council on Climate and Security, 2020; Middendorp & Bergema, 2019; The Center for Climate and Security, 2020; U.S. Department of Defense, 2019). This relationship needs to be unpacked, as several studies show that it might not be of a linear cause–effect type, but may be dependent on multiple variables that include context and

response (Fisher & Dugan, 2019). On the one hand, DTNH affect communities and engender human losses and material damages that weaken nations' physical and social infrastructures (Eastin, 2016; Paul. K. Freeman, 2000; Mirza, 2003). On the other, terrorism refers to the use of violence to create fear in individuals, groups or societies, through the disruption of economic, political and social systems, in order to achieve a religious, political, or ideological goal (Enders et al., 2016; Krueger & Maleckova, 2003; Reid & Chen, 2007). For the purpose of this review, we employ this inclusive definition of terrorism that reflects the complex terrorism criteria from the Global Terrorism Database (GTD) (START, 2022).

A growing number of studies started to establish an empirical relationship between the two domains, demonstrating the existence of far-reaching spillover effects and unexpected externalities (Adger et al., 2014; Asaka, 2021b; Berrebi & Ostwald, 2011, 2013; Hsiang et al., 2013; Paul & Bagchi, 2018; Raleigh & Kniveton, 2012; Salehyan & Hendrix, 2014). It has been suggested that DTNH can put a significant stress on a society and its government, where the response capacity of the affected government and population is significantly weakened and, therefore, exploited by terrorist organizations. In an investigation of 167 countries between 1970 and 2007, Berrebi and Ostwald (2011) demonstrated that DTNH can be an enabler of terrorist activities. Using a structured methodology to examine exhaustive data on DTNH, terrorism, country demographics, economic characteristics, and other indicators, the authors identified a strong positive relationship between DTNH and subsequent terrorist events.

Other studies explore the climate–terrorism relationship by focusing on the challenging socio-economic factors impacted by rapid climatic swings. Caruso et al. (2016) analyzed the association between climate variability, rice production, and violence in Indonesia over the 1993-2003 period. The researchers found that an increase in the minimum temperature during the growing rice season (that impacts the rice yields) can elevate the incidence of terrorist attacks and other violent events.

Fisher and Dugan (2019) assessed the incidence of DTNH on terrorism by focusing on the type of government response to a DTNH in the Philippines, Turkey, and the United Kingdom between 1987 and 2013. Using terrorism data from GTD, DTNH data from EM-DAT database (CRED, 2022), and Reuters News, the authors maintain that government responses to DTNH might change how terrorism is incentivized. In particular, they argue that the type of

governments' response to a DTNH affects the ensuing terrorism and that a more adequate response might reduce the risk of subsequent terrorist attacks.

Paul and Bagchi (2018) explored the effect of DTNH on both domestic as well as transnational terrorism. They analyzed the extent of property damage due to DTNH as opposed to domestic and transnational incidents of terrorism. Drawing on data collected from GTD and EM-DAT for 129 countries between 1998 and 2021, a significant association between DTNH and terrorism was established. The authors found that the incidence of transnational terrorism increases after the occurrence of a DTNH with a two-year lag.

Given the increasing number and frequency of calamities that are affecting societies around the world (Dalby, 2019; Döring, 2020; Ide, Lopez, et al., 2020), it is critical and timely to take stock of the body of research at the intersection of DTNH and terrorism. To the best of our knowledge, a comprehensive review of the literature on this topic is still lacking. A broad variety of theoretical and disciplinary perspectives could be leveraged to explore the emergent knowledge at the juncture of the two study domains (Spraggon & Bodolica, 2021). Therefore, the aim of this paper is to review the associated literatures and unveil the research trends seeking to understand the relationship between DTNH and terrorism.

Two research questions guided our inquiry. First, what are the key areas of focus that are most frequently explored in this field of study? And second, what is the structure of the network of scholars who are producing research on the topic? We employed term co-occurrences and co-citation network analysis methodologies to assess the academic publications on DTNH and terrorism produced over a four-decade period. Our analysis revealed two areas of focus – security and trauma – and the existence of four scholarly communities, namely political studies, economics, psychology, and sociology. Observing a total lack of collaboration between some communities, we advance a promising future research agenda for achieving knowledge cross-fertilization and creating a truly cross-disciplinary research field.

2.2 Methods

To generate the required sample of publications to perform our review, we used Web of Science (WoS) – a multidisciplinary electronic database that provides a comprehensive bibliographic coverage of the sciences and social sciences. Consistent with scholarly

recommendations on conducing literature reviews on topics of relevance to multiple fields of study (Bodolica & Spraggon, 2018; Tofan et al., 2013), WoS was chosen over other databases because research on DTNH and terrorism is conducted within several disciplines. There are some unavoidable limitations of using WoS, which are acknowledged in the limitations section of this paper. The keyword search technique along with 'AND'/'OR' search operators were employed to obtain a comprehensive list of publications related to our topic. We used several combinations of keywords and performed our search in two search fields simultaneously to capture all the pertinent documents at the intersection of DTNH and terrorism. Our search strategy was specified as follows: 'natural disaster*' AND 'terrorism*' OR 'terrorist attack*' OR 'national security' OR 'conflict*'. No filters were applied to delimit specific publication types, journal titles, author names, or document languages. Since the first identified paper appeared in 1976, we decided to include the literature that was produced over an entire four-decade cycle. Our search returned 1,027 scholarly documents published during the 1976-2017 timespan, constituting our final sample.

Figure 1 reports the number of publications identified per year over the review period. The annual trend of research on DTNH and terrorism remained flat till the end of 90s, with only the turn of the new millennium signaling the start of a noticeable upward trend. Indeed, the graph below indicates an exponential increase in total publications between 2000 and 2017, picking at 125 studies in 2016. This observation is validated by the coefficient of determination (R^2), which is a measure that assesses the ability of a model to predict an outcome in a linear regression setting (Glantz & Slinker, 2001). The R^2 for the exponential line of the graph is 0.86, suggesting a good fit with the observed data.

As shown in Figure 1, there are several spikes in the quantity of produced papers in the post-2000 period. In 2002 alone, the total research output more than doubled (n=19) relative to the year before (n=8). It appears that our study topic gained momentum in the aftermath of the September 11th, 2001 terrorist attacks in New York City. The next spike is noticed between 2003 and 2006 with the year-end publication counts corresponding to 10 and 52, respectively. It is during this time that humanity has witnessed several major DTNH, including the August 2005 Hurricane Katrina in the US, but also the 2004 Madrid train bombings as well as the 2005 London subway and bus bombings. Finally, the 2014-2016 period resulted in a 60% surge in

published documents, which also accounted for some of the deadliest DTNH, such as the 2015 earthquake in Nepal that killed nearly 9,000 people, in addition to the 2013 Boston marathon bombing and the 2015 Paris terrorist attacks.

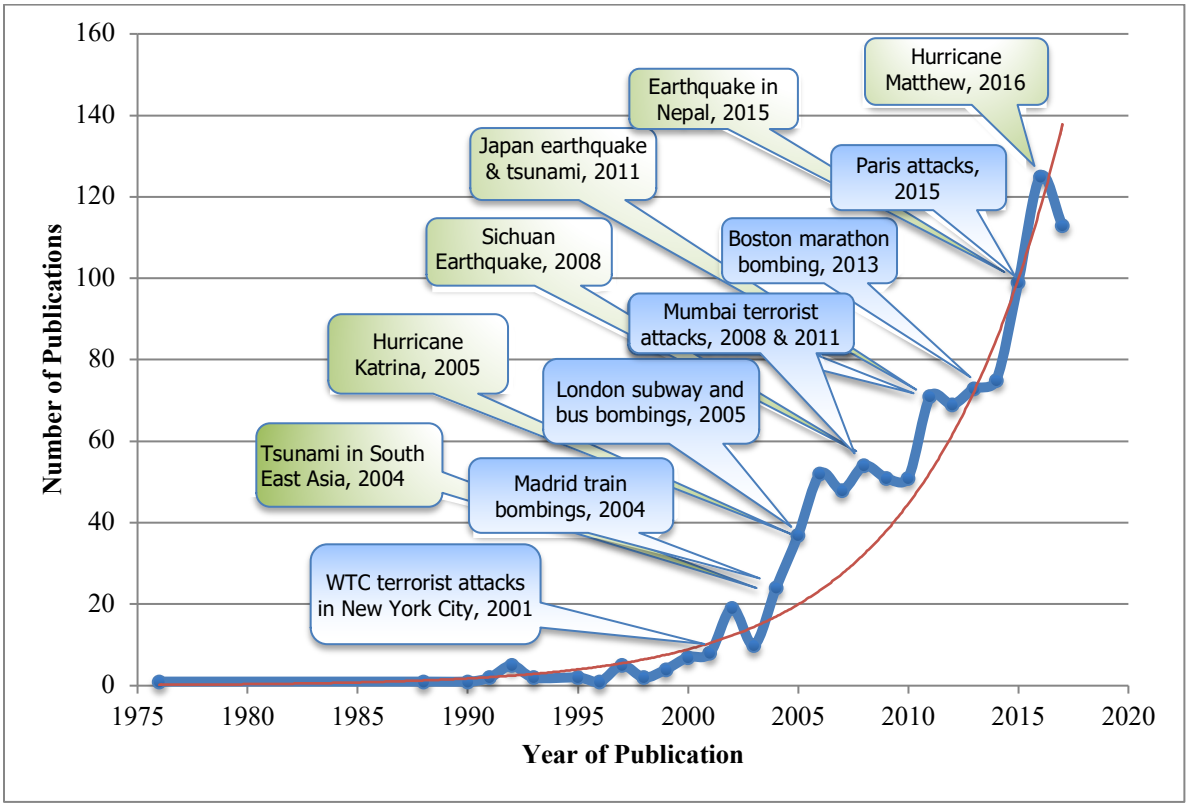


Figure 2.1: Number of publications per year linked to DTNH and terrorism

Most of the identified studies are in English, representing 96.4% of the total sample. The remaining 3.6% of papers were published in seven languages, including French, German, Spanish, Turkish, Slovak, Chinese, and Portuguese. With 932 items, scholarly articles and conference proceedings constitute 90.4% of all publications, with the remainder being books, book chapters and indexed reports. Reflecting the truly interdisciplinary nature of the review topic, the sampled documents were published in 868 different source titles from a broad range of disciplines. Figure 2 lists the top 30 source titles that account for only 180 sample items, implying a wide dispersion of research across publication outlets. With 13 articles each,

Disasters and *Journal of Homeland Security and Emergency Management* represent the top two journals in the field.

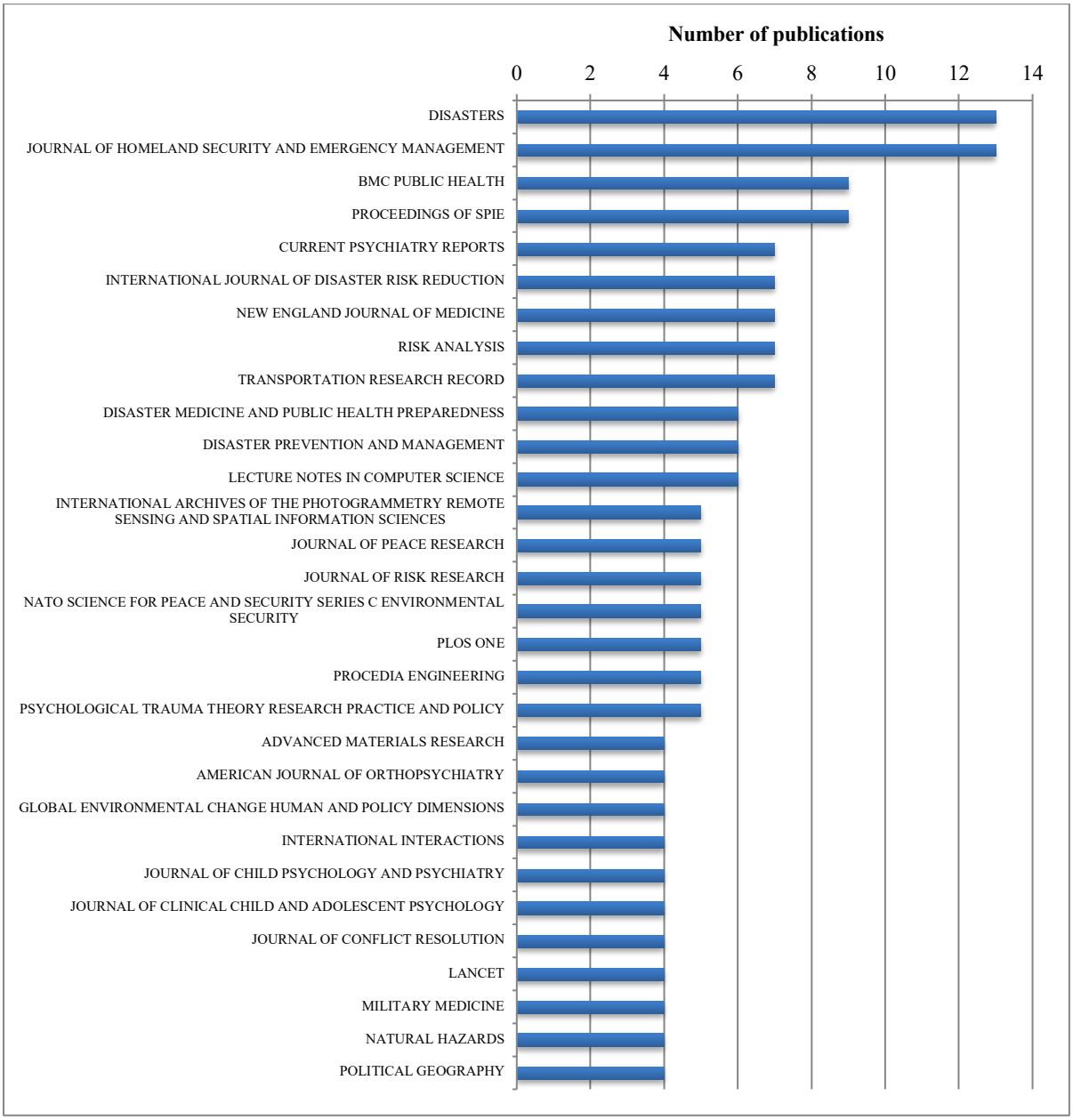


Figure 2.2: Top 30 source titles and number of publications

It is also difficult to distinctively identify one major discipline for DTNH and terrorism research, considering that our analytical results point to the existence of 186 different categories. The diversity of disciplines is noteworthy, ranging from more intuitive political

studies and environmental sciences all the way through study domains such as engineering, computer sciences, and telecommunications. Figure 3 reports the top 25 discipline-related categories that encompass 95% of the total number of publications. *Public, environmental and occupational health* (n=89) and *Psychiatry* (n=87) emerged as the top two disciplines that attracted the largest number of papers on the topic.

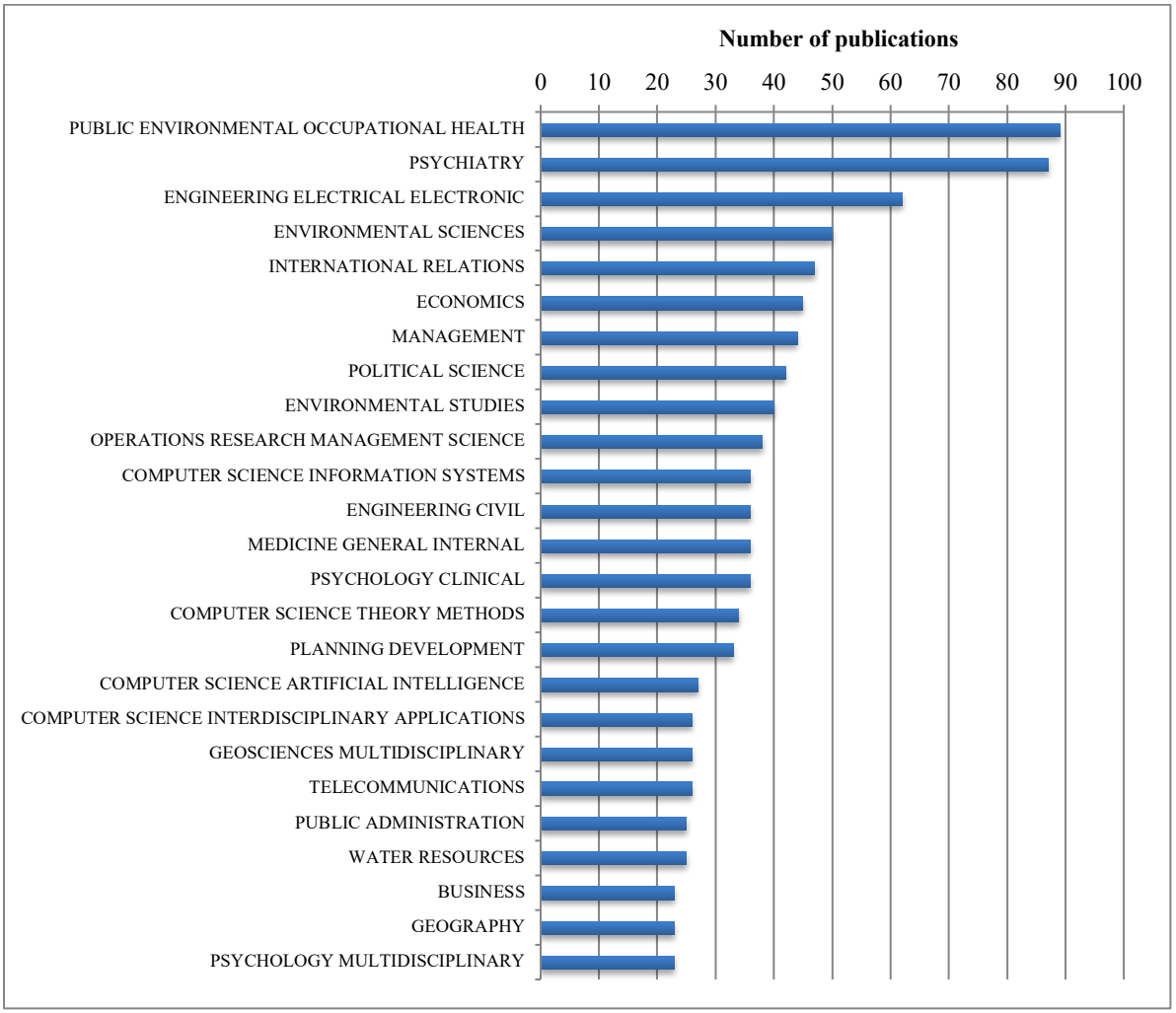


Figure 2.3: Top 25 Web of Science categories and number of publications

Next, to interpret the literature and detect meaningful research patterns, we conducted a metaknowledge analysis of our sample. Because the increase in the number of bibliometric datasets, such as electronic publications and digital archives, makes it more complex to identify trends, quantitative methods to evaluate scholarship across disciplines are in order (Osareh,

2009). Metaknowledge comes in to improve the large amounts of digital data construction and processing for better computational methods of text and network analysis (McLevey & McIlroy-Young, 2017; Zhang & Guan, 2017). In particular, to uncover trends and features of metaknowledge in the field, we used two methodologies of term co-occurrence and co-citation network analyses.

2.3 Findings

2.3.1 Method 1: Term co-occurrences

The term co-occurrences method allows identifying the two terms that occur together most frequently in publications, with results being visualized in a co-occurrence map. Extracted data in plain text file format were uploaded into the VOSviewer software (Van Eck & Waltman, 2010). In VOSviewer, we opted for 'title' and 'abstract' fields from which the terms were extracted. Then, binary counting was selected, meaning that only the presence or the absence of a term in a document matter, rather than the number of occurrences of a term.

The data extracted from WoS revealed a total of 23,198 terms. Having established the minimum number of occurrences to 10, a total of 560 terms met the threshold. A relevance score was calculated for each of these terms to retain the most relevant ones.

The default choice is set at 60% (Van Eck & Waltman, 2014), which resulted in a total of 336 selected terms. Finally, four words that had the highest number of occurrences but very low relevance, namely 'study', 'paper', 'system' and 'factor', were removed from the list of terms.

In the term co-occurrences density visualization map, the terms are represented by their labels. Each point in the map has a color that indicates the density of items at that point. Colors range from red to yellow to green. The larger (smaller) the number of term co-occurrences in the neighborhood of a point and the higher (lower) the weights of the neighboring items, the closer the color of the point is to red (green). For the analysis of the link between DTNH and terrorism, the term co-occurrences density map indicates the association strength or similarity between the terms extracted from different publications. The higher the similarity between two terms, the higher the weight.

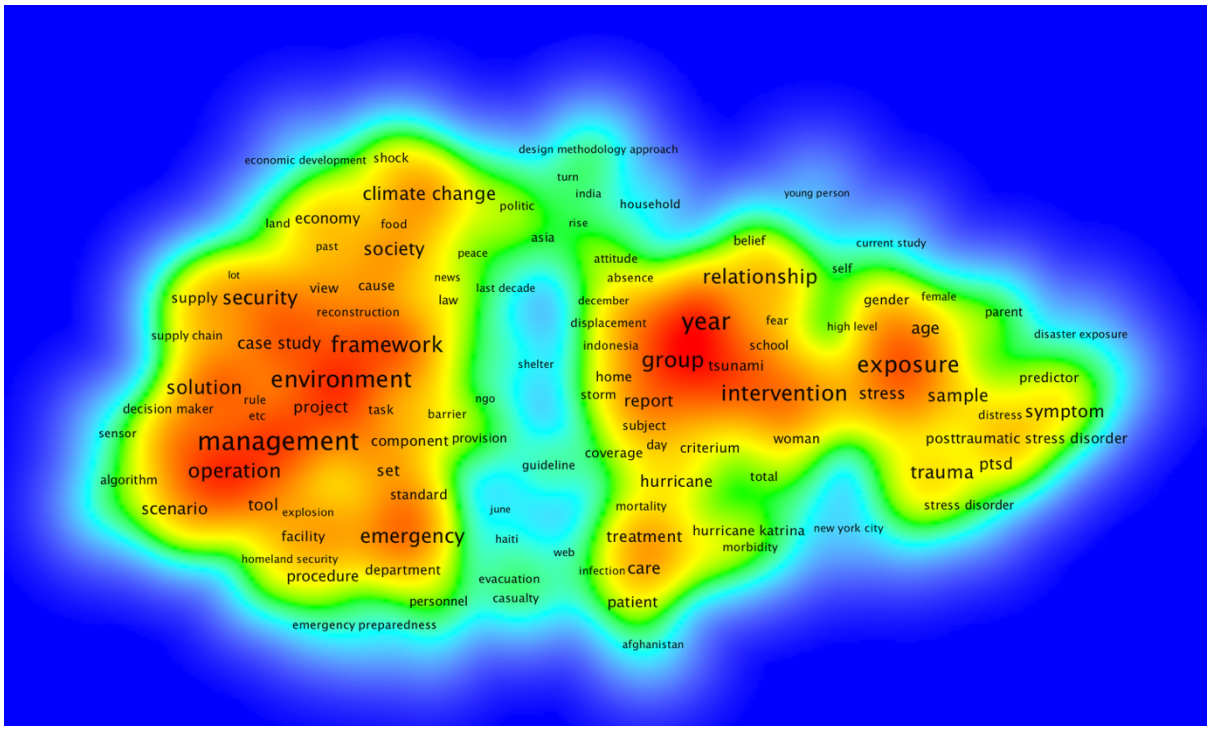


Figure 2.4: Term co-occurrences density visualization map

The map in Figure 4 reveals two very distinct areas. The first area on the left has a large red zone and a well-defined shape. This indicates that the area is very dense, suggesting a high association strength between the items of this area. There are 188 identified terms in total, with several of them having high co-occurrences, such as management, environment, security, emergency, climate change, and society. The second area on the right has a smaller red zone and is more dispersed. The area is almost split in the middle into two smaller clusters, yet with a strong link between them. Out of 138 total terms, there are noticeable terms that have high co-occurrences and link strength, such as intervention, exposure, group, relationship, trauma, stress, and symptom.

This density visualization reveals the general structure of the field, showing a clear separation between the two areas of term co-occurrences. This result indicates two major areas of focus, namely security and trauma. However, it is not clear why these two distinctive areas exist and who are the scholars addressing the topic. A second methodology of co-citation network analysis is thus needed for better understanding the literature on DTNH and terrorism.

2.3.2 Method 2: Co-citation networks

Author co-citation analysis can be very useful for recognizing scholars and categorizing them into particular groups (H. D. White & McCain, 1998). Highly co-cited authors are expected to be in the same knowledge field (H. D. White, 2011). Although co-citation analysis employs frequencies to count the number of co-cited papers, it does not allow the relationships among publications to be understood. Therefore, many researchers have begun to apply a social network perspective to co-citation analysis (Zhao et al., 2018).

To build the co-citation network, a specialized open-source software, based on the metaknowledge model, was used. Metaknowledge utilizes a programming language, called python, to do computational research in bibliometrics and network analysis (McLevey & McIlroy-Young, 2017). For our review, metaknowledge was used to transform the plain text data files from WoS and the open-source software Gephi was then deployed to visualize and analyze the co-citation network. This tool depicts the data through two-dimensional combined nodes and edges. The nodes represent publications (articles and books) and the edges indicate the relationships between them (Van Eck & Waltman, 2014). With 9,627 nodes and 36,279 edges, the raw co-citation network for DTNH and terrorism was relatively large. Most of these co-citations occurred only once or twice, being interpreted as a noise in the network. To expose strong relationships, co-citations that happened less than two times were filtered and isolated nodes were removed. The final co-citation network had 181 nodes and 397 edges.

After the co-citation network was created, clusters of articles and books that were heavily co-cited with one another were identified. In co-citation networks, these clusters represent intellectual communities, such as subfields and specialties, invisible colleges, intellectual movements, and epistemic cultures (Stokes & McLevey, 2016). These interconnected communities or networks (H. D. White, 2011) were uncovered using methods developed by network analysts (Wallace et al., 2009). A co-citation map identifies interrelations between authors by analyzing the counts of the number of articles that cite pairs of authors jointly (Ke et al., 2004; H. D. White, 2015).

The co-citation map for this review was created using Gephi software, which helps visualize bibliometric analysis. Figure 5 shows four co-citation networks, comprised of nodes and edges, that are visible in green, black, purple, and blue colors. Each node (circle) in the graph indicates

a publication, while each edge (line) represents the relationship between these publications. The edge connects documents that appear in bibliographies together three or more times. Larger nodes have a higher degree of centrality, which means that they are connected to more publications. Repeatedly co-cited groups of publications were combined into clusters. Color indicates association in these detected clusters using the Louvain algorithm (Stokes & McLevey, 2016).

The co-citation network in Figure 5 illustrates four clusters divided into two distinctive groups. The group on the left has two clusters (green and black) and the group on the right also includes two clusters (purple and blue). Apparently, the two groups are conducting research on the same topic without necessarily citing each other. The group of clusters on the right has a larger number of nodes, suggesting that there is more published research in those particular domains of specialization. The group of clusters on the left has a smaller number of nodes, but they are larger in size then the other clusters. This means that even if there are few publications in these domains, they are co-cited more often. Below, we discuss in detail the results of our analysis for each of the four clusters.

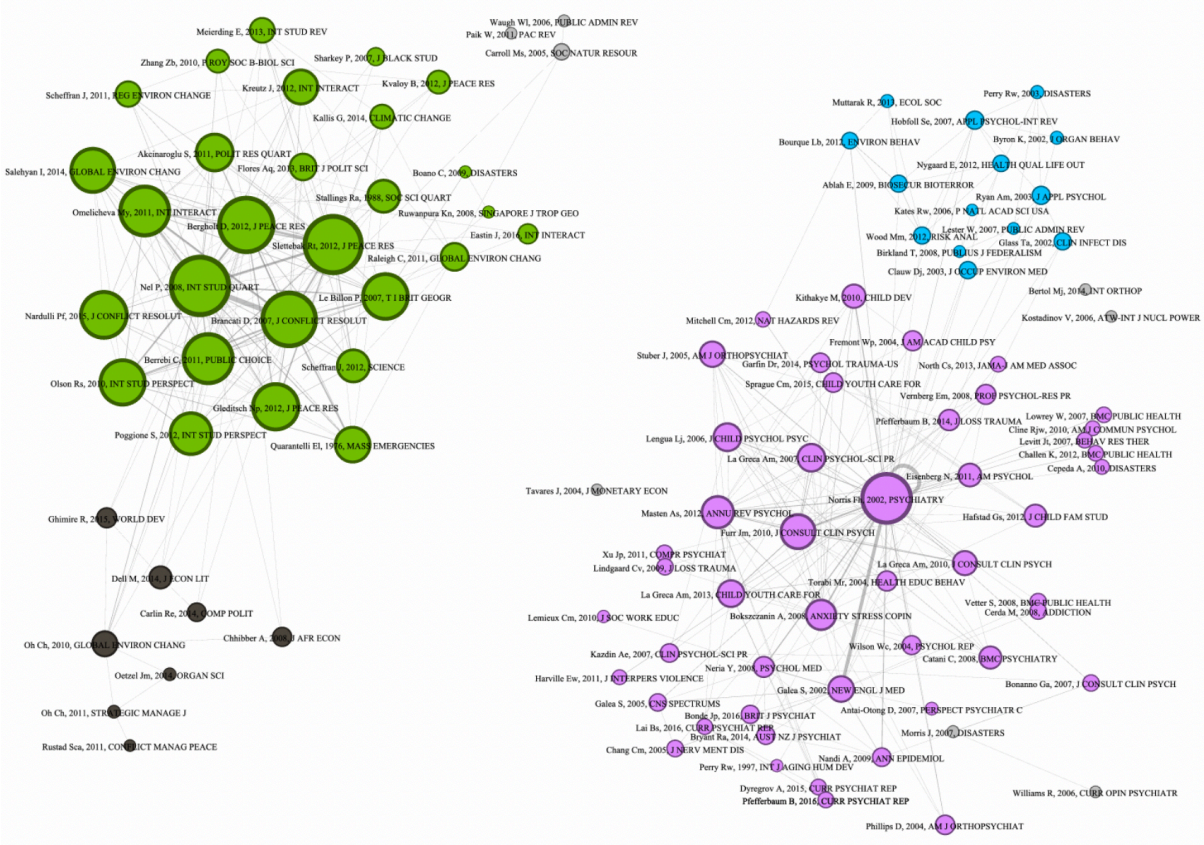


Figure 2.5: DTNH and terrorism co-citation network

2.4 Discussion

2.4.1 Green cluster

The green cluster has the biggest number of large nodes in the co-citation network. Table 1 lists the five most co-cited scholars and their publications. The largest node is Nel and Righarts' (2008) article, which revealed 33 co-cites and the highest degree of centrality (1.00). With a total of 29 co-citations, the node of Brancati (2007) follows. The common research theme in this cluster constitutes 'DTNH and conflicts'. Most frequently, authors contemplate whether calamities caused by nature, such as earthquakes and volcanic eruptions (Nel & Righarts, 2008), are linked to the onset of armed conflicts rather than terrorist attacks. However, the emphasis is placed on *violent* conflicts that trigger civil unrest (Bergholt & Lujala, 2012), political instability (Omelicheva, 2011), and interstate clashes (Brancati, 2007).

Count	Authors (Year)	Publication Title	Journal Title
33	Nel & Righarts (2008)	Natural disasters and the risk of violent civil conflict	*International Studies Quarterly*
29	Brancati (2007)	Political aftershocks: The impact of earthquakes on intrastate conflict	*Journal of Conflict Resolution*
18	Slettebak (2012)	Don't blame the weather! Climate-related natural disasters and civil conflict	*Journal of Peace Research*
14	Bergholt & Lujala (2012)	Climate-related natural disasters, economic growth, and armed civil conflict	*Journal of Peace Research*
10	Omelicheva (2011)	Natural disasters: Triggers of political instability?	*International Interactions*

Table 2.1: Five nodes with the largest co-citation number in the green cluster

Two articles suggest that DTNH exert a detrimental influence on civil societies, creating high insecurity and deteriorating countries' physical infrastructure, thus ultimately rising the likelihood of violent conflict outbreaks (Brancati, 2007; Nel & Righarts, 2008). However, the other three papers acknowledge that disasters affect populations and economies but without establishing a direct association with an increased risk of violent conflict or political instability (Bergholt & Lujala, 2012; Omelicheva, 2011; Slettebak, 2012). Even more, they go further to argue that DTNH can have a positive impact on communities because they are affected by a common external threat, which unites people.

There is no real consensus in the cluster on the sense of direction in the relationship between DTNH and conflicts. Slettebak (2012) warns that paying too much attention to this relationship may misguide policy-related decision making, whereas other authors call for strengthening security procedures to prevent conflict during disaster recovery (Brancati, 2007; Nel & Righarts, 2008). Scholars are divided on whether, and how, DTNH influence the risk of armed conflicts and what measures should be taken to guide recovery and adaptation policies. More research is needed to better appreciate the nuances and the extent of a state's vulnerability to conflicts as a critical determinant of post-disaster outcomes.

2.4.2 Black cluster

The black cluster in the co-citation network is closely related to the green cluster, as many black nodes have edges linked to green nodes. The five papers with the largest number of edges to the green cluster are listed in Table 2, with the remainder of black nodes being linked only to nodes within the black cluster. Having four and three edges, respectively, Oh and Reuveny (2010) and Dell et al. (2014) are top two publications that are most connected to the green network. The common research theme of the back cluster is 'DTNH, economic development and politics'. With its edges connecting to five black nodes, Bergholt and Lujala (2012) in the green cluster is the most co-cited by the black cluster. This is not surprising, because this is the only green-cluster article that tackles explicitly the economic implications of disasters and civil conflicts.

Count	Authors (Year)	Publication Title	Journal Title
4	Oh & Reuveny (2010)	Climatic natural disasters, political risk, and international trade	*Global Environmental Change*
3	Dell et al. (2014)	What do we learn from the weather? The new climate-economy literature	*Journal of Economic Literature*
2	Ghimire et al. (2015)	Flood-induced displacement and civil conflict	*World Development*
2	Chhibber & Laajaj (2008)	Disasters, climate change and economic development in Sub-Saharan Africa: Lessons and directions	*Journal of African Economies*
2	Carlin et al. (2014)	Trust shaken: Earthquake damage, state capacity, and interpersonal trust in comparative perspective	*Comparative Politics*

Table 2.2: Black cluster nodes that have a relationship with the green cluster

Black-cluster publications analyze the consequences of DTNH for economic outcomes, such as agriculture, energy demand, and bilateral trade (Oh & Reuveny, 2010). Since the performance of an economy can deteriorate from variations in temperature, precipitation and windstorm (Dell et al., 2014), DTNH extend their negative impact on the long-term economic

development (Chhibber & Laajaj, 2008). This cluster is also concerned with the assessment of disaster-induced effects on a nation's economy through a political lens. Carlin et al. (2014) demonstrate that low state capacity to deal with natural hazards reduces the level of interpersonal trust, thus turning DTNH into social disasters. Analyzing the impact of large floods on civil conflict, Ghimire et al. (2015) uncover that economically weak and corrupt states lead to people's displacement following extreme weather events.

In discussing the implications of climate-related disasters for economic development and political risks, researchers find that developing countries are starting to bear the highest cost of climate change despite being insignificant contributors to global warming. Additionally, a lack of agreement about the long-term economic impact of DTNH characterizes this small cluster. Because only eight publications compose the black cluster, some caution in drawing conclusions about the relationship between climate change, economic development and political risk is warranted. Since this research topic is only starting to carve out its space in the literature, further scholarly inquiry is needed to stimulate evidence-based discussions and propose superior adaptation solutions.

2.4.3 Purple cluster

The purple cluster exhibits the largest number of nodes in the co-citation network. Table 3 presents the six nodes with the highest count of co-citations in the purple cluster. The empirical literature review of Norris et al. (2002) represents the node with the highest co-citation count (n=63). The common theme of this cluster is 'disasters and psychology', with a specific emphasis on disaster-induced consequences for the stricken community's mental health. Assessing the prevalence of depression and post-traumatic stress disorder among the residents of New York after the 9/11 terrorist attacks, Galea et al. (2002) is the second most referenced paper with 33 total co-cites. The remaining four publications from the cluster examine the post-traumatic stress symptoms, following DTNH, wars or terrorist events, in the most vulnerable categories of population, namely children and youth (Bokszczanin, 2008; Furr et al., 2010; La Greca et al., 2010; Masten & Narayan, 2012). Scholars call for an increased attention to issues of psychological sequelae and mental health when designing disaster and terrorism response strategies to restore survivors' wellbeing in affected regions.

Count	Authors (Year)	Publication Title	Journal Title
63	Norris et al. (2002)	60,000 disaster victims speak: Part I. An empirical review of the empirical literature, 1981–2001	*Psychiatry: Interpersonal and Biological Processes*
33	Galea et al. (2002)	Psychological sequelae of the September 11 terrorist attacks in New York City	*New England Journal of Medicine*
14	Furr et al. (2010)	Disasters and youth: A meta-analytic examination of post-traumatic stress	*Journal of Consulting and Clinical Psychology*
9	Masten & Narayan (2012)	Child development in the context of disaster, war, and terrorism: Pathways of risk and resilience	*Annual Review of Psychology*
7	La Greca et al. (2010)	Hurricane-related exposure experiences and stressors, other life events, and social support: Concurrent and prospective impact on children's persistent posttraumatic stress symptoms	*Journal of Consulting and Clinical Psychology*
7	Bokszczanin (2008)	Parental support, family conflict, and overprotectiveness: Predicting PTSD symptom levels of adolescents 28 months after a natural disaster	*Anxiety, Stress, & Coping*

Table 2.3: Six nodes with the largest co-citation number in the purple cluster

Only Bokszczanin (2008) and La Greca et al. (2010) focused on people's post-traumatic stress symptoms in the aftermath of unique DTNH, such as floods and hurricanes. As the ongoing climate change may increase the frequency and intensity of climate-related hazards, more research should be conducted on post-traumatic stress phenomena following DTNH. Because most publications in this cluster focus on children and youth (Furr et al., 2010; La Greca et al., 2010, 2013; Lengua et al., 2006; Masten & Narayan, 2012; Pfefferbaum et al.,

2014), expanding the analysis to different age groups, such as adults and elderly people, is highly recommended. This cluster contains a significant number of studies that analyze solely the 2001 terrorist attacks on the World Trade Centre (Eisenberg & Silver, 2011; Galea et al., 2002; Lengua et al., 2006; Levitt et al., 2007; Phillips et al., 2004; Stuber et al., 2005; Torabi & Seo, 2004; Wilson & Rosenthal, 2004). Given that 1,492 terrorist events occurred in 2001 (GTD, 2021), the exclusive emphasis on the 9/11 attacks suggests a bias in how the authors define, view and study terrorism as a disaster. There is an ample room for growth in this cluster to include other disaster-associated psychology research that would go beyond a single terrorist event.

2.4.4 Blue cluster

The blue cluster in the co-citation network exhibits an apparent relationship with the purple cluster. Yet, the blue nodes are more linked to each other than to the purple nodes and there is not one node that has a higher count. Table 4 reports the list of the five nodes with the largest number of co-citations in the blue cluster. The common theme of this cluster constitutes 'disaster and emergency preparedness' to boost public response to DTNH and terrorist acts, with some consideration of human behavior and other social factors. The three most co-cited publications examine the disaster threat mitigation through personal (Ablah et al., 2009), household (Bourque et al., 2012), and society's (Perry & Lindell, 2003) preparedness.

Count	Authors (Year)	Publication Title	Journal Title
4	Ablah et al. (2009)	Factors predicting individual emergency preparedness: A multi-state analysis of 2006 BRFSS data	*Biosecurity & Bioterrorism: Biodefense Strategy, Practice, and Science*
4	Bourque et al. (2012)	Who prepares for terrorism?	*Environment and Behavior*
4	Perry & Lindell (2003)	Preparedness for emergency response: Guidelines for the emergency planning process	*Disasters*

3	Glass & Schoch-Spana (2002)	Bioterrorism and the people: How to vaccinate a city against panic	*Clinical Infectious Diseases*
3	Hobfoll et al. (2007)	Refining our understanding of traumatic growth in the face of terrorism: Moving from meaning cognitions to doing what is meaningful	*Applied Psychology*

Table 2.4: Five nodes with the largest co-citation number in the blue cluster

Overall, scholars highlight the lack of personal preparedness plan among individuals, in households, and in communities. Hobfoll et al. (2007) address the potential of post-traumatic growth following experiences of violence and terror exposure, while Glass and Schoch-Spana (2002) discuss how to integrate the public into bioterrorism response planning. Most of the studies in this cluster are US-centric, with claims rotating around the notion of preparedness in response to the 9/11 terrorist attacks (Ablah et al., 2009; Bourque et al., 2012; Byron & Peterson, 2002; Glass & Schoch-Spana, 2002; Perry & Lindell, 2003; Ryan et al., 2003). Therefore, a more diversified research approach is needed to explore the peculiarities of emergency planning in other national and regional settings.

2.5 Toward a cross-disciplinary research field

The results of our analysis uncovered the existence of four scholar communities researching the relationship between DTNH and terrorism. The first is the political studies community (green cluster) that examines whether and how natural hazards increase the risk of violent conflicts (Brancati, 2007; Nel & Righarts, 2008; Slettebak, 2012). The second is the economics community (black cluster) that studies the effect of climate-related disasters on the economic development, growth, and performance outcomes (Dell et al., 2014; Oh & Reuveny, 2010). The third is the psychology community (purple cluster) that assesses the post-traumatic stress disorder and mental health of the stricken population following disasters and terrorist attacks (Furr et al., 2010; Galea et al., 2002; Norris et al., 2002). The fourth is the sociology community (blue cluster) that evaluates disaster preparedness and emergency planning of the general public, communities, and households (Ablah et al., 2009; Bourque et al., 2012).

Our review of the specialized literature shows that research on the topic is dispersed across various study domains. There are two separate groups with two communities each that exhibit a high within-group activity through their co-citation patterns. First, the political studies and the economics communities of scholars find affinities in each other's work by pursuing meaningful collaborative undertakings. When DTNH or armed conflicts hit a location, they affect societies economically, plummeting agricultural output and weakening economic development. A context-embedded understanding of how political forces shape the economy, and vice-versa, may be essential for the drafting of relevant economic policies and disaster recovery plans. And second, the psychology and the sociology communities entertain a close relationship, seizing opportunities for conducting mutually-beneficial research collaborations. Emergency situations cause enormous psychological damages and post-traumatic stress in people and groups, diminishing their coping ability. An appreciation of differences in behavior and mental health effects for various categories of population may contribute to the design of viable strategies for boosting the individual and collective disaster preparedness.

However, the co-citation network analysis also indicates that there are no cross-group research interactions beyond the politico-economic and psycho-sociological communities. More interdisciplinary collaborations among the different communities of scholars are needed to better grasp the complexities surrounding natural hazards and terrorist attacks. Fruitful knowledge spillovers across study domains should be encouraged to gain a more accurate understanding of disaster-related phenomena and their impacts on individuals, groups, and societies. Policy makers could benefit from these broadly-diversified scholarly collaborations to design and implement effective intervention programs and recovery plans. There are many opportunities for knowledge exchange and cross-fertilization to build a truly interdisciplinary field of research. To get the discussion started, we advance below a promising agenda for further inquiry on issues related to DTNH and terrorism. The two-by-two matrix in Table 5 proposes future research questions that originate from the intersection of two scholarly communities.

The political studies and the psychology communities could join forces to shed light on psychological wellbeing programs to alleviate trauma of societies affected by violent civil conflicts. Many mental health practices and interventions may be designed to cultivate conflict

resilience or prevent the escalation of conflict in post-disaster settings, which can be discovered when these research communities cross-fertilize. Psychology studies could offer directions to policy makers by examining whether the provision of aid for post-traumatic stress alleviation in youth reduces the likelihood of armed conflicts in post-disaster zones (Nuttman-Shwartz, 2019). Of particular relevance may be the question of how state capacity affects the provision of mental health assistance to the most vulnerable residents, such as children, elderly, women and unemployed. Researchers could draw on comparative politics to discuss the lessons learned from the experiences of (low-, middle-, or high-income) countries in deploying psychological wellbeing programs in conflict- or disaster-stricken zones.

Communities	**Psychology**	**Sociology**
Politics	• What (psychological wellbeing) policies need to be put in place to prevent the escalation of conflict in vulnerable post-disaster locations? • Does the aid for post-traumatic stress alleviation in youth reduce the likelihood of terrorist events in post-disaster regions? (Nuttman-Shwartz, 2019) • What lessons can be learned from the experiences of (low-, middle-, or high-income) countries in deploying psychological wellbeing programs in disaster zones? • How state capacity affects the provision of mental health assistance to marginalized communities and most	• What state levers need to be deployed to boost the national disaster recovery capacity? (Gunay et al., 2020) • What government actions are required to prevent social unrest and violence in the post-disaster period? (Gagné, 2019) • What role formal education and training, and risk communication play in disaster preparedness? (Wood et al., 2012) • Does the effective aid allocation to disaster victims prevent political radicalism? • Does state preparedness to disasters affect public trust in government institutions?

	vulnerable citizens (children, youth, elderly, unemployed)?	
Economics	• What approaches are needed to support disaster-affected youth, so they can contribute to the economic recovery process? (Taylor et al., 2019) • Is the mental wellbeing of investors affected in the aftermath of sudden terrorist events and DTNH? (Halkos & Zisiadou, 2020) • How investors deal with DTNH and terrorist attacks? • How post-disaster stress-coping strategies of investors affect their risk profiles and future investment patterns?	• How population behavior influences emergency planning? (Roncancio et al., 2020) • How socio-economic characteristics of households (e.g., income level, family size, age, education) affect disaster preparedness? • What role social capital plays in disaster recovery? • What mechanisms of public involvement can enhance disaster response effectiveness? (De Juan et al., 2020; Mastroianni et al., 2021)

Table 2.5: Future research questions for cross-fertilizing the field

Interactions between the political studies and the sociology communities could be beneficial, especially with regard to emergency preparedness for enhancing national disaster recovery capacity (Gunay et al., 2020). The degree of state preparedness for natural hazards could prevent political radicalism and mitigate the risk of violent conflicts, affecting public trust in government institutions. Scholars could explore the role played by risk communication and formal education and training, such as disaster medicine, in the effective delivery of aid to disaster victims and the provision of crucial services to those in need (Wood et al., 2012). Engaging individuals in post-disaster processes may yield positive outcomes, boosting social cohesion and reducing right-wing political attitudes and support of political violence. To prevent social unrest and build confidence in entities that are working on disaster mitigation, governments are encouraged to avoid complicated bureaucracy and embrace transparent decision making (Gagné, 2019).

Although scholars representing the economics and the psychology communities do not reference one another, there might be several valuable pathways for their collaboration. It may be worth examining whether and how the allocation of financial resources to tackling people's mental health concerns contributes to the economic recovery of the entire disaster-stricken area. Taking a closer look at how different categories of survivors go through post-traumatic stress disorder could result in more personalized intervention approaches and more efficient provision of funds. Offering needed support for restoring the psychological wellbeing of disaster-affected youth may be vital for them to become the key drivers of future economic growth and development (Taylor et al., 2019). Another line of inquiry could focus on investors, their behavior and mental wellbeing, in the aftermath of DTNH and sudden terrorist attacks (Halkos & Zisiadou, 2020). For instance, the type and effectiveness of post-disaster stress-coping strategies of investors could affect their risk profiles and future financial investment priorities.

Finally, the economics and the sociology communities could collaborate to gain a deeper understanding of the relationship between the macro-/micro-economic processes and the social aspects of population behavior in emergency planning. There could be questions of how the financial aid distribution for disaster recovery influences the development of social capital and the subsequent economy's growth (De Juan et al., 2020). According to Mastroianni et al. (2021), a successful asset management policy implementation can reduce the detrimental impact of natural hazards and civil conflicts on people and nations. Various socio-economic characteristics of groups and households, such as disposable income, family size, members' age, and level of education, could be among the key predictors of disaster preparedness. Involving the general public in emergency planning may improve their behavioral response in times of crisis, leading to the optimization of scarce resources and the enhancement of disaster response effectiveness. Assessing the pre-existing social vulnerability throughout a country could help formulate relevant economic policies for attaining national disaster risk reduction and climate change adaptation goals (Roncancio et al., 2020).

2.6 Conclusion

2.6.1 Limitations and future research

In this paper, we performed a literature review on DTNH and terrorism and advanced a cross-disciplinary framework for further inquiry in the field. Despite its contributions, our review has some limitations that could be addressed in future research on the topic. While mostly bibliographic techniques were deployed to survey the specialized literature, other methodologies could be used to conduct systematic, integrative, or meta-analytic reviews (Bodolica et al., 2020; Bodolica & Spraggon, 2009; Ponomareva et al., 2022).

We relied on the WoS database and excluded other databases, such as Scopus and ProQuest, for reasons of compatibility with the software employed for co-citation analysis. Although focusing on only one database might have limited the size of our sample, this is consistent with prior reviews that used bibliometric methods (Ben Jaafar et al., 2021; Stokes & McLevey, 2016). At the conceptual level, the inclusive definition of terrorism that was used for the purpose of this review allowed accounting for a broader range of activities, as per the GTD. Because this might be more permissive on what is considered as terrorism, future studies may offer a more focused analysis by considering a more restricted definition.

When performing the co-citation network analysis of the literature, we identified several 'invisible colleges' representing communities in the network with shared interests and ideas. When scholars communicate through co-citation pathways, they create cohesive social groups focused on common conceptual specialties (Wallace et al., 2009). Yet, only the five or six most co-cited documents in each cluster representing four different scholarly communities have been reviewed. Future studies may find useful to perform a deeper qualitative analysis of a larger number of publications in each cluster to allow more accurate understanding of connections and associated themes both within and between academic communities.

We reviewed the specialized literature that was published over a period of four decades, ending in 2017. Since more investigations have been conducted on the topic in the last few years, another bibliographic study that would include additional databases and very recent publications may be especially worthwhile. The field would also benefit greatly from empirical inquiries that explore the nature and extent of the relationships between DTNH and terrorism.

Researchers could examine, in empirical settings, how DTNH are associated with civil or interstate conflicts, insurgencies, and other categories of disruptive human events, focusing on whether and how these associations differ depending on the type of terrorist event.

MANUSCRIPT ENDS

Chapter 3

Big Tech and Natural Hazards: Disaster Response Patterns of Fortune Global 500 ICT MNCs in Developing Countries

Contents of this chapter are published in:

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Abstract

Climate change is projected to increase the frequency and intensity of natural disasters worldwide, disproportionately affecting developing countries with limited capacity to respond effectively. This study examines the disaster response efforts of Fortune Global 500 (FG500) Information and Communication Technology (ICT) Multinational Corporations (MNCs) in developing countries from 2015 to 2019, based on content analysis of 246 sustainability reports. Findings indicate a rise in ICT MNC involvement, with response instances growing from 44 to 59, driven by cash donations (38%), in-kind contributions (38%), and partnerships, notably with the Red Cross (46%). These efforts underscore ICT's critical role in enhancing disaster management efficiency and coordination. However, a significant geographical disparity emerges: responses in developing countries declined from 77% to 25% of total efforts, while developed countries increased to 58%, with 40% concentrated in the US and Japan between 2017 and 2019. Despite a 50% profit margin increase, resource allocation favors headquarters proximity over vulnerability. This study highlights the need for further research into the drivers of these disparities and the efficacy of partnership strategies, contributing a foundation for understanding ICT MNCs' roles in disaster relief and informing equitable response frameworks as climate risks escalate.

MANUSCRIPT BEGINS

3.1 Introduction

On 14 March 2019, Cyclone Idai, one of the deadliest Cyclones slammed into the Southern Africa region impacting four countries, Mozambique in particular. Five weeks after, a second Cyclone, Cyclone Kenneth, made landfall in northern Mozambique and was the strongest cyclone to hit the country since records began. These two consecutive tropical cyclones left a trail of death, damage and destruction in their paths affecting more than three million people. Furthermore, both cyclones swept through the region during the main harvest, destroying hundreds of thousands of acres of crops, significantly impacting food security in the months ahead (NASA, 2019; OCHA, 2019; Waini et al., 2023). In response, Ericsson, a FG500 ICT MNC, activated its long-standing partnership with the Emergency Telecommunications Cluster (ETC), a global network of humanitarian, private sector and governmental organisations led by the United Nations World Food Programme, that provides communications services in disaster situations (Emergency Telecommunications Cluster, 2024). Within a week, the multinational mobilized personnel and equipment to set-up a wireless solution network, distribute connectivity and manage users' access to Internet. This vital communication services allowed 1,800 humanitarians from 440 organizations across 21 sites, to coordinate relief work and rescue efforts (Emergency Telecommunications Cluster, 2019; UN OCHA, 2019a, 2019b; World Food Program, 2019). Such actions illustrate corporate "responsiveness", i.e. the capacity and willingness of MNCs to mobilize resources and expertise swiftly in disaster aftermaths, a phenomenon increasingly critical as climate-induced calamities intensify.

Developing countries, like Mozambique face disproportionate vulnerabilities to natural disasters due to systemic challenges, such as fragile infrastructure, limited economic resilience, and heavy dependence on external assistance (Arouri et al., 2015; ITU, 2017; Thomas et al., 2014; Yulianto et al., 2020). Traditional actors like governments and NGOs are often stretched beyond capacity during large-scale crisis. Consequently, non-conventional actors, particularly MNCs, have emerged as critical players in disaster response and recovery. With their global reach, technological capabilities, and financial resources, MNCs are uniquely equipped to bridge gaps in disaster response and recovery (Ballesteros et al., 2017; Battikh et al., 2022; B. R. Johnson et al., 2011; McKnight & Linnenluecke, 2017b; Nsaku, 2023; Roy et al., 2020).

ICT MNCs, in particular, bring specialized assets, such as communication networks, data analytics, and logistics tools, that serve as lifelines in post-disaster scenarios, facilitating faster coordination and information flow (Hu & Kapucu, 2016a; Sakurai & Murayama, 2019a; Yulianto et al., 2020). Ericsson's deployment of connectivity solutions in Mozambique illustrates how such capabilities can accelerate humanitarian efforts, offering a tangible example of corporate impact in real time.

This responsiveness is shaped by a complex interplay of motives and mechanisms. Corporate Social Responsibility (CSR) strategies often drive voluntary aid, reflecting altruistic commitments and reputational goals (Carroll, 1991; Porter & Kramer, 2006). Simultaneously, societal norms and stakeholder pressures, whether from affected communities, employees, or investors, compel MNCs to act (DiMaggio & Powell, 1983; Freeman, 1984), while strategic interests, such as securing operational stability or market presence, align relief efforts with business objectives (Pfeffer & Salancik, 1978). These drivers manifest through diverse mechanisms, such as cash donations, in-kind contributions (like technology deployment), and partnerships with humanitarian organizations, yielding outcomes from immediate relief to enhanced community resilience (Johnson et al., 2011; Muller & Whiteman, 2009; Toya & Skidmore, 2015a). Yet, despite the growing involvement of ICT MNCs in disaster response, their specific role in developing countries, where disasters have the most severe impact, remains underexplored in academic literature. This gap is noticeable given their potential to address unique regional challenges, such as unreliable infrastructure and constrained local resources, through technological innovation (ITU, 2017; O'Reilly et al., 2006; Yulianto et al., 2020).

This paper seeks to addresses this gap by examining the disaster response activities of FG500 ICT MNCs (Fortune, 2024) in developing countries from 2015 to 2019, using content analysis of 246 sustainability reports. Johnson et al.'s (2011) typology guides the categorization of disaster response activities. This empirical study focus on the immediate activities of corporations "directed towards the response and recovery of natural disasters" (Johnson et al., 2011, p. 363). These activities include partnerships with NGOs, direct cash donations and in-kind activities, which represent both indirect and direct support mechanisms for disaster response. In addition to these established mechanisms, this research also explores emergent

ICT-specific themes in the reports to capture any activities that were not identified by Johnson et al.' model, which was developed exclusively for Fortune 100 firms, with headquarters in the United States (US).

This paper seeks to answer the overarching research question: *What is the role of Fortune 500 Global MNCs from the ICT sector in responding to natural disasters in developing countries*? In answering this question, this study aims to contribute to the growing body of literature on corporate disaster responsiveness, and to provide insights that can inform policy and practice in this critical area. This research is essential in this field as a foundational step to systematically document and understand the current practices, challenges, and outcomes of MNCs' disaster response efforts. This empirical groundwork is crucial before delving into the specific dimensions identified, such as the long-term impacts of ICT MNCs' activities, decision-making processes regarding geographical response locations, and the effectiveness of public-private partnerships.

In the following sections, this paper will first provide a review of the relevant literature on corporate involvement in disaster response and recovery, with a particular focus on MNCs and the ICT sector. This will be followed by a detailed description of the research methodology, including the selection of the sample of FG500 ICT MNCs and the analysis of their sustainability reports. The study's findings are then presented and discussed, highlighting the key roles and activities of these corporations in disaster response and recovery in developing countries. The paper will conclude with a discussion of the implications of the findings for theory, practice, and future research.

3.2 Literature Review

The theoretical framework for this interdisciplinary study integrates perspectives from CSR, disaster management, and ICT, focusing on MNCs' disaster responsiveness in developing countries. This section maps the field, synthesizing the roots, drivers, mechanisms, and implications of corporate disaster response, with a spotlight on ICT MNCs' distinctive contributions. By organizing and analyzing this literature, it positions the study to explore how FG500 ICT MNCs respond to natural disasters in vulnerable regions, offering insights into their societal and operational impacts amid a changing climate.

3.2.1 CSR and Disaster

The United Nations defines a natural disaster as a "serious disruption to the functioning of society, causing widespread human, material, or environmental losses which exceed the ability of affected society to cope using only its own resources" (United Nations, 1992, p. 27). Since then, the definition evolved from natural disaster to natural hazard (Montz et al., 2017) - which is classified under six categories: 1) Geophysical (e.g.: earthquake, volcanic activity), 2) Hydrological (e.g.: flood, landslide), 3) Meteorological (e.g.: storm, extreme temperature), 4) Climatological (e.g.: drought, wildfire), 5) Biological (e.g.: animal incident, disease), and 6) Extraterrestrial (e.g.: impact) (EM-DAT, 2023; IRDR, 2014). To be consistent with Johnson's et al. (2011) study, which focused on the first four categories of natural disasters (Geophysical, Hydrological, Meteorological and Climatological), this study will consider the same four hazards. The term natural disaster will be used since it is the term that is widely used in the sustainability reports.

These disasters are escalating in frequency and intensity due to climate change (IPCC, 2023), and they disproportionately burden developing countries with weaker infrastructure and economic resilience (Panwar & Sen, 2018; UNDRR, 2020). Floods, for instance, are the most common disaster globally, while cyclones and earthquakes cause significant casualties and economic losses, particularly in resource-scarce regions (UNDRR, 2020). This context amplifies the need for multi-stakeholder responses, increasingly involving the private sector (Forcadell & Aracil, 2021; McKnight & Linnenluecke, 2017b; Muller & Whiteman, 2009). The rising toll of such disasters, evidenced by the 2019 Cyclone Idai's devastation in Mozambique or the 2015 Nepal earthquake, underscores the urgency of integrating corporate capabilities into relief efforts, especially where governmental and NGOs capacities fade.

Corporate disaster responsiveness, a CSR subset, encompasses proactive and reactive actions to mitigate disaster impacts and support recovery (B. R. Johnson et al., 2011). Its roots trace to CSR's evolution: Carroll's (1991) pyramid framed corporate duties as economic, legal, ethical, and philanthropic, laying a foundation for societal engagement beyond profit motives. This model positioned philanthropy as discretionary, yet disasters elevate its urgency, blurring lines between obligation and choice. Porter and Kramer's (2006) shared value concept moved forward this paradigm, arguing that addressing societal needs, like disaster relief, enhances

competitive advantage, reframing responsiveness as a strategic imperative rather than mere altruism. Stakeholder theory further anchors this shift, positing that firms respond to pressures from key stakeholders, such as communities, employees, and governments, whose welfare hinges on disaster outcomes (Donaldson & Preston, 1995; Freeman, 2010). Burke et al. (1986) showed this through early corporate efforts to support communities, paving the way for modern disaster aid programs.

Drivers of responsiveness are multifaceted, intertwining ethical, economic, and strategic dimensions. Ethically, MNCs position themselves as "good corporate citizens," responding to moral imperatives and stakeholder expectations, as Mitchell et al. (1997) emphasize in their salience framework—stakeholders with power, legitimacy, and urgency (e.g., affected communities) compel action. Economically, disasters threaten tangible and intangible assets: supply chains, infrastructure, and markets face disruption, prompting protective measures. Ballesteros et al. (2017) found that MNCs with local operations respond faster to safeguard investments, a pattern Oh and Oetzel (2011) link to subsidiary autonomy in crisis zones. Philanthropically, corporate philanthropy disaster response (CPDR) reflects altruism, often catalyzed by external triggers. Media visibility amplifies public scrutiny, while proximity to disaster zones heightens engagement. Muller and Whiteman (2009) identify a "home region effect," where firms prioritize response to disasters near headquarters or operational hubs, a bias Zhang and Luo (2013) observed in post-2008 Sichuan earthquake, where local ownership boosted aid.

For ICT MNCs, a distinctive strategic driver emerges: their technological expertise in communication and data systems positions them as critical responders, enhancing relief in settings where traditional infrastructure collapses (Hu & Kapucu, 2016a). Ericsson's rapid deployment of wireless networks post-Cyclone Idai exemplifies this, enabling humanitarian coordination in Mozambique (Emergency Telecommunications Cluster, 2019). This capability goes beyond philanthropy, aligning with core competencies of ICT firms. For example, restoring connectivity represents a lifeline in chaos that can help coordinating supplies deliveries. Yet, the interplay of these drivers—ethical obligation, economic self-interest, and technological advantage—remains underexplored. Are ICT MNCs driven more by a moral imperative to support vulnerable populations or by strategic goals to bolster their global

standing? The literature provides fragmented insights: Johnson et al. (2011) point to a compelling ethical pull, as seen in swift corporate responses to Haiti's 2010 earthquake, while Ballesteros al. (2017) show firms prioritize disaster response where they have a presence, suggesting a strong economic driver. Hu and Kapucu (2016a) emphasize ICT's strategic power, where tech deployment in crises reinforces industry dominance. This study seeks to unravel these complexities, examining how FG500 ICT MNCs balance these forces in developing countries, where disaster impacts are magnified, and where technological solutions are both opportunity and necessity.

3.2.2 Types and Mechanisms of Disaster Responsiveness

Responsiveness manifests through diverse types and mechanisms, tailored to firms' resources and disaster contexts. Johnson et al. (B. R. Johnson et al., 2011) categorize corporate responses into three core types: direct aid (e.g., cash donations), in-kind contributions (e.g., goods, services), and partnerships (e.g., with NGOs). Cash donations provide immediate, flexible support, often delivered via corporate foundations, employee matching programs, or direct grants to relief funds. For example, following the 2004 Tsunami in Sri Lanka, the private sector responded with millions of dollars in cash contributions, employee matching contributions and in-kind donations (A. Thomas & Fritz, 2006). Burke et al. (1986) trace this practice to early corporate giving, noting its adaptability to urgent needs like food or medical supplies. Rencoret et al. (2010) emphasize that cash empowers NGOs to prioritize local demands, as seen in post-2010 Haiti earthquake relief efforts, where rapid funding was critical. In-kind donations, conversely, leverage firm-specific assets. ICT MNCs, for instance, donate equipment, or connectivity services, to restore communication in post-disasters . For example, Vodacom in Mozambique, provided free SIM cards, and offered free calls and SMSs to ensure people could connect with loved ones following the two large tropical cyclones disasters (GSMA, 2020). Partnerships, notably with NGOs like the Red Cross or UN agencies, merge corporate scale with local expertise, enhancing efficiency For example, Chen et al. (2013) explored how to form and sustain effective collaborative partnerships between governments, businesses, non-governmental organizations and local communities to support development of disaster resilient communities. Hunt and Eburn (2018) in their study have emphasized the

significance of multi-party partnerships in disaster management, highlighting their importance in all phases of planning and responding to large-scale natural disasters. Beyond these core types, additional mechanisms amplify responsiveness. Employee engagement—through volunteering or personal donations—fosters internal goodwill and external impact. Fundraising, such as text-to-donate campaigns, further extends reach. For example, mobile donation platform after 2010 earthquakes in Haiti and 2011 in Japan raised millions, blending technology with philanthropy (A. Smith, 2012). These mechanisms vary by firm size and sector, with MNCs often combining multiple approaches to maximize effect.

ICT MNCs distinguish themselves through technology-driven mechanisms, leveraging their core competencies to address disaster-specific challenges. Satellite communications, mobile networks, and data analytics enable real-time coordination and information flow—vital in chaotic aftermaths. For example, following the 2015 Nepal earthquake, UN OCHA used social media to swiftly gauge disaster-related harm and resource requirements, while simultaneously pinpointing the optimal locations for the dispatch of humanitarian aid workers (UN.ESCAP, 2016). In Sri Lanka, mobile alerts proved cost-effective for last-mile communities during cyclone warnings, reducing evacuation delays (Samarajiva & Waidyanatha, 2009). During the 2012 Beijing rainstorm, social media texts aided decision-making, guiding rescue operations (Wang et al., 2016). These tools accelerate relief, streamline logistics, and empower affected populations, aligning responsiveness with ICT firms' strengths rather than generic aid (GSMA, 2020; ITU, 2017).

Yet, challenges persist: unreliable local infrastructure, regulatory barriers, and coordination complexities with various stakeholders in developing countries complicate deployment. Overcoming these challenges requires a comprehensive approach that integrates technological innovation, policy advocacy, and collaborative engagement with local communities and governments (Sakurai & Murayama, 2019a). The literature often overlooks how these mechanisms evolve in developing settings, where cultural, logistical, and infrastructural barriers differ from developed contexts. This study examines such adaptations, analyzing how ICT MNCs tailor their technological contributions to developing countries' unique disaster landscapes.

3.2.3 ICT Response: Impact and Frontiers

Corporate responsiveness to natural disasters yields significant implications, both practical and theoretical, particularly in the context of developing countries where vulnerabilities are critical. Practically, it bridges critical gaps in governmental capacity, a pressing need in regions where disasters exacerbate poverty, displacement, and socio-economic instability (Madsen & Rodgers, 2015). According to the UNDRR (UNDRR, 2020), between 2000 and 2019, 83% of disaster-affected individuals resided in developing nations, facing a disproportionate toll from earthquakes, cyclones, and floods—events that overwhelm local resources and demand rapid, scalable interventions. Moreover, when considering economic losses as a percentage of Gross Domestic Product (GDP), there is a significant disparity, with low-income countries experiencing losses three times higher than high-income countries (UNDRR, 2020). MNCs, with their financial muscle and logistical reach, step into this breach, offering cash, goods, and expertise where state mechanisms falter. For instance, post-2001 Gujarat Earthquake, corporate aid supplemented India's strained response, deploying men and machinery for relief and rescue (Sayegh, 2004). ICT MNCs amplify this impact through technology: Ericsson's wireless networks enabled humanitarian coordination across 21 sites, a feat beyond local capabilities (Emergency Telecommunications Cluster, 2019). Such contributions reduce response times, and lay groundwork for recovery by reconnecting communities and markets.

Theoretically, corporate responsiveness turns CSR into a practical approach to help firms and communities thrive together, not just charity (Oh et al., 2020). Traditional CSR models, like Carroll's (1991) pyramid, frame philanthropy as optional, but disasters elevate it to a strategic necessity, aligning with Porter and Kramer's (2006) shared value paradigm. This shift suggests MNCs don't just react, they coordinate their efforts with government and NGOs responses (Sayegh, 2004), stretch partnerships to long-term (Johnson et al., 2011) and build community strength for future crises, keeping employees loyal and markets open (Oh et al., 2020). For ICT firms, impacts are quantifiable: mobile penetration reduces disaster fatalities by 47% across 1980–2013, a statistic rooted in enhanced early warnings and coordination (Toya & Skidmore, 2015). Beyond immediate relief, ICT fosters long-term trust. Tech also builds lasting trust, since connectivity after disasters ties communities to firms, a plus in competitive markets (D'Andrea et al., 2022).

Yet, these benefits are unevenly distributed, raising equity concerns. Muller and Whiteman (2009) highlight a geographical bias—the "home region effect"—where MNCs favor disasters near headquarters or operational hubs, often neglecting developing countries despite their greater need. Forcadell and Aracil (2021) found European firms prioritized regional crises over distant ones. This trend raises questions about the consistency and long-term commitment of multinationals in developing regions, which are often more vulnerable to natural disasters (Fomby et al., 2011; Panwar & Sen, 2018). This is a particularly relevant since regions such as Africa and Asia, hardest hit by climate-driven disasters, receive less attention unless MNCs have local stakes (Naoaj, 2023). This "local presence effect" suggests responsiveness tracks strategic interests over humanitarian need, a tension Ballesteros et al. (2017) tie to economic drivers like market protection. ICT MNCs, while impactful, aren't immune: their aid often clusters where infrastructure supports deployment, sidelining remote areas (Sakurai & Murayama, 2019a). Such disparities challenge the CSR narrative of universal good, demanding a closer look at allocation equity.

Significant gaps persist in the literature, limiting a full understanding of this phenomenon. Drivers beyond philanthropy—technological strategy, competitive positioning—are underexplored, especially for ICT MNCs, where capability might outweigh altruism (W. Ali et al., 2017). Ballesteros et al. (2017) suggest that being close to market serves as a motivator, but how this balances with ethical or technological imperatives remains unclear. Mechanisms also lack depth in developing countries contexts. Despite its importance in developing nations, the adaptation of ICT to unstable infrastructures, like frequent power failures or low literacy levels, is often overlooked (Yulianto et al., 2020). Studies mostly track quick wins, like how mobile networks cut deaths by 47% with better warnings (Toya & Skidmore, 2015) and miss bigger effects, like stronger communities or rebuilt economies (Madsen & Rodgers, 2015). Furthermore, geographical preferences distort the landscape where aid doesn't reach everywhere and some needy spots get ignored, limiting the scope of CSR theories (Yulianto et al., 2020).

This study addresses these gaps by analyzing FG500 ICT MNCs' sustainability reports (2015–2019), focusing on their responsiveness in developing countries. It probes drivers (e.g., CSR optics, technological leverage), mechanisms (e.g., ICT-specific aid like mobile

networks), and outcomes related to equity in distribution, while noting implications for relief efficiency. It offers a clear base for future theory and practice, answering calls for insights into MNCs' roles in climate crises (Roy et al., 2020).

3.3 Methodology

3.3.1 Data Collection

To better understand the intervention of MNCs in a post-natural disaster situation, this research uses content analysis of sustainability reports of the FG500 MNCs from the ICT sector from the year 2015 to 2019. Information such as where these multinationals intervened and how they responded, is usually reported in corporates' sustainability reports as a CSR-based activity. The use of the content analysis methodology is consistent with "a research method that uses a set of procedures to classify or otherwise categorize communication allowing inferences about context" (Short et al., 2010, p. 321). To execute this methodology, the qualitative characteristics extracts from sustainability reports are collected, coded, quantified, and then analyzed. This would help identify any trends or patterns that exist, and get some form of explanation, understanding, or interpretation of social phenomena (Bachman & Schutt, 2007; Creswell & Creswell, 2018a).

The FG500 represents the annual ranking, compiled and published by Fortune Magazine, of the largest 500 corporations worldwide as measured by total revenue of their respective fiscal years (Fortune, 2023). The focus on the largest companies offers a better prospect of finding disclosures, given that several research suggests that quality of corporate social disclosure is linked to firm size (Gray et al., 1995; Hou & Reber, 2011; Vuontisjärvi, 2006). Moreover, analysis of sustainability reports of the largest corporations in particular, gives a greater insights since the size of the company also has influence on the reporting of CSR initiatives, which consistently and positively affects sustainability reporting (Hahn & Kühnen, 2013; Hou & Reber, 2011).

The dataset for this research represents the sustainability reports of the FG500 firms from the ICT sector. These reports were retrieved from the firms' respective websites on the Internet for the specific years. Since ICT is not classified as a sector in the FG500 list, the selected companies were listed under 1) technology and 2) telecommunication sectors, the two sectors

that constitute the ICT sector. The number of companies that were selected for this study are listed in the table I below:

2015	2016	2017	2018	2019
50	50	54	56	53

Table 3.1: Number of FG500 ICT MNCs

Inclusion criteria required reports to be publicly available, in English, and covering the study period. Given that some MNCs did not publish sustainability reports for the years under which this study is conducted, of 263 potential reports, 246 (n) met these criteria, ensuring data rigor despite potential self-reporting bias. The table II and III below shows the number of reports used over the period of five years:

2015	2016	2017	2018	2019
46	48	50	50	52

Table 3.2: Number of Sustainability Reports

3.3.2 Analysis & Synthesis

The content analysis of these reports involved the extraction of selected sections based on two constructs: *type of natural disasters* and *firm's disaster responses*. These two constructs consist of lists of keywords that have been developed and validated through a multi-step process. First, a list of keywords was developed based on deductive words extracted from the academic literature, related to the constructs, synonyms, and variations of each construct (Short et al., 2010). Second, after reviewing the list of deductive words, a list of inductive keywords was constructed from a review of a random sample of 25 sustainability reports and any related words that were not previously included in the deductive list. Detailed descriptions of the identification process and the list of keywords are provided as supplementary information in the Appendix section.

After downloading the sustainability reports, MAXQDA software (Release 22.8.0) was used to conduct the qualitative text analysis. MAXQDA is a computer assisted qualitative data analysis software program designed for computer-assisted qualitative and mixed methods data, text and multimedia analysis (VERBI Software, 2023). To execute large textual dataset analysis, the use of a software such as MAXQDA allows for efficient and accurate pattern discovery, classification, representation, trend, and anomaly detection (Marjaei et al., 2019; Szalay & Gray, 2006). Since the dataset for this research consists of PDF files, MAXQDA software was selected because it allows to code PDF documents for qualitative data analysis (Kuckartz & Rädiker, 2019). This software also enables classification and quantification of qualitative data and use different user-friendly and self-evident visual options that helps identify trends.

To manage the analysis of large data, we used the text search tool in MAXQDA. This functionality allows "for automated searches of text for words, phrases, and co-occurring themes with more accuracy and time efficiency than hand sorting and counting" (D'Andrea et al., 2011, p. 49). This technology also enables "researchers to interrogate the data set, look for co-occurrences of codes or themes, relationships between codes, and to play with ideas in an exploratory fashion" (Lewins & Silver, 2008, p. 11).

3.4 Results

The FG500 ICT MNCs stand as pivotal engines of growth within the ICT sector and substantial contributors to the global economy. Between 2015 and 2019, these entities amassed revenues totaling $16,522.686 billion, alongside profits of $1,616.759 billion, underscoring their financial robustness and operational efficiency. Throughout this period, both revenue and profit trajectories demonstrated a similar upward trend, with a marked escalation commencing in 2017 and intensifying over 2018 and 2019. Notably, the profit margin showed a more pronounced growth rate compared to revenue, particularly in the concluding two years of the interval under review. Specifically, profit margins surged by 50%, whereas revenue experienced a 19% increase over the same timeframe. This delineation indicates that, while both revenue and profits within the ICT sector witnessed augmentation from 2015 to 2019, the acceleration of profit outpaced that of revenue (Figure 1). This analysis not only highlights the

financial success of the FG500 ICT MNCs but also underscores their critical role in advancing the technological landscape and contributing to economic prosperity on a global scale.

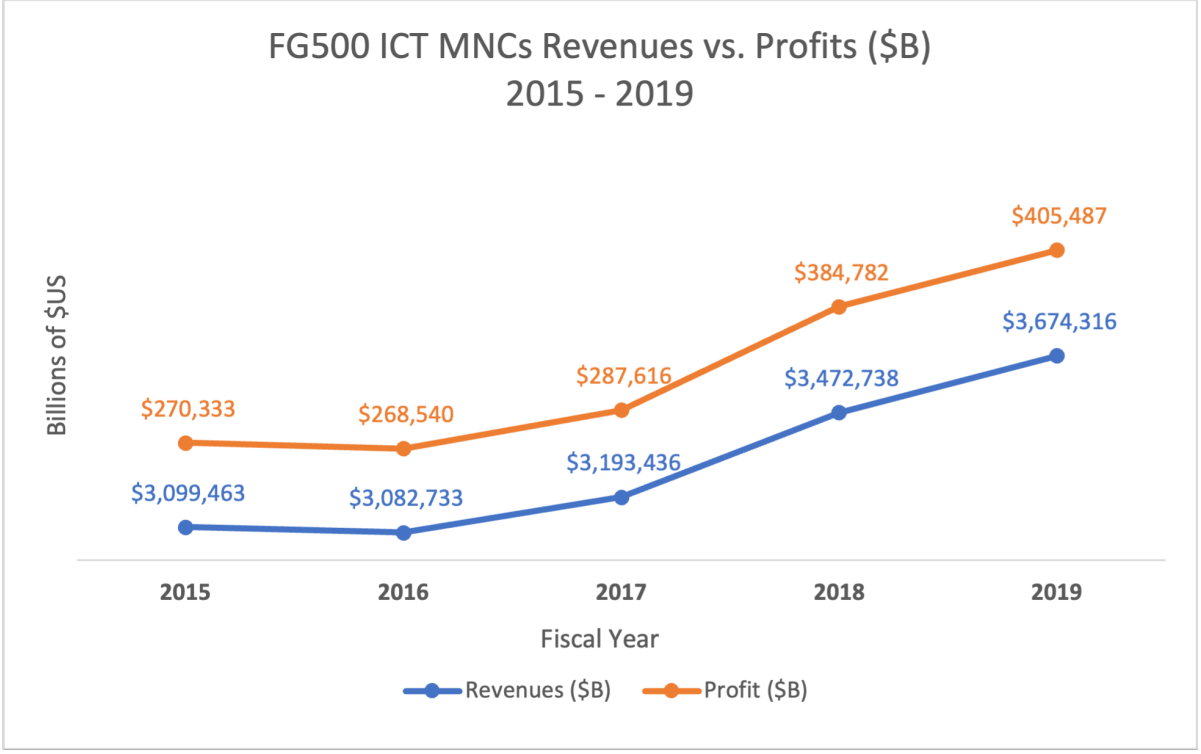


Figure 3.1: FG500 ICT MNCs Revenues vs. Profits ($B) from 2015 to 2019

The geographical distribution FG500 ICT MNCs headquarters for from 2015 to 2019 reveals a concentrated presence in several key countries, indicative of the global ICT landscape's current structure. The United States (US) emerges as the foremost hub, hosting 29% of these corporations, which underscores its paramount role in the ICT sector. Similarly, the European Union (EU) and Japan each account for an 18% share, reflecting Europe's substantial engagement in technology and Japan's sustained contributions to electronics and innovation. China's representation at 13% underscores its rapid ascent and expanding influence within the global technology sphere. Furthermore, Taiwan's 10% share highlights its indispensable role in the ICT supply chain, especially in semiconductor manufacturing. South Korea, with 6% of ICT MNC headquarters, demonstrates its prowess in electronics and telecommunications. The distribution also encompasses contributions from other regions, including Mexico (2%),

Singapore (2%), Canada (1%), and Australia (1%), illustrating the widespread yet concentrated nature of ICT MNC headquarters across the globe. This geographical distribution not only emphasizes the strategic significance of these regions within the technology and innovation ecosystem but also reflects the ICT industry's inherently global character, with a pronounced concentration of corporate headquarters in the US, EU, Japan, China, and Taiwan. Furthermore, the concentration of headquarters in developed countries, such as the US, EU, Japan, and South Korea, underscores their dominant position in the global technology landscape. Collectively, these regions account for 75% of the ICT MNC headquarters, highlighting the advanced technological infrastructure, robust regulatory environments, and substantial investment capabilities that foster innovation and global business operations (Figure 2).

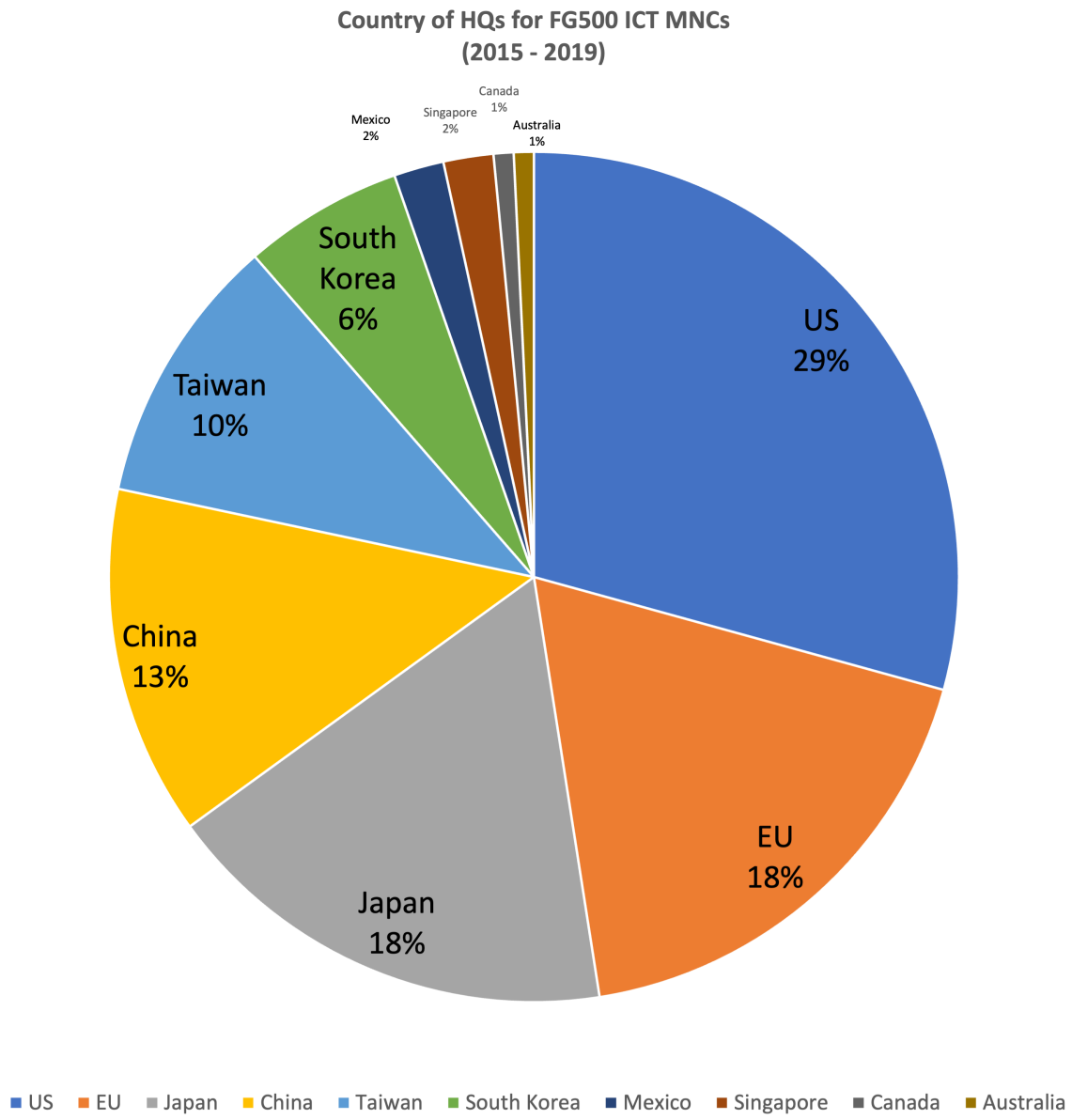


Figure 3.2: Country of Headquarters for FG500 ICT MNCs (2015-2019)

When the word frequency of the reports is analysed, it reveals significant insights into the trends and focuses within the ICT industry. The data comprises 246 documents, indicating a comprehensive coverage of the sector's sustainability reporting practices over the five-year period.

The most frequently occurring word is "environmental," appearing 28,899 times, which accounts for approximately 0.433% of all words in the data set. This high frequency highlights the paramount importance of environmental concerns within the ICT sector's sustainability efforts. Notably, the word appears in 99.2% of the documents, suggesting that nearly all companies are addressing environmental issues in their reports.

Following closely, the word "energy" is mentioned 26,742 times, making up 0.401% of the words and appearing in 98.8% of the documents. This reflects the ICT sector's significant focus on energy efficiency and renewable energy sources as key components of their sustainability strategies. "Sustainability" itself is the third most common word, used 24,956 times (0.374% of the words), and found in 92.8% of the documents. This underscores the broad adoption of sustainability as a central theme within the industry's reporting and operational strategies. "Products" is the fourth most mentioned word, found 23,545 times in the texts, which is 0.353% of the total word count. It appears in 99.2% of the documents, indicating a strong emphasis on the sustainability of products, including their life cycle, recyclability, and energy efficiency. Lastly, "social" rounds out the top five, with 23,464 occurrences, representing 0.352% of all words, and appearing in 99.2% of the reports. This signals a considerable focus on social responsibility, including labor practices, community engagement, and equal opportunities.

Overall, these results demonstrate a comprehensive commitment to environmental stewardship, energy management, product sustainability, and social responsibility within the ICT sector. These trends reflect the sector's response to global sustainability challenges and its role in promoting sustainable development (Figure 3).



Figure 3.3: Word Cloud Representing word frequencies from the Sustainability Reports

Aiming to gain a deeper insight into how MNCs respond to natural disasters, the analysis of the reports using MAXQDA software first focus is on identifying the various types of natural disasters to which these multinational entities respond. Following this, the study explores the specific actions undertaken by these corporations in response to such calamities, exploring the nature and scope of their activities. Lastly, the analysis seeks to pinpoint the geographical locales of these interventions, determining whether the disaster response efforts are primarily concentrated in developing nations or in developed countries. This comprehensive review aims to provide a clearer understanding of the strategic approaches employed by ICT MNCs in their disaster response initiatives.

3.4.1 Natural Disasters

The ICT MNCs intervened to the four categories of natural disasters covered by this study which are: Geophysical (earthquakes and volcanic activities), Hydrological (floods and mudslides), meteorological (cyclones: hurricanes (H) and typhoons (T)), and climatological (drought and wildfires). Four types of natural disasters were identified for which ICT MNCs responded the most, which are earthquakes, cyclones, floods, and wildfires (Figure 4).

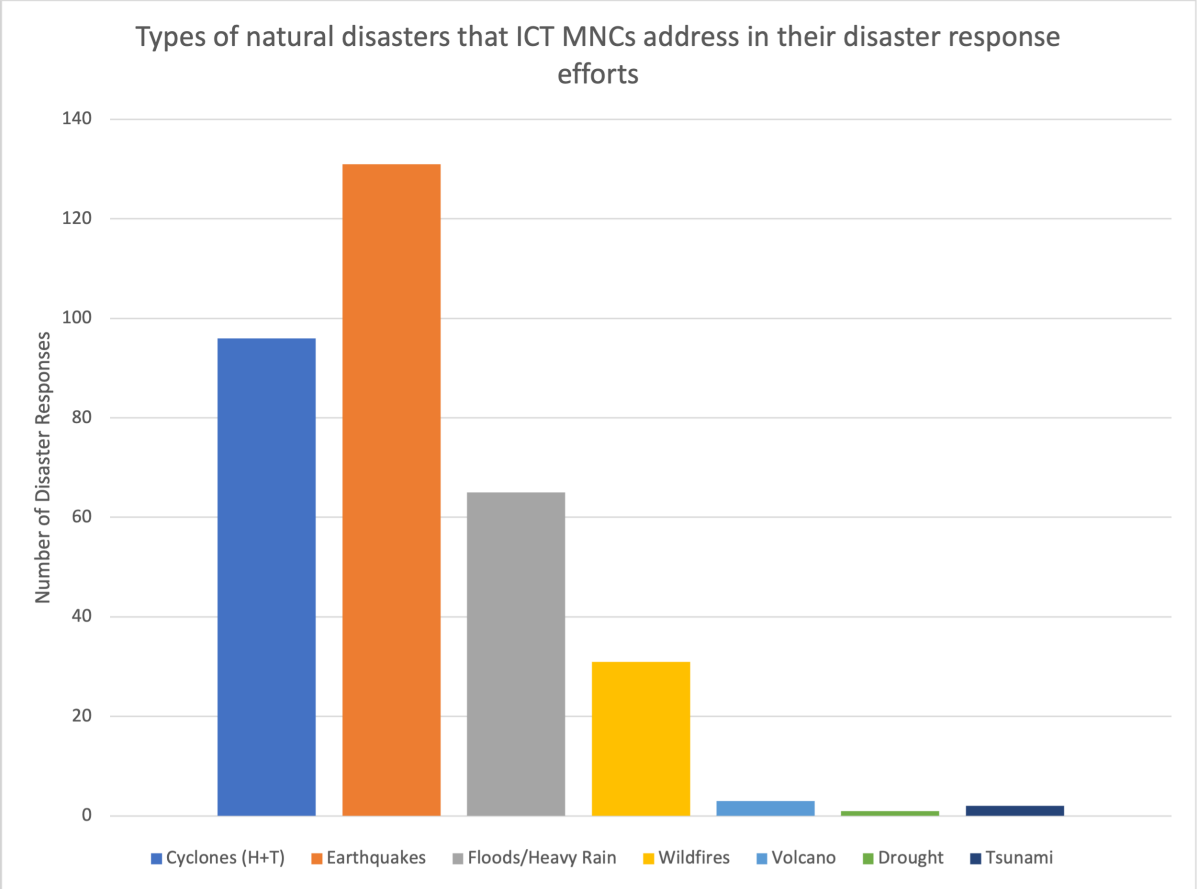


Figure 3.4: The types of natural disasters that ICT MNCs address in their disaster response efforts

	2015	2016	2017	2018	2019	Total
Cyclones (H+T)	3	6	34	24	29	96
Earthquakes	26	30	41	18	16	131
Floods/Heavy Rain	9	19	11	14	12	65
Wildfires	-	1	11	5	14	31
Volcano	-	-	-	3	-	3
Drought	1	-	-	-	-	1
Tsunami	-	-	-	-	2	2

Table 3.3: ICT MNCs Response to Natural Disaster

ICT MNCs have notably increased their response to natural disasters from 2015 to 2019, with specific attention to different types of disasters. Earthquakes garnered the most significant response, with 131 mentions accounting for 40.6% of total interventions, and 74% of these responses occurred between 2015 and 2017. Cyclones saw a major increase in attention, with the frequency of responses rising tenfold from 9 between 2015 and 2016 to 87 between 2017 and 2019, making up 29.7% of the total disaster responses. Floods were also a major focus, representing 20.1% of responses; aside from a spike in 2016, response levels remained fairly steady. Wildfires, while less frequent and comprising just under 10% of responses, showed an increase in intervention frequency from 2016 onwards, with a peak in 2019 at 14 instances. Overall, the data indicates a strategic scaling of responses with earthquakes being the most frequently addressed disaster, followed by cyclones and floods which together account for about half of all activities. Despite being less frequent, the response to wildfires and cyclones is on an upward trend, pointing to an increasing focus on these types of disasters as they become more prevalent and severe (Figure 5).

When the frequency of natural disasters, as reported by EM-DAT, is compared with the disaster response initiatives undertaken by ICT MNCs between 2015 to 2019, the data suggests an initial alignment between the increase in natural disasters and ICT MNCs' response efforts, indicating a potential responsiveness to global disaster trends. However, the subsequent plateau in response activities, despite the rising number of disasters, points to challenges in maintaining or increasing corporate disaster response efforts at a pace that matches the growing need, underscoring the importance of evaluating and potentially re-strategizing corporate roles and contributions to global disaster management efforts.

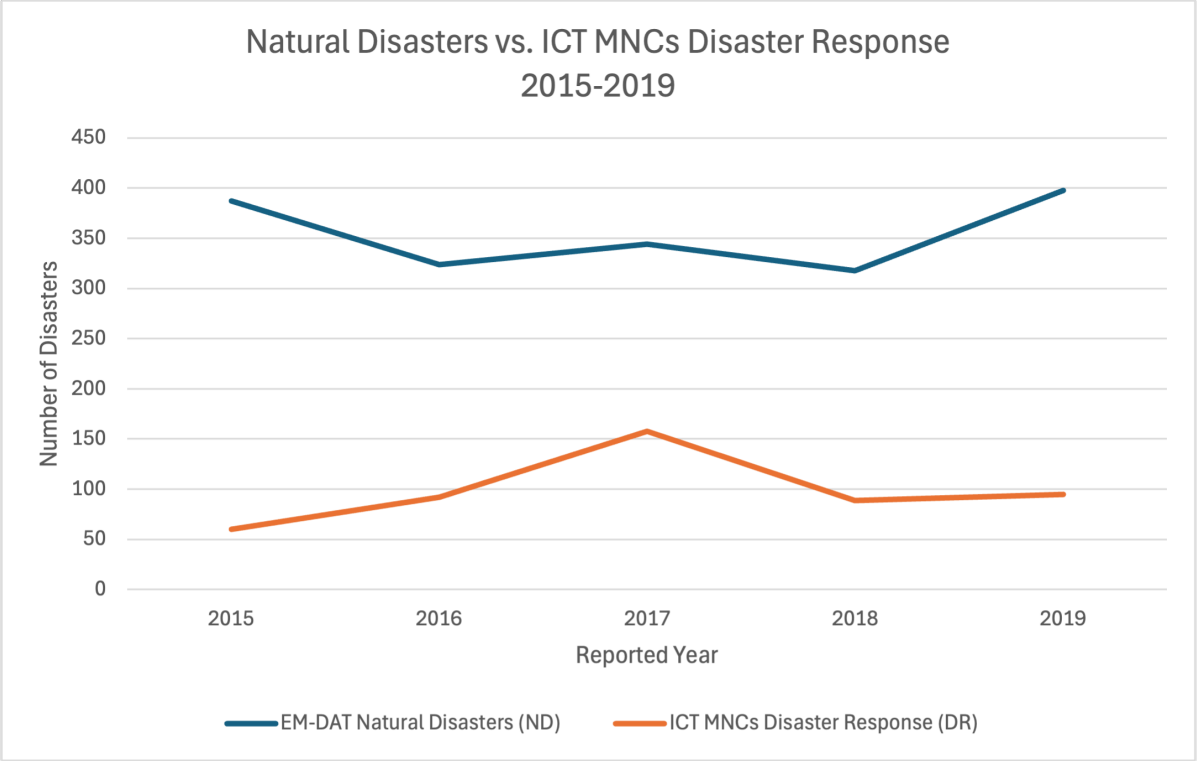


Figure 3.5: ICT MNCs Natural Disaster Response vs. National Disasters

3.4.2 Type of Disaster Response

Following the review of the sustainability reports from FG500 ICT MNCs, and based on the proportions of mentions, four key themes were identified, showcasing the approaches these corporations take in responding to natural disasters. These four categories of disaster response are 1) Cash Donations, 2) Employees Contribution, 3) Fundraising, and 4) In-kind donations. Notably, the distribution of these categories as illustrated in the figure 4 below, shows an equal predominance of Cash Donations and In-Kind Donations, each constituting 38% of the total response efforts. This equilibrium suggests a balanced approach by ICT MNCs, equally valuing the immediate financial support and the provision of goods and services as crucial to disaster relief operations. Employees' Contributions, making up 14% of the efforts, underscore the personal commitment of the workforce towards these humanitarian endeavors, while Fundraising activities account for the remaining 10%, highlighting additional avenues through which these MNCs mobilize resources for disaster response. The distribution underscores the

multifaceted strategy employed by ICT MNCs in addressing disaster relief, leveraging a combination of financial, material, and human resources to aid affected communities.

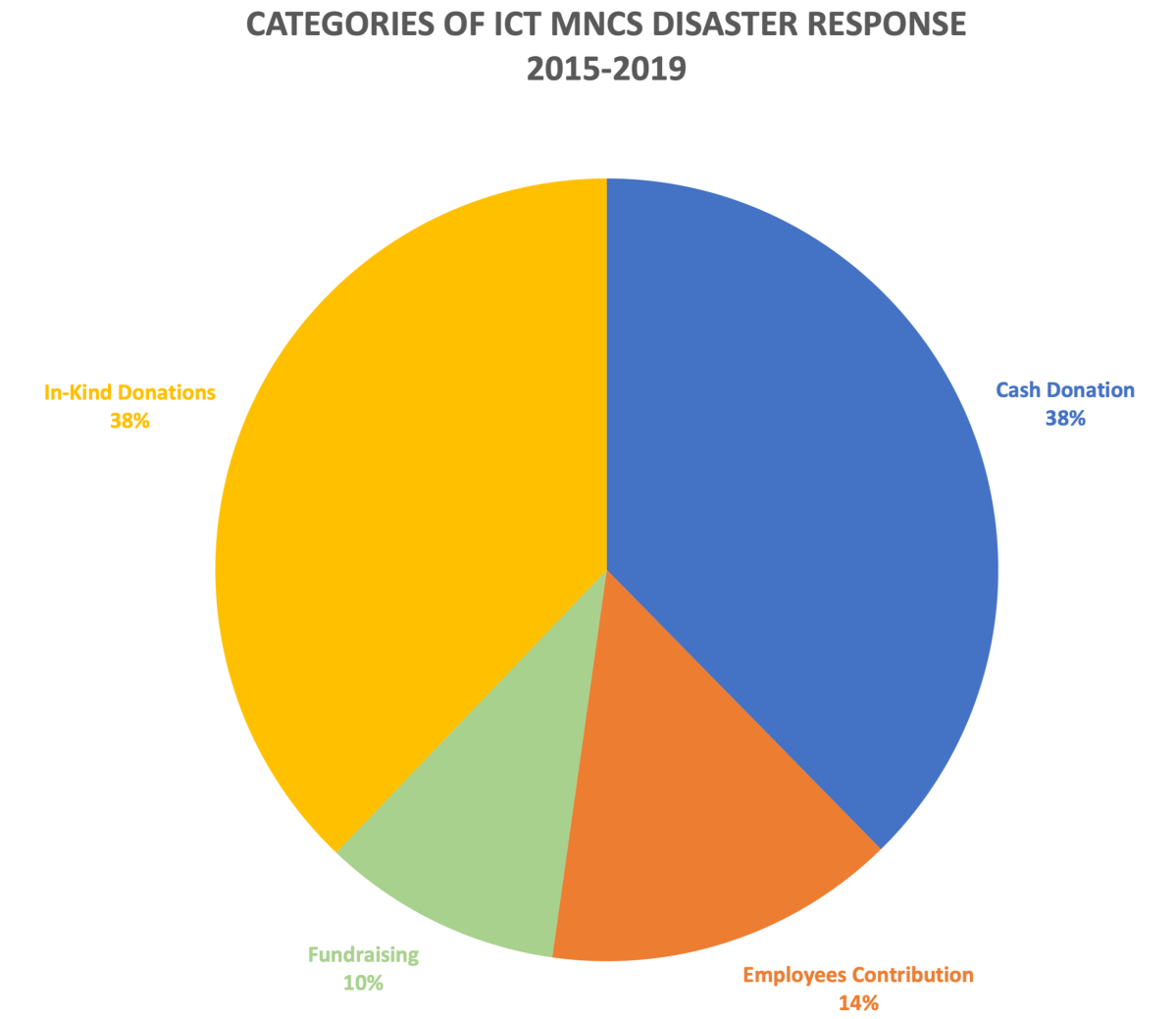


Figure 3.6: Categories of ICT MNCs Disaster Reponses (2015-2019)

The detailed categorization of disaster response types, as outlined in the table IV below, sheds light on the specific activities undertaken by ICT MNCs across the four primary areas (Figure 7).

	2015	2016	2017	2018	2019
Cash Donation					
To NGOs/Gov't	4	16	15	21	23
By Foundation	3	4	5	2	5
Matching	1	2	4	6	9
Others	5	16	18	15	12
Employees Contribution					
Donation	6	5	4	3	5
Volunteering	3	8	25	7	6
Fundraising					
	8	6	17	6	12
In-Kind Donations					
Equipment	8	12	15	8	8
Service	17	17	34	8	9
Other Donations	5	6	21	13	6

Table 3.4: Type of Disaster Response

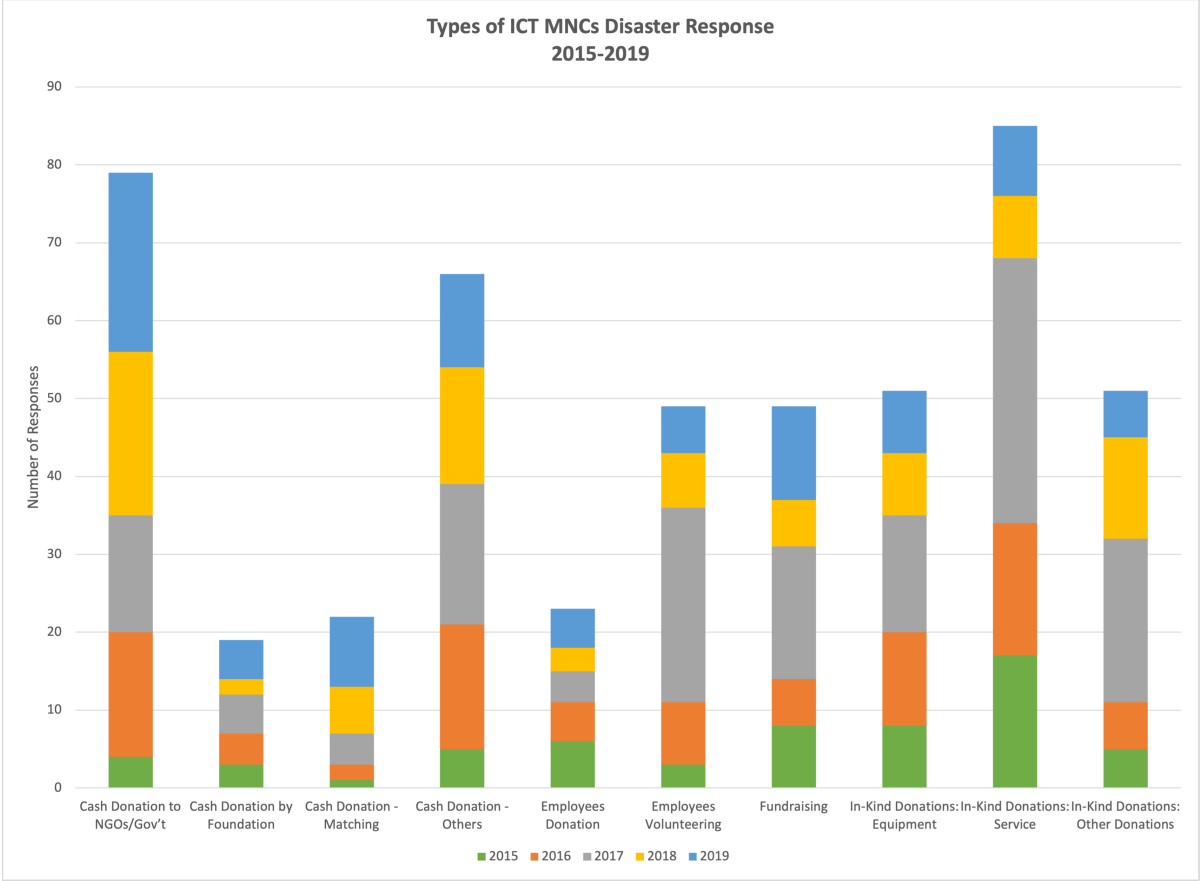


Figure 3.7: Categories of ICT MNCs Emergency Responses

Cash Donation

Following a natural disaster, multinational corporations often respond swiftly by providing substantial cash donations to assist in relief and recovery efforts. Such donations enable affected communities to access immediate resources, including food, clean water, medical supplies, and shelter. Multinational corporations' financial support not only aids in emergency relief but also contributes to long-term reconstruction and rebuilding efforts. These contributions can help restore critical infrastructure, such as schools, hospitals, and transportation systems, fostering community resilience and aiding in the recovery process. Four main categories of cash donations emerged from the data in this research, which are:

(1) Direct cash donation from the multinational;

(2) Donation to non-profit organizations and government agencies for disaster-relief;

(3) Donation through corporate foundation; and

(4) Matching of donations.

By examining the results extracted from the sustainability reports, the overall cash donations activities made for post-natural disaster relief efforts (direct, NGO, Foundation, and matching) show an upward trend over the years 2015 to 2019, increasing by almost four folds when comparing 2015 (13) to 2019 (49). Regarding the direct cash donation, the number of times the ICT MNCs made direct cash donations shows an increase from 2015 (5 instances) to 2017 (18 instances). However, this trend didn't continue, as there was a decrease in the subsequent years with 15 instances in 2018 and 12 in 2019.

- *Donation To Non-Profit Organizations and Governments Agencies*

By partnering with established NGOs, corporations can ensure that their donations are utilized efficiently and transparently, maximizing the impact of their contributions. Research has highlighted the positive outcomes of multinational corporations' cash donations to NGOs in disaster response situations. This financial support plays a crucial role in addressing immediate needs, fostering resilience, and facilitating long-term recovery in disaster-affected areas. For example, in the sustainability reports covered in this research, in 2020 “Lenovo donated US$50,000 to the Australian Red Cross to help with response efforts to the January wildfires” (Lenovo, 2020, p. 77), while in August 2018 Sony Group donated 25 million Japanese Yen between Save the Children and the government of Kerala Chief Minister’s Distress Relief Fund following the Kerela floods in India (Sony, 2020).

For this category the ICT MNCs cash donation to NGOs and governments shows a general upward trend from 2015 to 2019 (Figure 8). There was a significant jump from 4 instances in 2015 to 16 in 2016, after which the rise was gradual, reaching 23 instances in 2019.

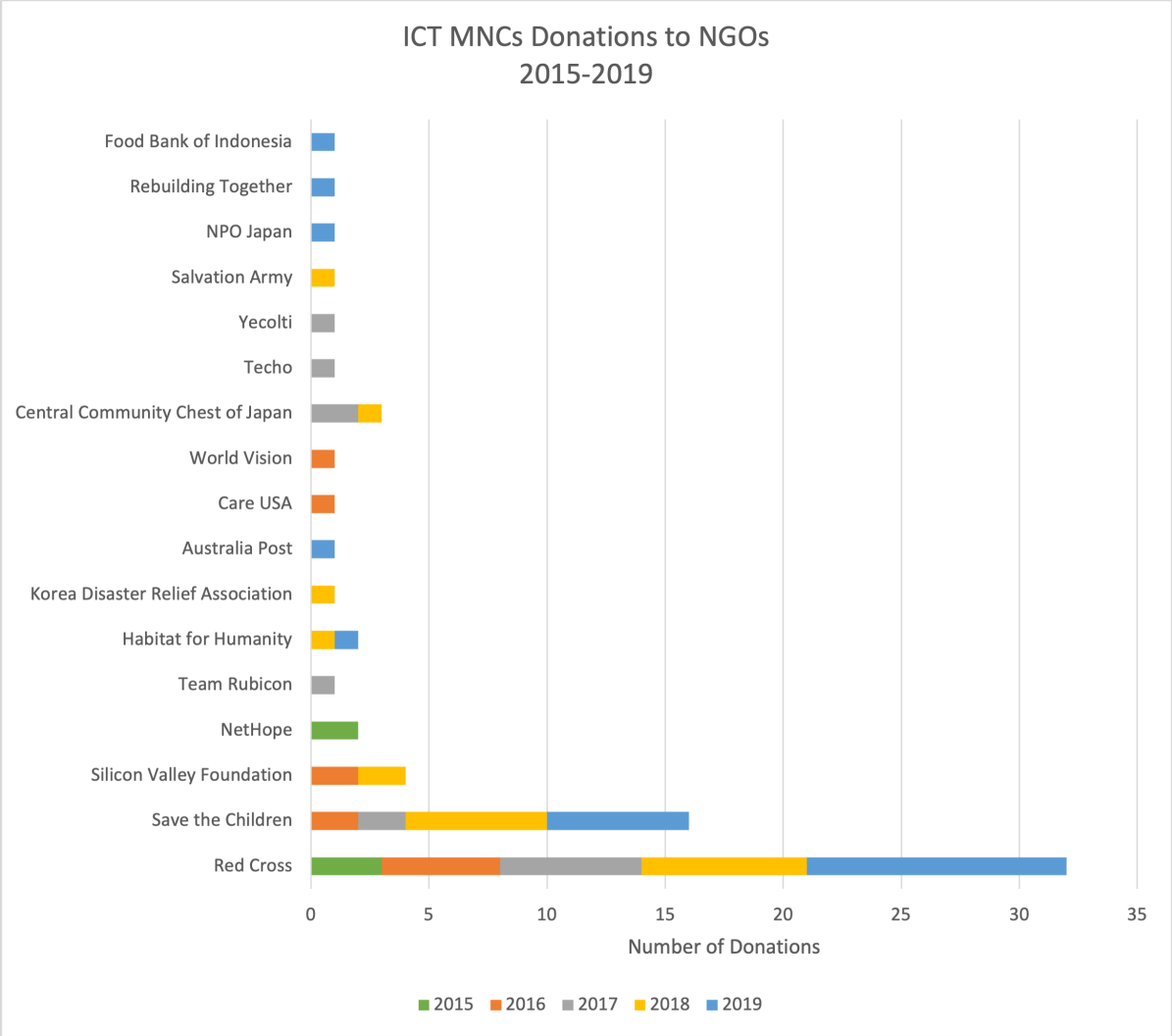


Figure 3.8: ICT MNCs Donation to NGOs and Governments Agencies

The most common NGOs that ICT MNCs partner with, in post natural disaster situations is the Red Cross with 46% (32 instances). The Red Cross includes national Red Cross societies, such as American Red Cross, Japanese Red Cross Society, Cruz Roja Mexico, and the International Federation of Red Cross & Red Crescent. The second NGO that ICT MNCs donate to the most is Save the Children, which represents 23% (16 instances) of all NGOs (Figure 9).

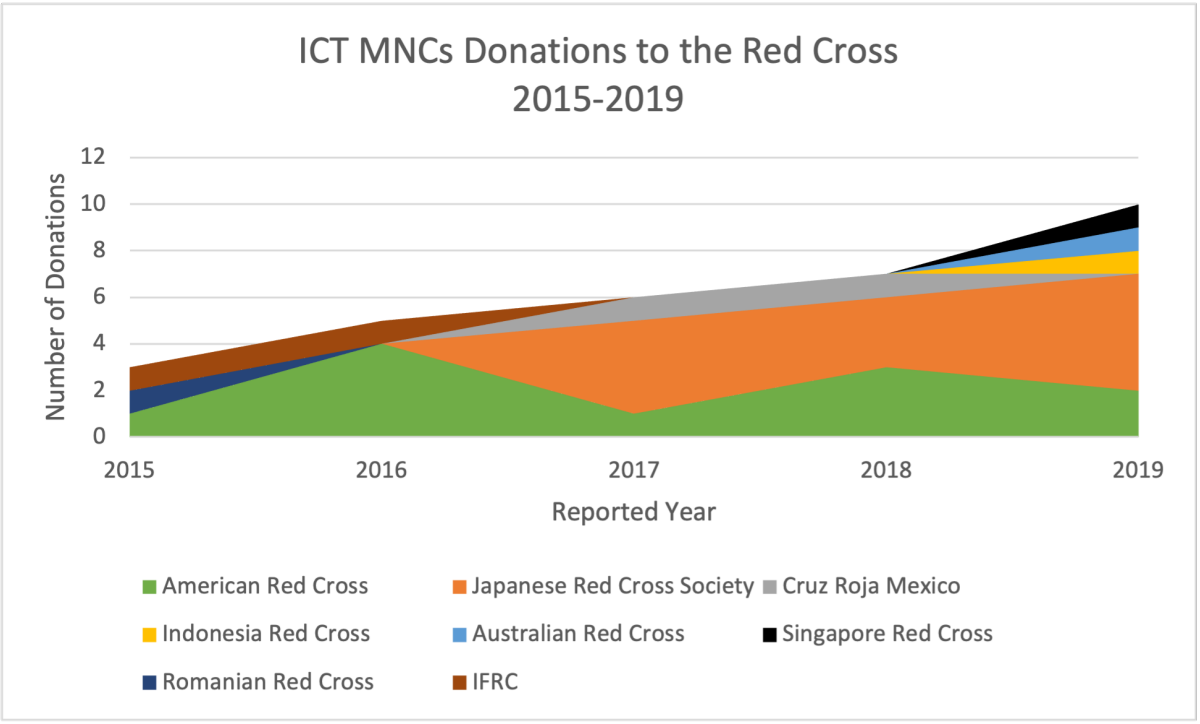


Figure 3.9: ICT MNCs Donations to the Red Cross

- *Donation Through Corporate Foundation*

The involvement of corporate foundations in disaster response allows for a coordinated and strategic approach to address the multifaceted needs arising from such events, promoting resilience and long-term community development (Grewal et al., 2019). Their contributions not only offer financial support but also demonstrate the commitment of multinational corporations to corporate social responsibility and their dedication to making a positive impact in times of crisis. For example, in 2015, Hewlett-Packard Company Foundation granted US $1.219 million to different partners to "assist with disaster relief and recovery efforts related to the earthquake in Nepal and flooding in Malaysia, as well as disaster preparedness initiatives" (HP, 2016, p. 108). Similarly for the 2015 Nepal earthquake, the Cisco Foundation gave a "US $100,000 cash grant to the NGO NetHope to enable communication and information sharing among emergency responding organizations" (CISCO, 2017, p. D7).

The number of times ICT MNCs contributed through their foundations remained relatively stable with little fluctuation. There were 3 instances in 2015, which increased slightly to 5 in 2017 and 2019, but there was a dip to 2 in 2018.

- *Matching of Donations*

In the context of disaster response situations, multinational corporations often adopt matching programs to mobilize additional resources and support relief efforts. Examples from this research show that in 2015, in response to two devastating earthquakes in Nepal, Flex Foundation matched a global employee donation for the benefit of the NGO Save the Children (Flex, 2017). Similarly, in response to Hurricane Harvey in the US, "Microsoft employee donation and corporate matching provided US $1.4 million to disaster response organizations" (Microsoft, 2018, p. 39).

ICT MNCs cash donation through matching shows a clear upward trend over the years. The number of times multinationals matched donations increased consistently from just 1 instance in 2015 to 9 in 2019.

Employees Contribution

Companies that encourage and support employee contribution to CSR initiatives can reap the benefits of a more engaged and motivated workforce, while also making a positive impact on society (Basil et al., 2008; Rodell et al., 2016; Sekar, 2021). Results revealed two main employees' contribution types emerged: *employees' donations* and *employees' volunteering*.

- *Employees' Donation*

Employees' donations refer to the money, goods, or services that employees provide to support charitable causes or social initiatives. For example, in 2015, several natural disasters occurred around the world, including earthquakes in Nepal, Afghanistan-Pakistan, and Yunnan, China. Many companies, including Deutsche Telekom and Ericsson, mobilized their employees to donate funds and provide aid to those affected by these disasters. Employee donation campaigns raised significant amounts of money for relief efforts, with Deutsche Telekom employees alone collecting more than 45,000 euros for the 2015 Nepal earthquake (Deutsche Telekom, 2016), and Ericsson employees' donation campaigns raised USD 75,000 to donate to WFP and ETC for the same disaster (Ericsson, 2016). ICT MNCs employees' donation activities in post-natural disasters between 2015 and 2019 shows a steady contribution throughout this period, oscillating between 9 instances in 2015 and 5 in 2019.

- *Employees' Volunteering*

Employees' volunteering is another essential component of employees' contribution. According to Greening et. al (2000), employees who volunteer have a more positive perception of their employer, are more satisfied with their jobs, and have a higher commitment to their company. In addition, volunteering provides an opportunity for employees to develop new skills and gain new experiences, which can benefit both the company and the employee. (Jones et al., 2014; Lamm et al., 2015; Myers & Carpenter, 2007; Porter & Kramer, 2006; Rupp et al., 2006). For example, in 2017, several ICT MNCs including AT&T, Verizon, Sony, Ericsson, IBM, and Telefonica, deployed employee volunteers to assist in restoration and recovery efforts. These volunteers distributed basic necessities, participated in reconstruction works, and provided critical emergency connectivity services. Employee volunteers played a vital role in the success of these programs, combining their diverse skillsets to help affected communities recover.

The results reveal that employees' volunteering in post-natural disasters between 2015 and 2019 shows a steady number of activities throughout the same period, oscillating between 3 and 8 instances for the years 2015, 2016, 2018, and 2019. However, during 2017, there has been a spike in employees volunteering activities with 25 instances reported.

Fundraising

MNCs from the ICT sector can leverage their technological expertise to support charitable causes and social initiatives when need there is, such as after a natural disaster. For example, they can create software or mobile applications that help raise funds for charities or enable people to donate to causes via their mobile devices (Bellio et al., 2013). For example, in 2017 AT&T launched a text-to-donate program that matched contributions up to $1 million. This program provided immediate funding to the NGO Team Rubicon to support disaster-stricken communities (AT&T, 2018). Similarly, during the same year, T-Mobile promoted a text-based fundraising 'Text to Give' – a mobile phone fundraising to help those impacted by the hurricanes. Any consumer could donate USD 10 to a non-profit of their choice working on Hurricane disaster relief efforts, such as the American Red Cross, by texting short codes (Deutsche Telekom, 2018).

The total number of reported fundraising activities reported by the ICT MNCs between 2015 and 2019 represented 49 instances. There is more particularly more involvement during 2017 and 2019, where the reported fundraising activities represents 60%.

In-Kind Donation

For MNCs, in-kind donations can be a valuable way to support social causes while also leveraging their technological expertise and resources. In the case of ICT MNCs in-kind donations could be donations of hardware equipment, such as servers and mobile phones. In kind donations could be in a form of a service. This service can involve free of charge consulting service, technical support, or even software licenses. Moreover, in-kind donations of services can also involve providing training or mentorship to help organizations build their capacity and improve their effectiveness (Islam et al., 2013). three main in-kind donation themes emerged, which are donation of equipment, services, and other kind of donations.

- *Equipment*

For ICT MNCs, in-kind donation of equipment refers to the donation of physical assets, such as computers, servers, mobile phones, or other technological tools, to support charitable causes or social initiatives. This can also involve donating outdated or surplus equipment to organizations that lack the resources to purchase or upgrade their own equipment. In-kind donations of equipment can also involve providing technical support or training to help organizations optimize their use of the donated technology. For example, in 2017 following Hurricane Maria disaster in Puerto Rico, Telefonica distributed satellite telephones and Broadband Global Area Network (BGAN) telephones to public and private entities (Telefonica, 2018). The donation of equipment is the same for 2015, 2018 & 2019 with 8 instances reported for each of the years. However, there is a surge in equipment donations for 2016 & 2017 representing 52% of the total.

- *Service*

In-kind donation of services refers to the donation of professional services or expertise to support charitable causes or social initiatives. For ICT MNCs, this can involve providing pro bono consulting, technical assistance, or other professional services such free air-time connectivity or software licenses to NGOs or social initiatives`. For example, in 2017 & 2018

following hurricane Harvey, Irma, and Florence, Charter Communications "offered $3 million in Public Service Announcements (PSAs) to air at no cost to assist organizations with fundraising and awareness for hurricane relief efforts." (Charter Communications, 2020, p. 5). The results reveal a noticeable increase in contributions from 2015 to 2017, with the number of times an ICT multinational contributed in a post natural disasters activity with service donation increasing from 17 to 34. However, this trend seems to reverse in 2018 and 2019, with contributions dropping to 8 and 9 respectively. It is important to notice that the donation of services for the initial three years represent 80% of total.

- *Other Donations*

In-kind donations of other goods refer to the donation of goods other than equipment or services. This can involve donating products or services that are unrelated to the company's core business or expertise. This can include donations of food, water, medication, furniture, or other non-technological items that can help support the affected communities. For example, after a 7.8 magnitude earthquake struck Nepal in 2015, LG Electronics with their local buyer built and donated 100 prefab housing units to victims of the disaster. The same year, the MNC donated medical supplies to more than 820 families affected by the floods that hit Myanmar in August (LG Electronics, 2016).

The analysis reveals that the other donations category is similar in year 2015, 2016, and 2019 with respectively 5, 6, and 6 instances. However, the total activities for 2017 and 2018 show a hike and it represents 65% of total 'other donations'.

3.4.3 Geographical Response

This study investigates what responses ICT MNCs are taking to address natural disasters in developing nations. Developing are defined in accordance with the United Nations' (UN) classification of developing countries, based on the 2023 Human Development Index (HDI) criteria (United Nations, 2023). The HDI measures a nation's progress in terms of education, health, and life expectancy, with values ranging from 0 to 1, where scores above 0.80 typically denote more developed countries (United Nations, 2023). This study focuses on countries with an HDI below 0.80.

The analysis reveals that the disaster response efforts of ICT MNCs span both developing and developed nations across all continents. The frequency of these responses has shown an upward trend from 44 occurrences in 2015 to 59 in 2019, with a notable surge to 99 occurrences in 2017. Despite this overall increase, the study notes a significant reduction in the proportion of responses in developing countries, dropping by over 50% from 2015 to 2019. Initially, in 2015, responses in developing countries accounted for 77% of the total ICT MNC responses, but this percentage fell sharply to 25% by 2019. In reverse, there is a steep upward trajectory in emergency response activities by ICT MNCs in developed countries, growing from 10 instances in 2015 to 57 in 2017 followed by a decrease to 34 instances by 2019. The overall trend shows a significant increase of emergency response activities in developed countries from 23% in 2015 to 58% in 2019.

Another result that emerged from the analysis is the "dominance" of two countries where ICT MNCs intervened the most - Japan and US - neither of which were developing countries. Between 2017 and 2019 the average disaster response of ICT MNCs in these two countries represent 40% of total interventions. And in 2015 and 2016, Japan by itself represented an average of 21% of the total ICT MNCs disaster responses (Figure 10).

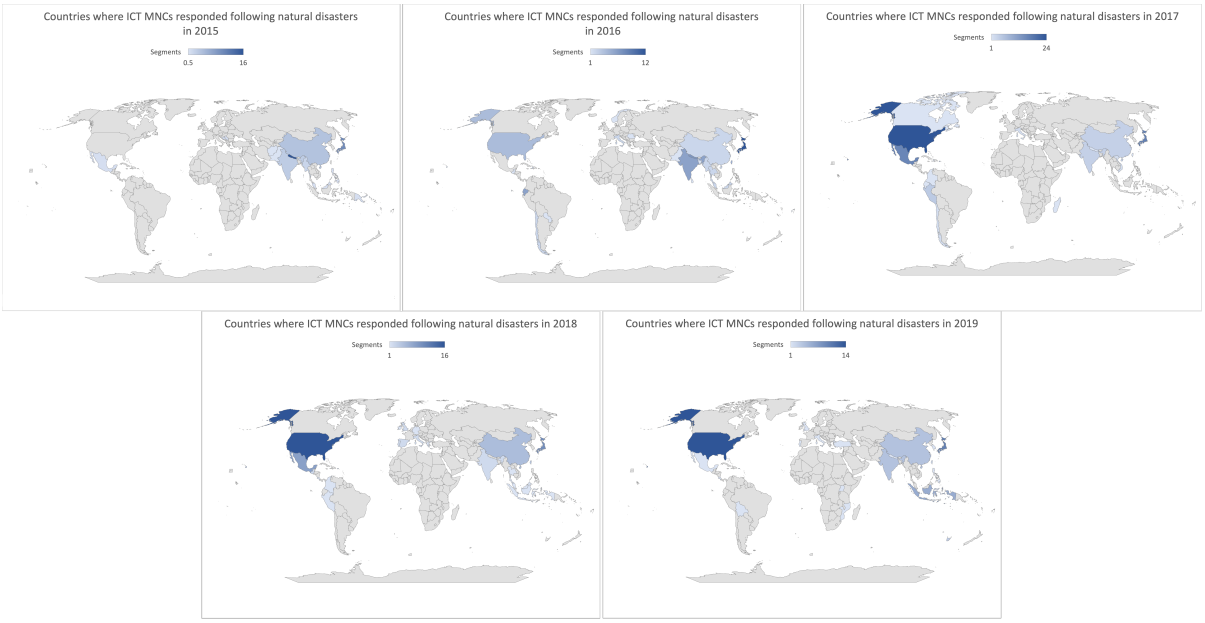


Figure 3.10: Countries where ICT MNCs intervened following natural disasters (2015-2019)

The opposing trends highlight a pivot in the focus of ICT MNCs' emergency responses from developing to developed countries around 2017. While initial efforts were heavily concentrated in developing regions, the subsequent years show a reallocation of resources, though with challenges in maintaining a consistent level of response in developed countries (Figure 11).

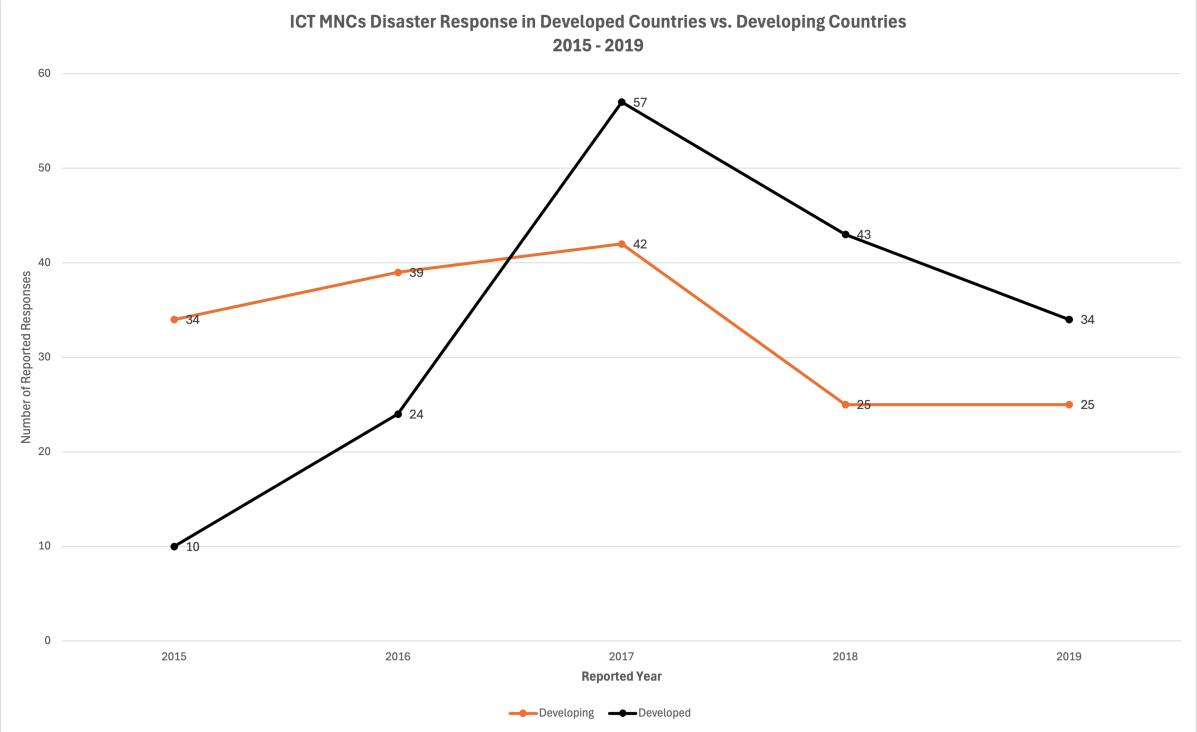


Figure 3.11: ICT MNCs Disaster Response in Developed Countries vs. Developing Countries

When the disaster response efforts by ICT MNCs in both developed and developing countries is compared with natural disaster occurrences with data incorporated from EM-DAT, over the five-year span, there is a noticeable decline in the number of natural disasters in developing countries, contrasted by a significant increase in 2019. In parallel, disaster responses in developing countries exhibit a gradual upward trend, albeit at a much slower pace. Conversely, the frequency of natural disasters in developed countries remains relatively stable, with a slight uptrend, whereas disaster response efforts show a sensible increase. The disparity between the number of natural disasters and the scale of disaster response in developing countries raises critical considerations about the allocation of resources and the adequacy of

response mechanisms. It suggests that while ICT MNCs are stepping up their efforts, there may still be gaps in addressing the full scope of needs in areas more prone to natural disasters. The comparative steadiness in developed countries indicates a more balanced alignment between the occurrence of disasters and response initiatives, pointing towards a potential need for enhanced focus and resource distribution towards developing regions to better match the scale of emergencies encountered (Figure 12).

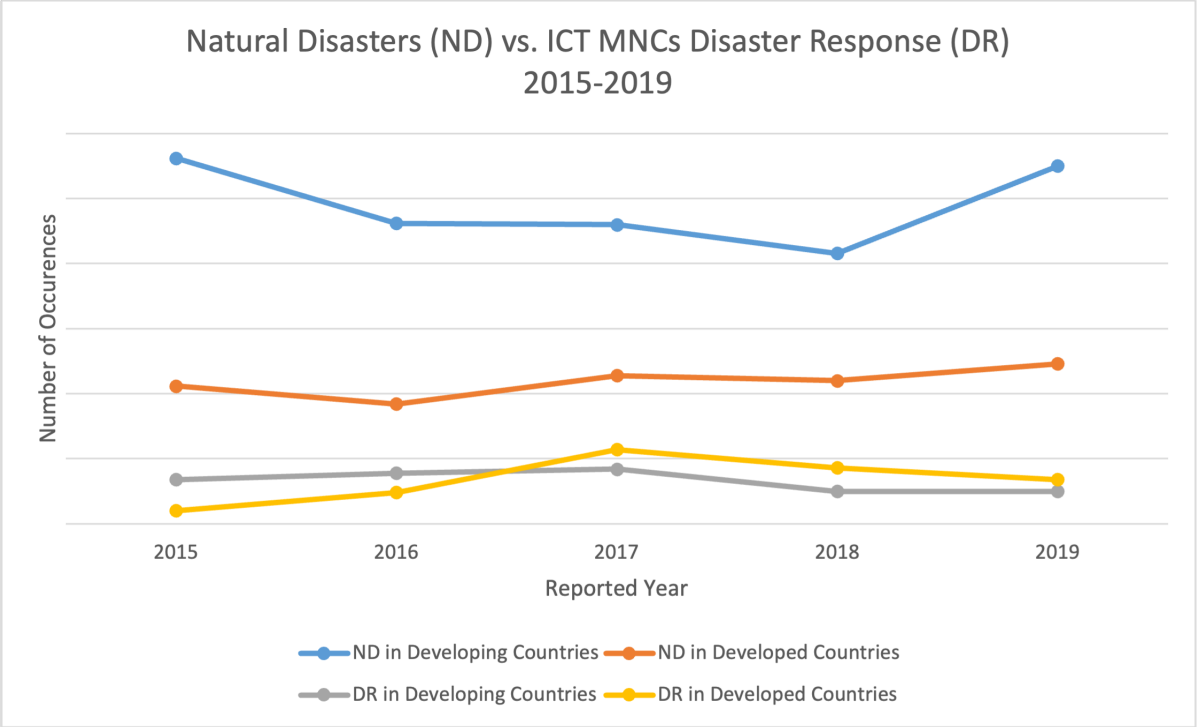


Figure 3.12: ICT MNCs Emergency Response in Developed Countries vs. Developing Countries with EM-DAT data

3.5 Discussion

The objective of this study was to understand the role of FG500 ICT MNCs in responding to natural disasters in developing countries, drawing on content analysis of 246 sustainability reports from 2015 to 2019, a period marked by escalating climate-driven disasters (IPCC, 2023). In response to this challenge, the effective use of ICT has become increasingly vital in disaster response efforts (Freeman et al., 2019). This study contributes to the literature on corporate disaster responsiveness by offering three key insights: growing involvement,

geographical disparities, and response strategies, each with implications for both theory and practice.

3.5.1 Growing Involvement of ICT MNCs

This study confirms the growing involvement of ICT MNCs in disaster response from 2015 to 2019. This trend aligns with the broader recognition of ICT and the strategic importance of MNCs in global disaster response efforts. This finding supports observations from systematic reviews of academic literature focusing on ICT in disaster management, which have documented an expanding body of research and technological advancements in this field (Ghadge, 2023; LU et al., 2020; Marić et al., 2022; Sood & Rawat, 2021). While previous studies, like Kaur & Sood (2019), have examined this trend through academic publications, this research uniquely examines the phenomenon through an analysis of sustainability reports, providing a complementary perspective. The growing involvement of ICT MNCs in disaster response globally, highlights the evolving landscape of corporate disaster responsiveness practices, and how it is increasingly integrated into corporate CSR frameworks (Ali, 2023). This shift reflects Porter and Kramer's (2006) shared value paradigm, where addressing societal needs, like disaster relief, enhances strategic positioning, moving beyond Carroll's (1991) discretionary philanthropy.

In developing regions, where infrastructure deficits amplify disaster impacts (Kaur et al., 2022), ICT tools such as mobile networks have proven vital, reducing fatalities by 47% through improved early warnings (Toya & Skidmore, 2015). However, a plateau in response activities post-2017, despite a steady rise in global disaster, raises questions about scalability. With profit margins surging 50% over the study period, resource availability seems less a constraint than strategic intent or operational capacity. Does this reflect fatigue, a shift in priorities, or limits in deploying ICT solutions to chaotic post-disaster settings (Yulianto et al., 2020)? This growing involvement positions ICT MNCs as critical partners in global disaster management (Roy et al., 2020), yet the long-term resilience benefits, such as rebuilt economies or community empowerment (Madsen & Rodgers, 2015) remain underexplored, warranting further investigation as climate pressures intensify.

3.5.2 Geographical Disparities in Disaster Response

While engagement grows, the geographical distribution of aid reveals a concerning disparity. Responses in developing countries plummeted from 77% of total efforts in 2015 to 25% in 2019, while developed countries' share climbed from 23% to 58%. Japan and the United States, home to 47% of these MNCs' headquarters, accounted for 40% of the responses between 2017 and 2019, with notable spikes tied to the 2016 Kumamoto earthquake in Japan, which was one of the deadliest earthquake sequences in Japan, and the 2017 devastating and costliest historical hurricane season in the US (NOAA, 2018). These findings are consistent with Muller and Whiteman (Muller & Whiteman, 2009) suggesting that companies tend to focus on disasters that are closer to their home base or in areas where they have a physical presence, potentially due to a sense of responsibility or a greater sense of visibility. The complex interplay between geographic location and corporate disaster response actions emphasizes the need to consider geographic factors when analyzing and promoting effective corporate engagement in disaster relief efforts. This trend raises questions about the consistency and long-term commitment of ICT MNCs in developing regions, which are often more vulnerable to natural disasters (Fomby et al., 2011; Panwar & Sen, 2018). This is a particularly relevant finding given that the demand for assistance in developing nations remains significantly higher with respect to the number of natural disasters compared to their developed counterparts (Naoaj, 2023). This finding builds on Johnson et al.'s (2011) broader MNC relief observations, offering an ICT-specific lens that highlights a pivotal shift around 2017. With 75% of headquarters in developed nations, economic drivers, such as protecting local markets or supply chains (Ballesteros et al., 2017) or CSR optics may outweigh ethical imperatives to aid the most vulnerable (Mitchell et al., 1997). In contexts where disasters overwhelm local governments, ICT MNCs could bridge critical gaps (Duc & Linh, 2020), yet their retreat from developing regions raises questions of consistency and commitment. Is this shift event-driven, responding to high-profile domestic disasters, or a structural recalibration of priorities? The interplay of these factors, i.e., proximity, economic stakes, and moral duty, remains unclear, echoing calls for deeper analysis of corporate behavior in disaster-prone developing economies (Ali et al., 2017; Oh et al., 2020) and policy interventions to realign aid with need (Baidoo, 2018).

3.5.3 Disaster Response Strategies

The strategies employed by ICT MNCs reveal a balanced reliance on cash donations and in-kind contributions, each comprising 38% of total responses, with in-kind services dominating 80% of efforts from 2015 to 2017 and partnerships with the Red Cross leading at 46%. Expanding Johnson et al. (2011) US-centric framework, this study provides a global, ICT-specific perspective, showing cash as a flexible, immediate resource from (Islam et al., 2014) and in-kind aid, such as Telefonica's satellite phones, as a deployment of core technological expertise. This distinction sets ICT MNCs apart from generic corporate philanthropy, aligning with their capacity to restore connectivity and coordination in disaster zones (GSMA, 2020). In-kind contributions, often costlier for NGOs to procure independently, suggest a need to broaden Islam et al.'s (2014) "convenient donation" construct to encompass strategic technological aid, a view bolstered by Stute et al.'s (2020) emphasis on enhanced MNC-NGO collaboration. The Red Cross's dominance as the primary recipient, i.e. receiving nearly half of ICT MNC support, underscores its pivotal role as a trusted humanitarian partner, likely due to its global reach, disaster expertise, and established networks. This focus contrasts with broader NGO engagement, suggesting a strategic preference that amplifies impact but may limit diversity in aid distribution. Employee volunteering (14%) further enriches this mix, offering skilled support, such as technical assistance, that cash alone cannot replicate. Partnerships with NGOs leverage local knowledge and networks, ensuring cultural and logistical relevance (J. Chen et al., 2013), yet their effectiveness hinges on trust and coordination, areas where developing countries' unstable infrastructure. For example, power outages or low literacy, pose persistent challenges (Sakurai & Murayama, 2019a). While efficiency is implied (e.g., "immediate resources"), the absence of concrete metrics, such as response times or lives saved, limits claims of impact, a gap the literature flags as critical (Yulianto et al., 2020). This strategic blend hints at untapped potential: deeper ties with leading partners like the Red Cross, alongside tailored ICT deployment, could amplify relief, particularly in under-resourced settings, if barriers are addressed and outcomes quantified.

3.5.4 Practical Implications

Based on the findings from the study, several robust management and policy implications arise to guide ICT MNCs, policymakers, and humanitarian organizations in enhancing disaster response effectiveness in emerging economies:

- **For MNCs**: ICT MNCs should develop clear, comprehensive, and transparent strategies for disaster response that explicitly outline their commitment to both developed and developing countries. These strategies should be integrated into their broader CSR initiatives and should consider the specific needs, vulnerabilities, and contexts of different regions. Given the observed geographical disparities in disaster response efforts where aid to developing countries falling from 77% to 25%, they must prioritize vulnerable zones, where disasters hit hardest, using in-kind strengths such as equipment and services. Detailed deployment plans should align with local needs, while long-term partnerships with NGOs, notably the Red Cross (46% of support), build trust and relevance. Boosting employee volunteering (14%) and matching donations can further amplify impact.
- **For Policymakers:** Policymakers in both developed and developing countries should play a more active role in encouraging and facilitating MNC involvement in disaster response through appropriate incentives, such as tax benefits or recognition programs, and by fostering public-private partnerships. They should also work to create an enabling regulatory environment that facilitates the effective deployment of ICT for disaster management, including streamlining customs procedures for emergency equipment and ensuring adequate spectrum availability for communication services, particularly in developing countries. Recognizing the critical role of ICT infrastructure in disaster response, governments in developing nations should prioritize investments in resilient telecommunication infrastructure and collaborate with ICT MNCs to leverage their expertise in building and maintaining such systems. Moreover, policies should aim to promote transparency and accountability in corporate disaster response efforts.
- **For NGOs:** NGOs should proactively engage with ICT MNCs to leverage their unique resources (38% in-kind), technological expertise, and global reach. They should explore ways to strengthen partnerships and collaboration with these corporations, establishing clear communication channels and protocols for effective coordination before, during, and after

natural disasters. Given the finding that the Red Cross is a primary recipient of ICT MNC support (46%), other NGOs could learn from these established relationships and explore similar collaborations. NGOs should also actively communicate their specific needs and priorities to MNCs to ensure that corporate contributions are targeted and impactful, particularly in developing countries. Furthermore, NGOs can collaborate with ICT MNCs to develop and implement technology-driven solutions for disaster preparedness, early warning systems, and relief distribution, thereby enhancing the overall effectiveness of humanitarian aid.

3.6 Limitations and Future Directions

3.6.1 Limitations

Findings from this study has limitations. The study was carried over a period of five years to showcase a longer trend, studies including a longer time period would be beneficial. However, five years was sufficient to start understanding some of the trends, especially that 2017 was included, which was historically the most devastating and costly weather and climate disasters year. Additionally, this research relied on the examination of sustainability reports, which are published by the multinational corporations themselves, and the validity of the information in these reports is variable. The self-reported data may understate efforts in developing countries or overstate CSR optics, risking bias as firms control disclosures (Hahn & Kühnen, 2013). The MAXQDA content analysis, while robust, depends on keyword selection, potentially missing nuanced activities. These gaps suggest caution in generalizing findings, urging practitioners and researchers to scrutinize reporting transparency and data scope.

3.6.2 Future Research

Future research exploring the phenomenon of MNC natural disaster response must consider the following important dimensions. First, future research should delve deeper into the reasons behind the declining trend of disaster response activities in developing countries and explore ways to encourage sustained engagement in these regions that will be impacted further by climate change. Second, there is a need for longitudinal studies to assess the long-term impact

of ICT MNCs' disaster response activities on community resilience and recovery. These initiatives often manifest as short-lived or singular relief actions and spontaneous, non-recurring engagements rather than as part of a sustained, long-term strategy (Azuma et al., 2023; Mishra, 2023). Third, the decision-making process about geographical location for the ICT MNCs is not clear and requires specific research. For example, if MNCs respond to a specific type of natural disaster or targeting a specific geographical location linked to their headquarter location is unclear but might be significant based on the findings of this study. Fourth, further research is necessary to evaluate the efficacy of public-private partnerships in disaster response and recovery, particularly with dominant players like the Red Cross, to optimize collaboration in developing regions. Additional studies around efficiency metrics could quantify impact, guiding firms and policymakers. Finally, more research are welcomed to provide actionable recommendations for enhancing the collaborative frameworks between ICT MNCs, government entities, and NGOs in disaster-prone regions particularly in developing nations (Berg, 2015; Dunn-Cavelty & Suter, 2009; Osei-Kyei et al., 2023; Valente, 2010; Valente & Crane, 2010).

3.7 Conclusion

This study investigates FG500 ICT MNCs' emergency response to natural disasters in developing countries, analyzing 246 sustainability reports (2015–2019). Responses grew from 44 to 59 instances, peaking at 99 in 2017, reflecting ICT's integration into global disaster management (Ghadge, 2023). Cash donations (38%) and in-kind aid (38%, 80% of 2015–2017), often through partnerships with the Red Cross (46%), highlight ICT's role in speeding coordination, balancing corporate social responsibility pressures with tech-driven relief (Porter & Kramer, 2006). This underscores ICT's potential where infrastructure falters (M. Kaur et al., 2022).

The analysis reveals pronounced geographical imbalances in ICT MNC disaster responses. The aid share for developing countries declined from 77% to 25% between 2015 and 2019, while responses in developed nations increased to 58%, with the US and Japan accounting for 40% of efforts from 2017 to 2019. Given that 75% of MNC headquarters reside in wealthier regions and profits rose 50%, proximity appears to outweigh need (Muller & Whiteman, 2009),

despite greater vulnerability in developing countries (Panwar & Sen, 2018). Efficiency lacks quantification, with missing metrics such as lives saved (Yulianto et al., 2020), rendering impact presumptive rather than validated. Strategic NGO partnerships, utilizing ICT expertise like mobile networks (Toya & Skidmore, 2015), address gaps but prioritize structured, headquarters-centric efforts over equitable distribution.

These findings frame ICT MNCs as vital but uneven responders. As climate change intensifies disasters (IPCC, 2023), they urge firms and policymakers to recalibrate, targeting tech and cash to vulnerable zones rather than convenience. Future research should probe this shift's drivers, test long-term resilience gains, and measure partnership efficacy, ensuring ICT's promise matches global need. This baseline informs theory and practice for balanced, sustained relief across sectors.

MANUSCRIPT ENDS

Chapter 4

Harnessing Global Tech for Local Resilience: The Role of ICT Multinationals in Disaster Response to Kenya's Cyclone Hidaya Floods

Contents of this chapter are published in:

Battikh, J. Y., Wood, M. O., Bodolica, V. (2025). Harnessing Global Tech for Local Resilience: The Role of ICT Multinationals in Disaster Response to Kenya's Cyclone Hidaya Floods. Manuscript submitted for consideration

Abstract

Information and Communication Technology (ICT) multinational corporations (MNCs) play a vital role in addressing the challenges of climate change and natural disasters. This study analyzes ICT MNCs' engagement during the 2024 Cyclone Hidaya floods in Kenya – a country acutely vulnerable to climate change-induced extreme weather. Using a qualitative case study approach, semi-structured interviews with six decision-makers from four leading ICT MNCs were triangulated with data from reports and white papers to develop a grounded theory model. We develop a Triggering Response–Engagement Motivation–Championing Technology (TEC) framework, revealing that local presence and government liaisons triggered responses, while corporate social responsibility (CSR), strategic interests, and ethical imperatives drove motivations. Technological interventions, such as cloud computing, geospatial analysis, Artificial Intelligence (AI)-driven damage assessments, and drone support, enhanced situational awareness and resource allocation, with capacity-building efforts fostering local resilience. This research contributes to the ICT and disaster management literature by offering a novel framework that integrates local and global strategies for humanitarian outcomes, while highlighting challenges such as data ethics and scalability. The study underscores the value of local partnerships and technology transfer for sustainable disaster response in developing regions, providing actionable insights for policymakers and calling for future research to assess

the long-term efficacy and generalizability of these interventions across diverse disaster contexts.

MANUSCRIPT BEGINS

4.1 Introduction

Between March and May 2024, Kenya experienced catastrophic flooding triggered by Cyclone Hidaya (see Figure 1), one of the most severe cyclonic storms affecting East Africa in recent years (Mahongo, 2024). The cyclone brought intense rainfall and powerful winds, affecting 43 out of 47 counties, devastating communities across Kenya and leaving thousands displaced (Kenya Red Cross, 2024). This tragic disaster underscores the growing vulnerability of the region to extreme weather events fueled by climate change. When the newly appointed Special Envoy on Technology within the Government of Kenya reached out to ICT MNCs to support the Kenya Red Cross Society (KRCS) in developing digital solutions to enhance flood response and relief efforts, they responded present. The technology firms provided data, equipment, support, and services for humanitarian use.

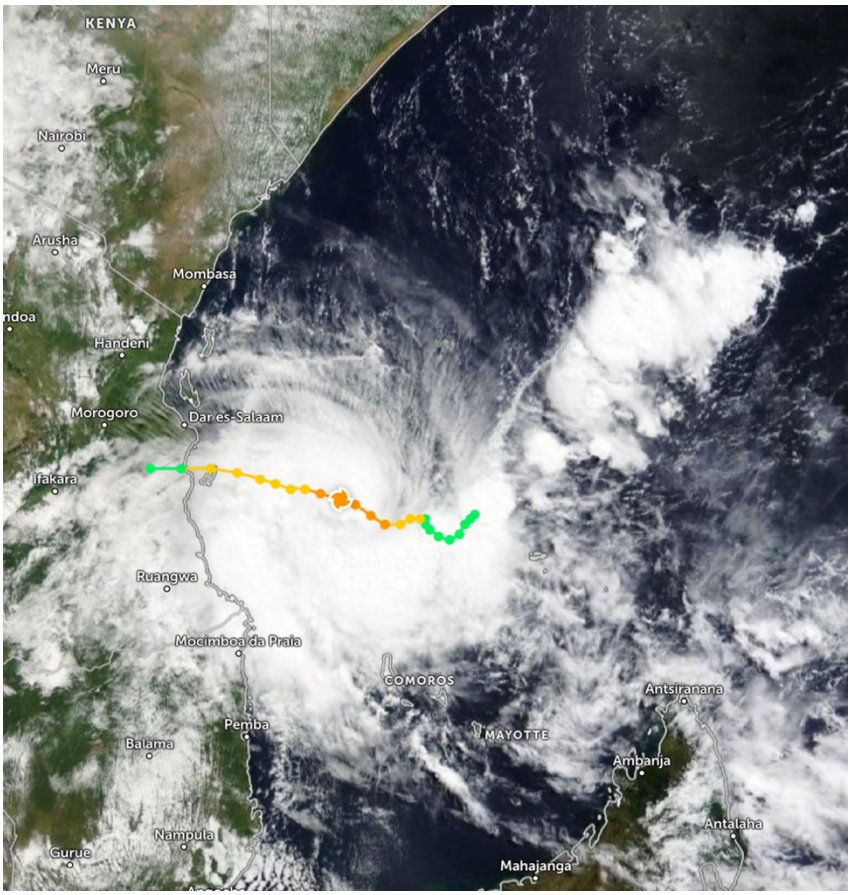


Figure 4.1: Trajectory of tropical cyclone Hidaya on 3 May 2024 – (Source: Zoom Earth, 2024)

The occurrence of severe natural catastrophes, such as the recent flooding in Kenya, has become more frequent worldwide. Traditionally, national governments and non-governmental organizations (NGOs) have spearheaded disaster-relief efforts. However, corporations are increasingly assuming prominent roles in disaster response and climate change adaptation. This private sector contribution is driven by a combination of CSR, strategic interests, and the recognition of their capabilities in logistics and resource mobilization to address such global challenges.

The ICT sector, in particular, has been at the forefront of this transformation (Hu & Kapucu, 2016b; Sakurai & Murayama, 2019b; Toya & Skidmore, 2015, 2018; R. Zhang et al., 2010). As the key drivers of global economy and innovation, ICT MNCs have the potential to make

significant contributions to disaster response and recovery efforts. This is especially valid in developing countries, which are often disproportionately affected by natural disasters and have limited resources to respond effectively (ITU, 2017; O'Reilly et al., 2006; Yulianto et al., 2020). However, despite the increasing involvement of ICT MNCs in disaster response, our understanding of their roles, the strategies they employ, and the impact of their actions is still limited.

Recent research has explored multinationals' behavior in responding to natural disasters (Arias et al., 2024; Ballesteros, 2024; Chatterjee, 2021; Nussbruch & Girschik, 2024; Oh & Oetzel, 2023). Despite the growing involvement of MNCs in disaster response, academic studies on their contributions, particularly within the ICT sector, remains sparse. Existing literature on disaster management largely focuses on the efforts of national governments and non-governmental organizations, often overlooking the strategic and operational contributions of private sector actors. While some studies have examined CSR in humanitarian crises (Fontainha et al., 2016; Hotho & Girschik, 2019; Murphy et al., 2022), there is a lack of scholarly analysis on how and why MNCs engage in emergency response activities, particularly in reactive interventions following sudden-onset disasters.

This research aims to fill this gap in the literature by examining the disaster response efforts of ICT MNCs and the mechanisms through which their emergency interventions are identified and implemented. Focusing on 'reactive responses' of ICT MNCs to natural disasters, we draw on the specific context of the 2024 Cyclone Hidaya that affected Kenya. In particular, our study seeks to answer the following two research questions: 1) Why do some MNCs in the ICT sector choose to respond to natural disaster emergencies, and 2) How are emergency response interventions identified and implemented by MNCs from the ICT sector?

Drawing on a qualitative case study and grounded theory methods, this paper seeks to understand the role of MNCs from the ICT sector following natural disasters through their disaster response activities. We analyze the type of disaster response of ICT MNCs that participated in relief efforts and identify the purpose and motivation behind the implication of these MNCs in the aftermath of this historical natural disaster that hit Kenya. By analyzing the corporates' response to this calamity, this study aims to contribute to a deeper understanding of the evolving role of the private sector in humanitarian action, offering empirical insights

into corporate engagement in disaster relief beyond traditional financial donations (Ballesteros et al., 2017; Choi et al., 2023; Harvard Business Review, 2019).

In the next section, we review the literature on corporate involvement in disaster response and recovery, with a particular emphasis on MNCs and the ICT sector. This is followed by a detailed description of the methodology, including the research context, and data collection and analysis. The study findings are then presented and discussed, highlighting the motivation and activities of ICT multinationals in responding to the floods in Kenya. The paper concludes with the development of a Triggering Response–Engagement Motivation–Championing Technology (TEC) framework of disaster response along with discussions of implications for theory and practice. In undertaking this research, we aim to shed light on the evolving role of corporations in disaster response and recovery and to stimulate further research and dialogue on how MNCs can contribute to addressing the challenges of climate change and natural disasters.

4.2 Literature Review

4.2.1 CSR and Disaster Response

CSR theory encompasses the idea that businesses have a duty to act ethically and contribute positively to society, beyond their primary goal of profit maximization (Carroll, 1991; Garrett, 1989). This theory has gained prominence in various sectors, particularly in the context of disaster response, where corporations are increasingly recognized for their strategic and operational contributions (Johnson et al., 2011; McKnight & Linnenluecke, 2017). One of the key aspects of CSR theory is the recognition that corporations can play a significant role in disaster relief efforts. Madsen and Rodgers (2015) argue that CSR initiatives, particularly those focused on disaster relief, can enhance a company's reputation and stakeholder relationships. Highlighting the antecedents and consequences of stakeholder attention to corporate disaster relief, the authors suggest that effective engagement in such initiatives can lead to positive outcomes for both the corporation and the communities it serves. This aligns with the broader understanding that CSR activities can influence corporate financial performance by fostering goodwill and enhancing brand loyalty.

While CSR initiatives in disaster response exhibit a growing prominence, understanding the contextual factors that shape these engagements is equally important. Jamali and Neville (2011) highlight the divergence in CSR practices across different geographical and socio-economic contexts, particularly within developing countries. They emphasize that the local institutional environment influences how CSR is perceived and enacted, suggesting that MNCs must navigate varied expectations and responsibilities when operating in diverse settings. This insight is crucial for comprehending the complexities of CSR in disaster management, as local community needs and cultural nuances dictate the effectiveness of corporate interventions. Similarly, Uduji and Okolo-Obasi (2020) provide practical implications by illustrating how community-specific CSR programs can impact local development. Their focus on the Niger Delta emphasizes that CSR must address local realities to cultivate meaningful engagement. This perspective reinforces the need for MNCs to adopt contextually relevant strategies that respect local traditions and engage communities in a way that empowers them rather than fostering dependency.

In the context of disaster response, CSR is often operationalized through corporate philanthropy (Cha & Rajadhyaksha, 2021) and strategic partnerships with NGOs and governmental organizations. Johnson et al. (2011) emphasize that CSR disclosures from Fortune 100 companies reveal a holistic approach to disaster management, which includes long-term activities aimed at reducing vulnerability and building resilience in affected communities. This integrated approach underscores the importance of viewing CSR not merely as a reactive measure but as a proactive and sustainable strategy that aligns corporate objectives with societal needs (Khanchel et al., 2024).

4.2.2 MNCs' Motivations

The motivations behind MNCs' engagement following disaster response are multi-layered and can be understood through various lenses, including CSR, stakeholder management, reputation enhancement, strategic business interests, employee engagement, and regulatory and competitive pressures. At the core of MNCs' involvement in disaster response is the concept of CSR, which reflects a corporation's commitment to ethical business practices that consider the social, environmental, and economic impacts of its operations (Dahlsrud, 2008).

MNCs increasingly recognize their potential to influence local communities, particularly during crises, and often integrate disaster relief efforts into broader CSR initiatives to address societal challenges and mitigate the negative externalities of their business activities (Johnson et al., 2011).

Another key motivation is effective stakeholder management. Stakeholders, including customers, employees, and investors, increasingly expect corporations to demonstrate social responsibility, and MNCs that engage in disaster relief can signal their commitment to the well-being of affected communities (Madsen & Rodgers, 2015; Seow, 2024). This proactive approach not only strengthens relationships with key stakeholders but also fosters loyalty among customers and employees, which can yield long-term organizational benefits (Post et al., 2002). Reputation enhancement is also a significant driver of MNCs' participation in disaster response. By contributing to humanitarian efforts, MNCs can bolster their public image and gain a competitive edge in the market. Becker-Olsen et al. (2006) highlight that corporate philanthropy positively influences consumer perceptions and behaviors, particularly in an era where consumers increasingly favor socially responsible brands.

Strategic business interests motivate MNCs to engage in disaster response. Integrating CSR into a corporate strategy can lead to long-term financial and operational benefits such as improved brand loyalty and market share (B. J. Ali & Anwar, 2021). Additionally, disaster relief efforts can open new market opportunities, particularly in regions where MNCs have operational interests, creating a mutually beneficial scenario for both corporations and the communities they serve (Ballesteros et al., 2017; Oh & Oetzel, 2022). Employee engagement and morale are also enhanced by disaster response initiatives. Studies have shown that employees derive pride and satisfaction from their employers' contributions to meaningful social causes, which can translate into increased productivity and reduced job strain (Watkins et al., 2014). By fostering a culture of social responsibility, MNCs can strengthen their organizational cohesion and drive their long-term success.

Finally, regulatory and competitive pressures play a significant role in motivating MNCs to participate in disaster response. As CSR expectations grow among consumers, governments, and investors, corporations face increasing pressure to demonstrate their commitment to CSR. This is particularly evident in emerging markets, where regulatory frameworks are evolving to

encourage corporate participation in social issues (Sahasranamam et al., 2020). MNCs that fail to respond to these pressures risk reputational damage and loss of competitive advantage (Oh & Oetzel, 2022; Waddock et al., 2002).

4.2.3 ICT MNCs in Disaster Response

ICT plays an increasingly critical role across all stages of disaster management, particularly during the response phase (J. D. Freeman et al., 2019; ITU, 2021; Lu et al., 2020; Shklovski et al., 2008). This growing significance is reflected in scholarly discussions on how these technologies enhance disaster preparedness, response, and recovery operations (Buzzelli et al., 2014). ICT tools—including telecommunications infrastructure, satellite imagery, geographic information systems (GIS), and artificial intelligence (AI)—have received considerable attention within recent literature, due to their ability to support timely, accurate, and efficient disaster management interventions (Lu et al., 2020; Madhavaram et al., 2017; Ocen et al., 2016).

Telecommunication infrastructure forms the backbone of effective disaster management, enabling the timely dissemination of critical information and coordination among responders. Existing research highlights that a robust telecommunications infrastructure significantly influences disaster response effectiveness, as communication networks facilitate immediate information flow between agencies, communities, and individuals (Gallarno et al., 2024; Gomes et al., 2016). However, reliance on ICT infrastructure also introduces vulnerabilities, particularly if systems fail during extreme events (Kwasinski, 2010). Consequently, scholars emphasize the importance of developing resilient telecommunications systems, including redundant networks and alternative communication channels, to sustain emergency operations under adverse conditions (Comfort & Haase, 2006; Karaman et al., 2024).

Satellite imagery and GIS technologies have become increasingly essential in disaster management, providing critical data for informed decision-making and resource allocation. Satellite imagery, particularly from remote sensing technologies, enables rapid damage assessment by comparing pre- and post-disaster conditions. Its role is evident in flooding and cyclone scenarios, where satellite images quickly identify affected areas, guiding immediate emergency responses (Yun et al., 2015). GIS complements these capabilities by integrating

diverse data sources and enabling real-time updates on infrastructure status, resource distribution, and evacuation routes (Mansour, 2019). The deployment of GIS during the 2015 Nepal earthquake enabled precise mapping of affected areas, optimizing resource allocation, and improving situational awareness for responders (Ge et al., 2015; Yun et al., 2015). The use of satellite imagery and AI-driven analytics in the 2010 Haiti earthquake response provided actionable insights into damage assessment, underscoring ICT's transformative potential in crisis management (Kunz & Reiner, 2012).

These technologies enhance situational awareness and contribute to more efficient resource management, highlighting their value as decision-support systems in disaster contexts. Recent research underscores the growing significance of AI in disaster management, highlighting AI's capacity for enhancing predictive modelling, real-time monitoring, and damage assessment. AI-driven models analyze vast datasets from satellite imagery and social media to identify patterns, predict disaster impacts, and optimize resource distribution (Abid et al., 2023; Harika et al., 2024). Such technologies offer the potential for significant advancements in proactive disaster preparedness and rapid response (Ofli et al., 2016). Challenges, including data reliability and sovereignty, algorithmic bias, and ethical implications, must be carefully managed to ensure transparency, trust, and effective application of these technologies in diverse socio-economic contexts (Ghaffarian et al., 2023).

The private sector, particularly ICT MNCs, has emerged as a significant actor in disaster management, usually led by government and humanitarian organizations. Recent scholarship highlights an evolution in corporate roles from passive donors to active partners, deploying core competencies, such as logistical infrastructure, data analytics capabilities, and advanced communication technologies (Ampratwum et al., 2022; Linnenluecke & McKnight, 2020; Oh & Oetzel, 2023; Osei-Kyei et al., 2023). Despite the increasing recognition of corporate contributions, gaps remain in understanding how and why ICT MNCs become involved in disaster responses and the implications for governance, local autonomy, and long-term disaster preparedness (Izumi & Shaw, 2015; Johnson & Abe, 2015). Scholars have identified the critical need for frameworks to delineate the roles and responsibilities of private sector actors in disaster scenarios to prevent dependency and foster genuine resilience (Busch & Givens, 2013; Shaw, 2018).

The literature underscores the pivotal role of ICT in transforming disaster response, particularly through the application of advanced technologies, such as cloud computing, GIS, satellite imagery, and AI, which enhance coordination, situational awareness, and resilience in crisis contexts (Ghadge, 2023). These technologies have demonstrated significant empirical potential to improve disaster management outcomes, from predictive modeling to real-time resource allocation. However, while this potential is well-documented, a critical gap persists in understanding how and why ICT MNCs, as key providers and innovators of these technologies, strategically engage in disaster response efforts, particularly in developing regions like Kenya, where local capacities are often constrained by limited infrastructure, funding, and technical expertise (F. Chen et al., 2021). This gap is twofold: it encompasses not only the mechanisms and strategies through which ICT MNCs deploy their technological capabilities during crises, but also the underlying motivations driving their involvement. Existing research has largely focused on the technical efficacy of ICT tools, with less attention paid to the corporate decision-making processes, incentives, and contextual dynamics that shape MNCs' participation in disaster settings.

4.3 Methodology

This study addresses the dual gap in the literature by examining the contributions of ICT MNCs during the 2024 Cyclone Hidaya floods in Kenya – a country marked by acute vulnerability and resource limitations. It explores their motivations (the "why"), such as enhancing reputation and stakeholder relationships (Madsen & Rodgers, 2015), securing strategic business interests like market opportunities and brand loyalty (B. J. Ali & Anwar, 2021; Ballesteros et al., 2017), or responding to regulatory and competitive pressures in emerging markets (Oh & Oetzel, 2022; Sahasranamam et al., 2020). These motivations align with broader CSR frameworks that emphasize ethical commitments and societal impact (Dahlsrud, 2008; Johnson et al., 2011), alongside the operational mechanisms (the "how") they employ, such as providing data analytics, communication networks, or partnerships with local stakeholders like the KRCS.

By examining both the motivational and operational dimensions, this research seeks to provide a comprehensive framework for understanding the engagement of ICT MNCs in

disaster response beyond mere technological application. This approach not only bridges the identified scholarly gap but also aims to offer practical insights into how such corporate involvement might be leveraged to bolster resilience in developing regions facing escalating climate-related challenges.

4.3.1 Case Study Approach

This research employs a qualitative case study approach, which is widely recognized for its ability to provide a comprehensive, in-depth examination of a specific situation through the integration of various data sources (Yin, 2018). We adopt an instrumental case study with exploratory elements to investigate the role of ICT MNCs in responding to the 2024 Cyclone Hidaya floods in Kenya. An instrumental case study uses a particular instance—here, the Cyclone Hidaya event—as a tool to gain insight into a broader phenomenon, namely the motivations and mechanisms of ICT MNCs' engagement in disaster response, particularly in developing-country contexts (Stake, 1995). The exploratory dimension complements this by addressing the limited scholarly understanding of this emerging area, allowing for the generation of new insights into an underexplored topic (Yin, 2018). Buchanan and Denyer (2013) further emphasize that case studies are adept at unravelling intricate, emerging issues in uncertain conditions, offering an adaptable yet rigorous structure to tackle urgent challenges, as is the case in crisis research. The selection of the Cyclone Hidaya case is justified by its instrumental value—its significant ICT MNCs' involvement provides a lens to examine corporate disaster response strategies—while its unique characteristics, such as the unprecedented scale of the floods and novel technological interventions, enable exploratory inquiry into new dimensions of this phenomenon.

The methodology consists of three linked stages: (1) contextual analysis, (2) key informant interviews, and (3) document analysis. This multi-stage design allows for triangulation to enhance the credibility and depth of the study by synthesizing diverse streams of evidence—contextual, experiential, and archival (Denzin, 2012). The contextual analysis situates the case within Kenya's socio-economic and environmental landscape, providing a foundation for understanding ICT MNCs' actions. Key informant interviews with MNC representatives offer experiential insights into the motivations and operational processes, while document analysis

of company reports, press releases, and relief effort records provides archival evidence. This triangulated approach enhances internal validity and aligns with qualitative research's focus on deep, detailed insights, assuring that the results are useful for broader theoretical discussions (Creswell & Poth, 2016).

4.3.2 Research context

The case context is shaped by a mix of past events, interactions, and situational details that make it unique and worth exploring. This case study centers on Kenya's recent floods, where heavy rains and a dam burst have swept away homes, power lines, and farms, disrupting lives and the economy in a country already grappling with climate challenges. Getting a handle on this background is key to digging into real-world situations where we actively study the setting using sources like reports to deeply understand how it connects to the research question (Merriam, (1998). This depth of understanding is what Flyvbjerg (2006) describes as a clear picture of the setting that helps connect the findings to bigger ideas.

Cyclone Hidaya formed in the Indian Ocean, where rising sea surface temperatures created conditions conducive to stronger and more frequent cyclones. As the storm approached East Africa, it intensified rapidly, a phenomenon linked to the warming of ocean waters. When it made landfall, the cyclone unleashed torrential rain that overwhelmed Kenya's already vulnerable infrastructure. Rivers overflowed their banks, inundating towns and villages, while landslides and mudflows further compounded the destruction in mountainous regions (International Center for Humanitarian Affairs, 2024; Kenya Red Cross, 2024; Nkonge & Lasteck, 2024; Shamim, 2024).

The rainfall totals during this period were unprecedented in many areas, with some regions recording more than double their average rainfall for the season (ICPAC, 2024; NDMA, 2024). Urban centers, including Nairobi and Kisumu, faced widespread flooding, disrupting transport networks, overwhelming drainage systems, and causing significant economic losses. In rural areas, agricultural fields were submerged, destroying crops and threatening food security for millions. The floods also severely damaged essential infrastructure, such as roads, bridges, and power lines, hampering both emergency response efforts and long-term recovery.

Beyond the immediate impacts, floods highlighted the interconnectedness of natural disasters and climate change. Scientific studies have linked the increasing frequency and intensity of extreme weather events, such as Cyclone Hidaya, to climate change. Warmer oceans not only fuel cyclones but also increase the atmospheric capacity to hold moisture, leading to heavier rainfall during storms. This dynamic was evident during Cyclone Hidaya, where prolonged and intense rainfall exceeded the capacity of Kenya's natural and man-made water management systems (NDMA, 2024). Kenya, like much of East Africa, is particularly vulnerable to the effects of climate change due to its geolocation and socioeconomic factors (OCHA, 2024a, 2024b). The country frequently experiences periods of drought followed by extreme rainfall – a pattern that has been exacerbated by global temperature increases. This variability places immense strain on communities that are ill-equipped to adapt to such extremes, often leading to cycles of humanitarian crises. Moreover, rapid urbanization, deforestation, and poor land-use practices have reduced the land's ability to absorb water, amplifying the effects of flooding.

The human toll of the floods was significant, with over 290 reported fatalities, over 160 people missing, and nearly 300,000 people uprooted impacting over 410,000 lives (Help.NGO, 2024; Kenya Red Cross, 2024; OCHA, 2024a). Agricultural losses were also substantial in Kenya, with more than 60,000 acres of cropland damaged and over 10,000 livestock lost (Kenya Red Cross, 2024; USAID, 2024). In terms of infrastructure, the United Nations Office for the Coordination of Humanitarian Affairs (2024a) reported in early May that 61 roads, 886 businesses, 103 schools, and 42 health facilities were affected. Economically, Nairobi is the largest county in Kenya, contributing 28.3% to Kenya's overall GDP. Furthermore, the flooding also increased the risk of waterborne diseases such as cholera, particularly in overcrowded shelters and flood-prone areas lacking clean water and sanitation (OCHA, 2024b). These damaged infrastructures and public health challenges further highlight the urgent need for robust disaster preparedness and climate adaptation strategies.

The floods following Cyclone Hidaya serve as a stark reminder of the urgent need to address climate change on a global scale. While Kenya bears the brunt of these impacts, it is a relatively low emitter of greenhouse gases (GHGs), generating less than 0.1% of global GHG emissions (World Bank Group, 2023). This inequity underscores the importance of international

cooperation and support for climate adaptation in vulnerable regions. Investments in early warning systems, sustainable urban planning, and resilient infrastructure are critical to mitigating the impacts of future disasters. The devastation caused by Cyclone Hidaya is not an isolated incident but a manifestation of the broader climate crisis. As the world continues to warm, such extreme events are expected to become more frequent and intense, posing grave challenges for countries like Kenya (IPCC, 2023). Addressing this crisis requires a coordinated global effort to reduce emissions, enhance resilience, and support those most affected by climate change's escalating impacts.

4.3.3 Data Collection and Analysis

The data type used were semi-structured interviews and document analysis to answer our research question about how ICT MNCs in Kenya responded to the floods, looking at what they did, how they did it, and why. Yin (2018) explains how to blend interview insights with documents, like company reports, to get a full picture of MNCs' actions. Spraggon and Bodolica (2021) suggest that digging deep reveals the smart choices firms make during crises. Interview findings were supported with analysis of rich types of qualitative data from multiple sources to accurately reconstruct the multinationals' actions. In line with previous case study research, the information posted on MNCs' websites, press releases, social-media, and publicly available documentation and reports were accessed and analyzed (Bodolica et al., 2021; Dacin et al., 2010). Other sources of data were also used, such as social media, which is particularly relevant to gain insights in this case study regarding a sudden, disruptive, and devastating event (Buchanan & Denyer, 2013). Furthermore, of particular interest was the white paper by the International Center of Humanitarian Affairs (ICHA) at the KRCS titled "Leveraging technology in the face of disaster". The KRCS was the key organization managing the disaster response efforts of the flooding events.

Semi-structured interviews

The choice of semi-structured interviews was based on flexibility, accessibility, clarity, and capacity to uncover important behavioral characteristics (Qu & Dumay, 2011). Semi-structured interviews provide the opportunity to seek further clarification and explore complex

issues (Barriball & While, 1994). We conducted semi-structured interviews to collect information from a small group of key individuals working for the multinationals and involved at different degrees in the disaster response. This study has been reviewed and received ethics clearance through the Research Ethics Board (#46487) of the University of first author's affiliation. Interviewees were recruited by email between August and October 2024. The 60 minutes interviews were conducted remotely via video link and were audio-recorded and anonymized. The recorded data for each interview were then transcribed for qualitative analysis (Creswell & Creswell, 2018b; McIlroy-Young & Thistlethwaite, 2019; Sandhu et al., 2024). The transcribing was undertaken with an appropriate level of detail and transcripts were checked several times. While transcribing, the identity (name) of the participant was removed and letters were used for each participant (A to F). References to interviews are, therefore, anonymous and identified by a letter (e.g., "Interview A").

Participant selection

Interviewees' selection was determined by multiple criteria: their role within the MNC, their implication in disaster response activities, and their role in the decision-making process. In other words, they had to be a key player in deciding if the ICT MNC is participating in the response effort or in explaining the process. The corporate positions held by these individuals ranged from public sector lead (one) and project manager (one) to global heads (two) and directors (two). These roles were under different functions within the MNCs, five were global functions (in four different countries) and one was local (based in Kenya). These functions were under different departments such as sales, disaster response and humanitarian affairs, global community engagement, humanitarian solutions, AI for Good, and AI for Social Good.

A total of 11 interview requests were sent out, six led to interviews, a sample size deemed sufficient as theoretical saturation was achieved, with no new themes emerging after the fifth and sixth interviews (McIlroy-Young & Thistlethwaite, 2019). The interviewees represented four ICT multinationals that participated in the disaster response in Kenya: Amazon's AWS, Esri, Google, and Microsoft. Although this sample represents a limited number of ICT companies, with Esri being the sole non-publicly traded entity, these MNCs rank among the top 26 most financially powerful global enterprises, collectively generating over a trillion

dollars in annual revenue (Fortune, 2024). The interviewed ICT MNCs represented four out of the six ICT MNCs actors that supported the flood response in Kenya (International Center for Humanitarian Affairs, 2024).

Interview design and execution

Predetermined questions were utilized during the interviews to ensure comparable results and minimize interviewer bias. The interview process allowed respondents to expand on certain answers, facilitating the collection of comprehensive data and the potential emergence of novel concepts (Taherdoost, 2022). This approach was designed to obtain feedback while maintaining consistency across interviews. By employing a thoughtful approach to participant selection, data collection, and analysis, researchers can uncover rich qualitative data that informs decision-making and policy development (Taherdoost, 2022). The literature underscores the importance of this methodology across various fields, highlighting its potential to enhance understanding and foster collaboration among stakeholders.

Data analysis

Interviews were used to assess the MNCs' interventions using three criteria: how they got involved, what was their response, and why they did respond. Following Creswell and Creswell's (2018b) approach, data were sorted into clear themes to show exactly why and how these companies responded to the flood disaster. To analyze the interviews, a structured qualitative approach was employed, drawing on principles of case study methodology (Yin, 2018) and thematic analysis (Braun & and Clarke, 2006). The transcripts were systematically coded to identify key themes and cross-case patterns. The analytic process followed a staged framework. First, each transcript was reviewed to understand the initial point of contact or trigger for their involvement. Second, the specific actions and resources mobilized by each company were documented. Third, the timeline of each company's engagement was established, including both the immediacy of the response and the duration of support. Fourth, the stated motivations for engagement were extracted. The analysis then turned to the collaborative dimension of the response, identifying partnerships with local and/or international actors. Sixth, the technologies and platforms employed by each company were

recorded. Finally, the extent to which interventions were designed with sustainability and long-term capacity building in mind was evaluated. This multi-step, theory-informed analysis allowed for the development of a nuanced and comparative understanding of ICT MNCs' disaster response strategies, while remaining grounded in participants' own accounts of their organizations' decisions and actions.

Grounded theory coding process

The qualitative research process was executed by gathering raw data, including interview transcripts, white papers, and corporate websites (Bodolica et al., 2021). Subsequently, the information was categorized based on terms and sentences to allow the organization of data into prevalent conceptual patterns. The sequential relationships amongst these patterns were then examined to uncover emerging meanings (Yin, 2018). The analysis process involved gradually distilling raw data by identifying specific lower-level codes and connecting them to more abstract higher-level concepts. Initially, codes were assigned to various text segments, aiming to preserve the original source language and refining them as necessary to generate a set of 16 first-order categories. By examining the relationships between these categories, they were consolidated into eight second-order themes, each representing distinct theoretical groupings. The conceptual connections among these themes were then scrutinized to organize them into three aggregate theoretical dimensions, which formed the core of the grounded theory approach (Corbin & Strauss, 2008). The study's methodology and limited sample size preclude broad generalizations about ICT MNCs' behavior, which is not the study's intended purpose. Instead, we aim to develop a well-informed understanding about the industry, serving as a foundation for future, more extensive research endeavors.

4.4 Results

The categories, themes, and dimensions that form the foundation of the grounded model examining ICT MNCs' response to flood disasters in Kenya are illustrated in Figure 2. The advanced TEC (Triggering response–Engagement motivation–Championing technology) model identifies key dimensions influencing the disaster response efforts, including: 1) local and headquarters' enablement to trigger the engagement; 2) CSR, ethical imperatives, strategic

interests, and business dynamics that shape organizational motivations; and 3) technological capabilities, such as cloud computing and geospatial technology, as foundational tools driving innovation and resilience.

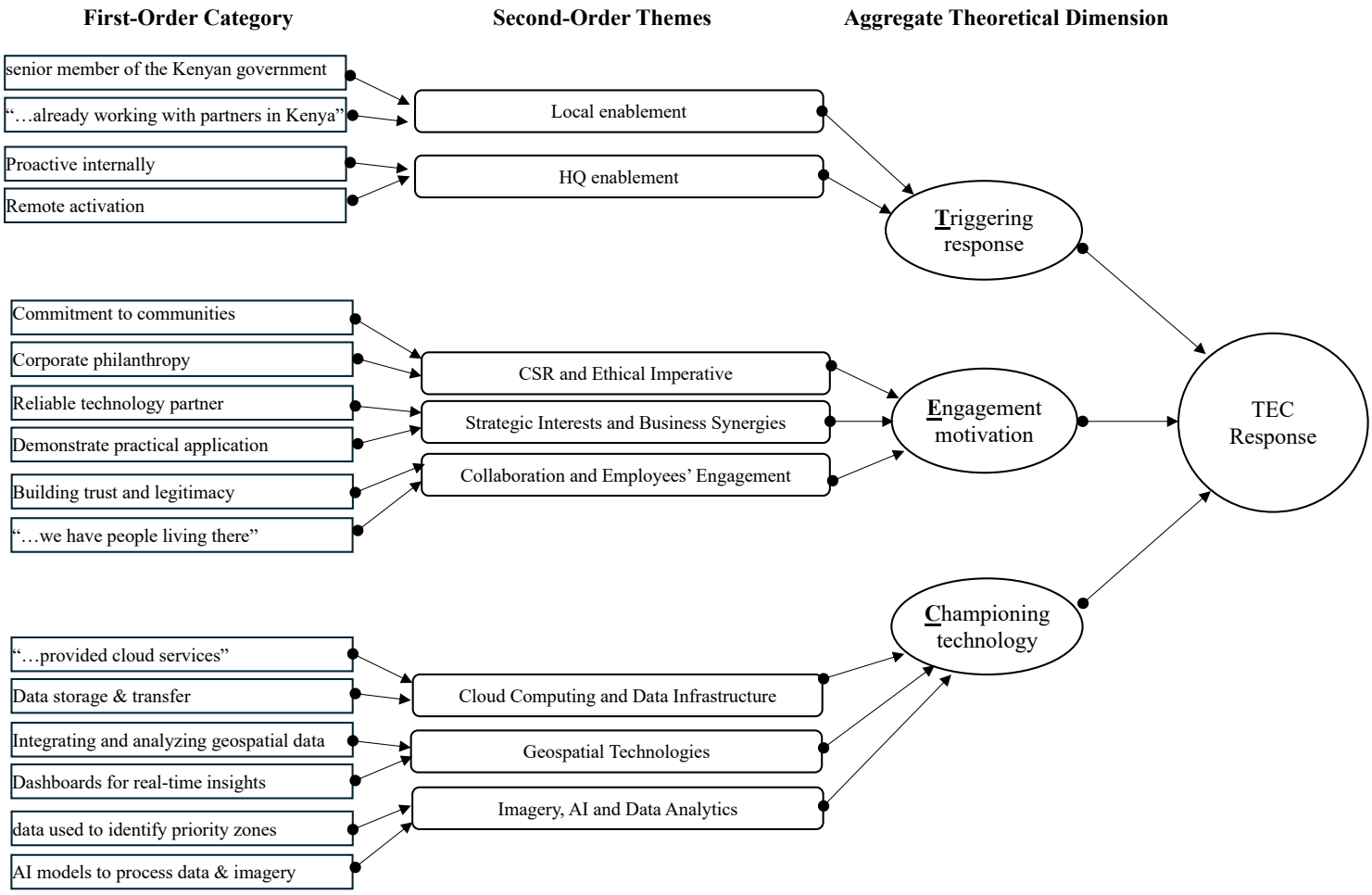


Figure 4.2: TEC Response framework of ICT MNCs' disaster response – (Source: Study authors)

Appendix B offers a curated selection of quotes sourced from diverse data sets, providing additional substantiation for the case findings in this study and serves as a companion to Figure 2. By including these selected quotes, Appendix B reinforces the empirical basis of the

qualitative research, lending further credibility to the thematic analysis and offering illustrative support for the observed patterns in the MNCs' disaster response approaches.

4.4.1 Triggering Response

Interviewees discussed the initial engagement of ICT MNCs in disaster response efforts for the subsequent floods in Kenya, which revealed diverse mechanisms driven by a combination of CSR, existing relationships, and technological capabilities. AWS initiated its involvement through a proactive internal response, spurred by its leadership principle that emphasizes broad responsibility and a commitment to its communities. A local Kenyan employee in Nairobi, witnessing the disaster firsthand, recognized the need for support and alerted the global AWS disaster response team. This local awareness, combined with a pre-existing engagement with the Nairobi City County to provide technology for communication and information gathering, demonstrates the importance of both local personnel and established networks in triggering disaster response (Interview A, 2024; Interview B, 2024). The global team had a team ready to deploy, but needed a local contact, which highlights the need for both local and global capabilities. Amazon's engagement was further facilitated through connections made by senior member of the Kenyan government, who linked them to the KRCS. This underscores the role of key individuals in bridging the gap between corporations and local responders.

Esri also engaged through a combination of formal and informal channels. While the National Disaster Management Agency (NDMA) and the National Disaster Operation Center (NDOC) initially requested Esri technology and were fulfilled with some solutions, they "…ran into sort of procedural red tapes around, data sharing and some environments where they could install this technology, whether they could use cloud technology and so forth…" (Interview E, 2024). These bureaucratic hurdles were caused by "…the military control elements within Kenya…" and led to delays in the formal government process. Esri's engagement was expedited when a senior member of the Kenyan government, who had prior knowledge of Esri's capabilities, reached out to the multinational through a personal connection (Interview E, 2024; Interview F, 2024). This illustrates how personal connections, and prior relationships can streamline disaster response, bypassing some formal bureaucratic

processes. Esri's local presence in Nairobi through its regional distributor also facilitated rapid deployment of resources and support, indicating the importance of localized networks.

Google took a different approach, proactively monitoring global disasters through internal tools and data. Their response was not contingent on local requests, instead activating their philanthropic arm, Google.org, based on the magnitude of the disaster and the need for response (Interview D, 2024). This independent activation demonstrates a strategy driven by internal analysis and a commitment to deploying their technological tools for humanitarian impact. Microsoft, on the other hand, engaged through existing partnerships. "…we were already working with some partners in Kenya, particularly with the Kenya Space Agency. So we were working with them on another project… so when all of these floodings were becoming more severe, they reached to us because they knew that we were working on these damage assessment models and they asked us if we could get involved…" (Interview C, 2024). This request from the Kenya Space Agency demonstrates the value of pre-existing collaborations in disaster response. This engagement was further driven by local awareness of the severity of the floods by Microsoft team members in Kenya. Their response mechanism was flexible, adapting to the specific needs of the situation and the partners they worked with.

The engagement of these four ICT MNCs highlights a range of approaches to disaster response: proactive internal mechanisms (Amazon, Google), existing relationships and local networks (Esri, Microsoft), and the crucial role of key individuals in bridging gaps (Amazon, Esri, Microsoft).

4.4.2 Engagement Motivation

The disaster response to the Kenyan floods following Cyclone Hidaya witnessed engagement from several ICT MNCs. These companies deployed a range of technologies and resources to aid relief efforts, driven by a complex interplay of motivations. Interviewees discussed these different motivations and highlighted a blend of CSR, strategic interests, and a genuine commitment to leveraging their technological capabilities for humanitarian good.

CSR and ethical imperative

Interviews suggested that the primary driver for ICT MNCs' involvement was a deep-seated sense of CSR driven by ethical imperatives and a sense of obligation. Companies like Amazon and Esri view disaster response as a fundamental part of their commitment to communities. "…Amazon leadership principles, there's one where we talk about… being responsible for our communities" (Interview B, 2024). This highlights Amazon's Leadership Principles and the company's responsibility to give back to communities that have contributed to its success (Amazon, 2024). This ethical imperative extends beyond mere philanthropy, reflecting a broader organizational culture that seeks to address societal needs.

Esri, as a family-owned company, integrates social responsibility into its core mission and values. "…so being a family owned company, we are sort of formal buckets for CSR and there's no foundation and philanthropic, but it's ultimately in our DNA to be quite in that area" (Interview E, 2024). The ICT MNC frames its disaster response as a core part of its mission and vision, stating that: "…so Esri ultimately builds technology to help solve global challenges, and disasters, being an unfortunate one on the list there, so one of those really ambition and vision is to build technology that helps in these scenarios…" (Interview E, 2024). This ethical stance is also reflected in the company's "GIS for Good" programs and initiatives. "…so I think we broadly bring all this into a category we call GIS for Good" (Interview E, 2024; Interview F, 2024), which formalizes their commitment to using technology to support positive change (Esri, 2024). The interviews reveal a commitment to helping communities during times of crisis, regardless of whether they are existing customers/partners or not. This suggests that these MNCs view disaster response as an intrinsic part of their corporate identity.

Interviewees also discussed the philanthropic participation of their multinationals to the flood response. Google, through its philanthropic arm Google.org, frames its involvement as a matter of responsibility, seeing the corporation as a global entity that must support people in need, regardless of its presence. "…on the one hand, it's a responsibility. So as a large corporation that has physical presence in many places…we respond in places we don't have a physical presence…but especially where we have a physical presence, we want to make sure that we are having a local face and supporting people in their time of need…" (Interview D, 2024). "For Cyclone Hidaya, we did our standard response effort, which is we provide a grant

and we launched an employee campaign, so that employees can donate and we'll match donations to an organization that then sub grants to provide relief and recovery efforts on the ground..." (Interview D, 2024). Similarly, Microsoft demonstrates its commitment in utilizing its technological capabilities to help communities, stating that it is part of their broader mission to use AI for good. "…so the AI for Good Lab is a part of Microsoft Philanthropy, where we work with AI to do good for the world…" (Interview C, 2024).

Strategic interests and business synergies

While ethical considerations are important, the disaster response efforts also align with strategic interests and business synergies for these ICT MNCs. For Amazon, engaging in disaster relief allows the company to showcase the capabilities and resilience of its cloud infrastructure. "…we do all of that because we feel that our cloud workload capabilities really do differentiate and really help people that have been impacted by these things…" (Interview A, 2024). This not only provides immediate assistance but also reinforces Amazon's position as a reliable and versatile technology provider and partner. Similarly, Esri's disaster response efforts also serve as an opportunity to demonstrate the practical application of its geospatial technology. By providing free licenses and support during disasters, Esri is not only helping in the immediate response but also building long-term relationships with organizations that may become future customers.

Google's response is driven in part by the fact that "…billions of people come to Google during crises to get information…" (Interview D, 2024). The company's disaster response, including its flood forecasting tools, help to showcase the promise of their technologies while also providing essential services to communities. For Microsoft, the disaster response in Kenya allowed them to test and refine their AI-driven damage assessment models, which are now being open-sourced to make it accessible. "…our idea is to scale this disaster response and to make it as available to the most amount of people as possible" (Interview C, 2024).

Collaboration and employees' engagement

Another aspect of ICT MNCs' motivation is the influence of local connections and employees' engagement. According to the individuals interviewed, these local connections not

only facilitated the collaboration for disaster response but also reflected the companies' broader commitment to creating a localized impact. The disaster response of Amazon was initially spurred by the actions of an employee from the Nairobi office who witnessed the disaster "at the time when this was happening, I was actually in Nairobi… so I could essentially see what was happening…" (Interview B, 2024), highlighting the importance of local knowledge and initiatives.

Microsoft's engagement was also informed by the input of their employees in Kenya. "In the case of the Kenya flooding, it was a particular case because we have people living there who knew these floods were becoming more and more severe and we were actively working with an organization that was getting involved in helping or providing assistance to different places…" (Interview C, 2024). This emphasizes the importance of local awareness in guiding corporate action. Several companies had local offices or partners that helped accelerate the delivery of aid. This aligns with the idea of embeddedness, where companies use their local networks and personnel to adapt to their surroundings. The ability of employees to engage during disasters also reflects the humanitarian philosophy that infuses within these organizations.

4.4.3 Championing Technology

The disaster response to the Kenyan floods following Cyclone Hidaya saw the deployment of a diverse array of technologies to address the urgent needs of affected communities. Based on discussions with the interviewees, the technological interventions were categorized into three key themes: cloud computing and data infrastructure, geospatial technologies, and imagery, AI and data analytics.

Cloud computing and data infrastructure

Interviewees discussed cloud computing as a cornerstone of their response efforts. Amazon quickly provided cloud services credit to the KRCS for access to critical cloud infrastructure "…for one year" (Interview B, 2024). The KRCS was having challenges in terms of capacity and infrastructure to run several tools for disaster relief efforts. The provision of cloud services secured resilient and scalable computing resources for the Red Cross (Interview B, 2024). This

is particularly important to ensure continuity and reliability in data management and application hosting during emergency situations. Amazon deployed its Snow family of data transfer devices to facilitate the collection and transfer of field data (Interview A, 2024). This capability was valuable in a context where traditional communication infrastructure was either destroyed or unreliable, ensuring that field data could be securely and efficiently transferred for analysis and decision-making.

Geospatial technologies

The usage of geospatial technologies was instrumental in mapping and understanding the disaster's impact. ArcGIS platform, which is a suite of tools based on geographic information system (GIS) technology, was provided by Esri as a central tool for integrating and analyzing geospatial data, creating comprehensive dashboards that provided a common operating picture for decision-makers. These dashboards were used by the Kenyan government and the Red Cross and offered real-time insights into the extent of damage, population displacement, and resource needs (Interview E, 2024; Interview F, 2024). This platform also enabled the fusion of diverse data sources, including satellite imagery, weather forecasts, and population data, which were used for predicting flood extents and optimizing resource allocation (Interview E, 2024). Esri provided map-based data collection tools that allowed field teams to gather real-time information, streamlining data-driven decision-making processes. Esri provided "the tools that allow the users to create the system" (Interview F, 2024).

Imagery, AI and data analytics

Interviewees highlighted the role of remote sensing technologies, including drones and satellite imagery, in disaster assessment and resource prioritization. Amazone "…brought in drones and drone pilots" (Interview B, 2024) to support the Red Cross with aerial imagery of affected areas, over a period of four weeks. This data was used to identify priority zones for aid delivery and infrastructure restoration. To improve local capacity, the drone pilots supported KRCS staff to operate and maintain the equipment. In parallel, the use of satellite imagery from different providers, like Planet and open-source platforms such as Sentinel-2, contributed to a comprehensive understanding of the disaster's scale, which was the case of

Microsoft that "…in Kenya in particular we use Planet, but we also used Sentinel 2, which is another open source imagery" (Interview C, 2024).

Microsoft leveraged this imagery (see Figure 3) to run AI-powered models, generating precise damage assessments and providing actionable insights to the Kenyan Space Agency and the KRCS. "…we run the assessment on that imagery and we identify which areas have been affected the most and we can give like a percentage of the buildings that have been affected and in which like what's the percentage of damage" (Interview C, 2024). The use of AI models to process satellite imagery and quantify the extent of damage produced metrics on affected buildings and infrastructure. These outputs were shared broadly, including through LinkedIn posts, to facilitate broader knowledge sharing and engagement (Interview C, 2024; B. Smith, 2024).

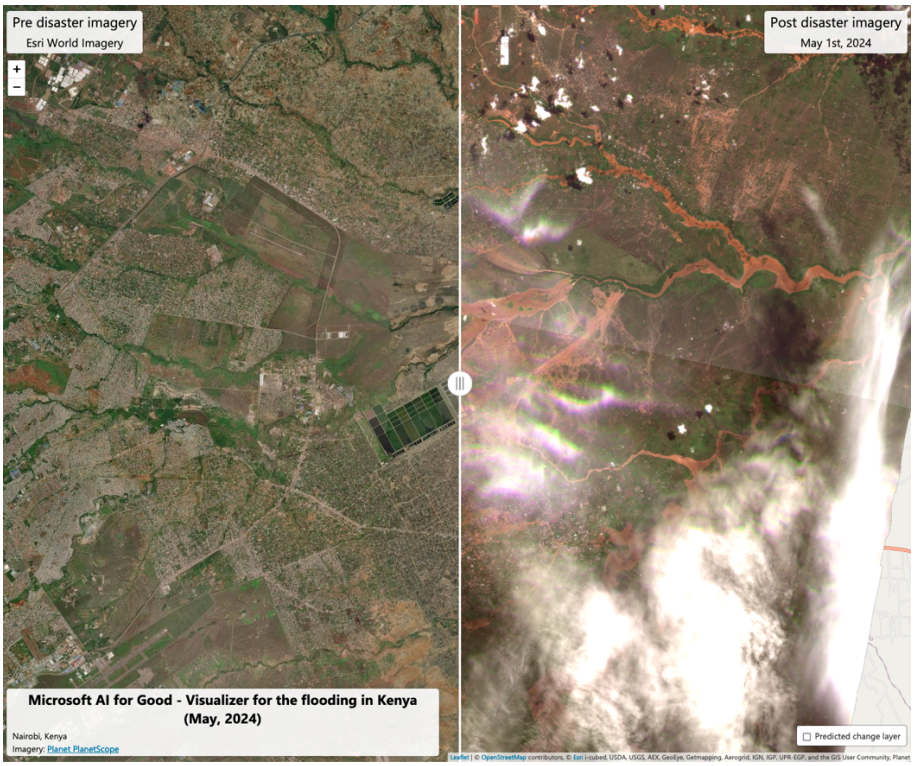


Figure 4.3: Pre and post disaster imagery – Visualizer for the flooding in Kenya (May, 2024) – (Source: Microsoft, 2024)

4.5 Discussion

This study examined the engagement of several ICT MNCs in disaster response efforts following Cyclone Hidaya and subsequent flooding in Kenya. The analysis reveals a constant pattern where these MNCs engaged locally, were driven by CSR values, and leveraged their technological capabilities. This approach underscores the evolving role of the private sector in humanitarian crises (Ballesteros et al., 2017; Fontainha et al., 2016; B. R. Johnson et al., 2011). Drawing upon the findings of this study as a foundation for theoretical development, the TEC framework of disaster response is illustrated in Figure 4 and is proposed to help understand ICT MNCs in becoming effective stakeholders in disaster relief efforts. The model includes three response steps: trigger response, motivate engagement, and champion technology.

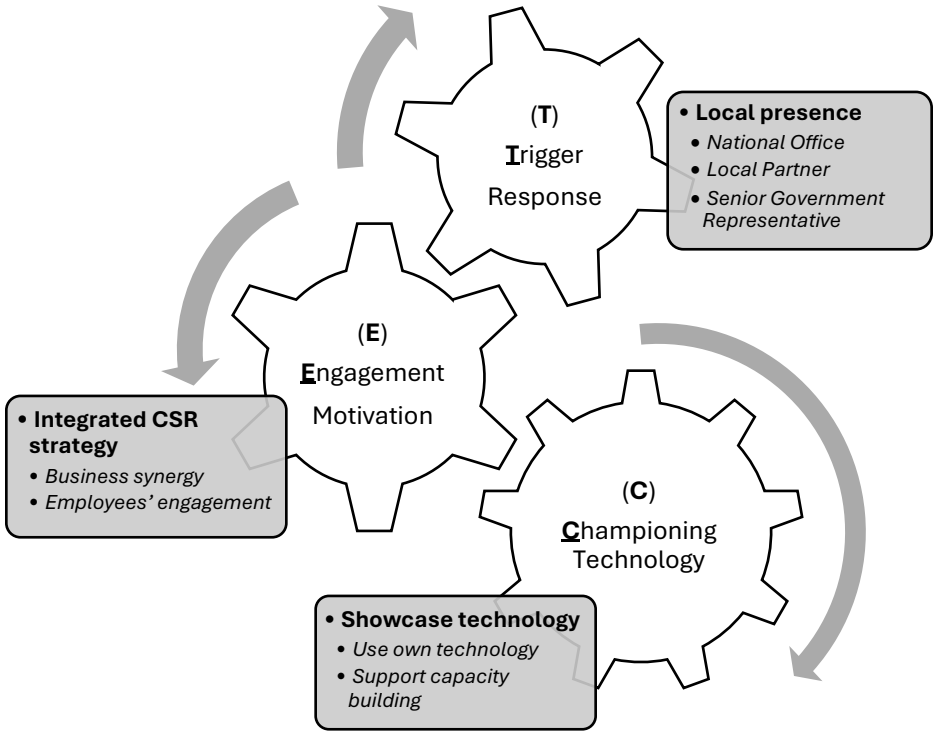


Figure 4.4: TEC Response framework of natural disaster response – (Source: Study authors)

4.5.1 Trigger Response

Importance of local presence

The presence of multinationals in the affected area appears to be an essential factor driving disaster relief initiatives. Findings show that all interviewed ICT MNCs had existing local offices or partnerships in Kenya, which facilitated their engagement as well as their rapid response. These results are in-line with studies maintaining that corporates often leverage their local presence and resources for rapid response (Ballesteros et al., 2017; Forcadell & Aracil, 2021; Muller & Whiteman, 2009). This research findings show that Esri and Microsoft had local offices that were able to rapidly deploy resources and expertise on the ground. Amazon, although having a local presence, operated via its global disaster response team, but used its local team in Kenya for support. However, this local presence contrasts with Google's more centralized response model, where decisions were made at headquarters and a response was then activated.

Partnership with local entities

This study also found that a considerable aspect of the MNCs' approach was their collaboration with local organizations, most prominently the KRCS. This partnership model underscores the importance of integrating local knowledge and capacity into international disaster response efforts (Hirono & Nurdin, 2024). While Google was the only company that initiated its disaster response effort from its headquarters in the US, the rest of the multinationals were contacted through a local liaison. The KRCS acted as a central coordinating body, receiving technological support, data, and resources from the various MNCs, confirming to be the preferred local partner for ICT MNCs following natural disasters, similar to findings from Battikh et al. (2025). The emphasis on local partnership reflects a move toward more contextually relevant and sustainable interventions, as suggested by Ferati et al. (2023).

4.5.2 Motivate Engagement

CSR is a key motivator

MNCs' commitment to CSR is a key motivator for engaging in disaster response and humanitarian operations. This aligns with a broader understanding that corporations are increasingly moving towards strategic CSR, aligning business strategies with social and environmental initiatives (Fontainha et al., 2016; Roy et al., 2020), and also engaging in long-term initiatives and partnerships with NGOs and governments (B. R. Johnson et al., 2011; McKnight & Linnenluecke, 2016). Amazon emphasized its leadership principle of "success and scale bring broad responsibility," driving their engagement. Esri's actions were aligned with its mission to build technology to address global challenges. Microsoft's actions were guided by the company's philanthropic agenda "AI for Good" initiatives. These motivations are consistent with the CSR-related literature and indicate a move beyond mere profit-driven activities, demonstrating an ethical commitment to supporting communities affected by disasters and recognizing the need to bridge technological divides in the humanitarian sector (Carroll, 1991; Garrett, 1989).

4.5.3 Champion Technology

This study found that ICT MNCs are essential in providing technology-based solutions for disaster response. Consistent with Ghadge (2023), findings indicate that the primary mode of intervention for the MNCs was the application of technologies, ranging from providing cloud infrastructure and drone support to offering geospatial analysis, AI-driven damage assessments, and communication platforms. The multinationals' ability to leverage their technical expertise is a critical component of effective disaster relief, such as information dissemination, damage assessment, and coordination among responders (LU et al., 2020; Ocen et al., 2016). Moreover, these technological contributions highlight the importance of leveraging digital solutions, which significantly increase the speed and coordination of disaster management (Aggarwal et al., 2024; Ahmad et al., 2023; Ghadge, 2023).

Support capacity building

This study also analyzed how multinationals are working towards the sustainability of disaster response. All MNCs utilized a data-driven approach, leveraging information for rapid assessment and resource allocation. This evidence-based approach ensured that relief efforts were targeted where they were most needed. Several MNCs emphasized the critical role of capacity building during the disaster response to support evidence-based technology for decision-making in disaster management (Aggarwal et al., 2024; Pazirandeh, 2010). Amazon and Esri highlighted the importance of capacity building, by training local personnel on using drones and mapping technologies, which aims to enhance the long-term self-sufficiency of the KRCS. This highlights an increasing recognition of the substantial benefits that can be derived from cross-learning and collaboration between humanitarian organizations and private sector companies.

Such partnerships not only enhance immediate disaster response through the efficient deployment of technological innovations, but also foster sustainable capacity-building within local institutions. The collaboration observed between ICT MNCs and local humanitarian organizations, such as the KRCS, underscores the value of leveraging complementary strengths. Humanitarian actors offer critical context-specific knowledge and community trust, while the private sector provides innovative technological solutions, operational efficiency, and scalability. Continued dialogue and mutual knowledge exchange between these sectors are essential to improve disaster preparedness and response efficacy, ultimately leading to more resilient communities and sustainable humanitarian interventions.

4.6 Conclusion

This study advances the understanding of ICT MNCs' role in disaster response by providing empirical insights into their strategic engagement and technological contributions during the 2024 Cyclone Hidaya floods in Kenya. The advanced TEC framework offers a novel theoretical contribution, delineating the mechanisms through which ICT MNCs can enhance humanitarian action while aligning with their corporate objectives. The findings underscore the importance of local partnerships, capacity building, and technology-driven solutions in fostering resilience in disaster-prone regions. As climate change intensifies the frequency and

severity of natural disasters, the private sector's role in humanitarian efforts will likely grow, necessitating robust frameworks to ensure accountability, equity, and sustainability. Future research should explore the long-term efficacy of ICT interventions, the ethical dimensions of data usage, and comparative analyses across different disaster contexts to further refine the role of ICT MNCs in global disaster management.

Limitations and Future Research

This research highlights the role of ICT MNCs in disaster response initiatives in Kenya following the 2024 historical floods. The study uncovers the capacity of these companies to rapidly deploy resources, technology, and expertise, often acting as a crucial supplement to governmental and humanitarian efforts. The cases of Amazon's AWS, Esri, Google, and Microsoft reveal diverse technology-driven humanitarian approaches, ranging from providing cloud infrastructure and drone support to offering geospatial analysis, AI-driven damage assessments, and communication platforms. Future research should investigate the efficacy of these varied interventions and their long-term impacts on community resilience. Because the effectiveness of the usage of ICTs in reducing casualties and economic losses during disaster response was not captured, further inquiries are needed to assess the impact of ICTs on disaster outcomes across various phases and contexts (J. D. Freeman et al., 2019; LU et al., 2020).

Due to the limited number of participants we interviewed, it is not feasible to extrapolate the findings to represent the broader community of ICT MNCs. Nevertheless, all selected interviewees were key personnel within the participating multinationals, possessing hands-on experience in the response efforts and extensive expertise in their respective roles. The advanced TEC framework for disaster response could be further investigated by conducting other studies in other situations with a broader group of multinationals. It is worth noting, however, that it is not common to have many corporations from the same sector responding to the same event.

Furthermore, this study indicates a complex interplay between local needs and global corporate strategies. The motivations behind these interventions, whether rooted in CSR, leadership principles, or a desire to bridge the technological gap in the humanitarian sector, merit further exploration. It is important to analyze the sustainability of these interventions and

whether they facilitate capacity building within local organizations. Scholars should examine the degree to which technology transfer occurs, empowering local actors to independently manage future crises. This includes analyzing the ethical implications of data collection and usage in disaster response.

The proposed TEC model showcases the involvement of ICT MNCs as a stakeholder in disaster relief efforts. While corporate engagement provides valuable resources, technological capabilities, and logistical expertise, this trend also challenges established frameworks of accountability and governance. It invites reflection on the dynamics of collaboration and coordination among private sector actors, governmental bodies, and humanitarian organizations (A. Thomas et al., 2021), particularly in developing countries (Auzzir et al., 2014). The role of individual actors, such as the senior member of the Kenyan government, in initiating and mediating these collaborations, also warrants further study. Comparative case studies across different and similar geographical contexts, particularly in neighboring country Tanzania that suffered from the same devastating Cyclone, are needed to identify best practices and challenges in the deployment of ICT resources for disaster response.

MANUSCRIPT ENDS

Chapter 5

Conclusion

This dissertation presents interdisciplinary research that provides significant insights into the interconnected domains of CSR, disaster management, and climate security to address the overarching research question: *How are natural disasters and global security interconnected, and what motivates and drives the disaster response efforts of multinational corporations?* As outlined in Chapter 1, interconnected gaps frame this inquiry. Corporate disaster response engagement has been insufficiently theorized in the CSR and stakeholder literature, which often reduces it to philanthropy and underplays questions of motivation, sustainability, and legitimacy. Second, disaster research has not adequately accounted for the role of ICT MNCs in disaster management, despite the paradigm shift from state-led reactive approaches to whole-of-society risk governance under the Sendai Framework. Finally, the link between corporate disaster interventions and climate security has been under-theorized, even as climate-related hazards are increasingly recognized as threat multipliers. This dissertation addresses these gaps through three empirical studies.

First, the empirical findings enrich and empirically ground established CSR theory by revealing how corporate interventions in disaster settings operate through a spectrum ranging from philanthropic to strategic. The TEC Response framework (Triggering response, Engagement motivation, Championing technology), developed in Chapter 4, provides an empirically grounded model that explains how ICT MNCs translate corporate responsibility into practice. Derived from original data, the framework reveals how corporate motivations operate within the underexplored sector of ICT MNCs in disaster response through distinct technological and relational mechanisms. These behavioural patterns align not only with strategic CSR but also with private governance dynamics, where firms assume governance-like roles without formal delegation, reinforcing the need to interpret corporate disaster response through both CSR and private-authority lenses. Findings showed that corporate disaster responses are often triggered by local presence or government partnerships, motivated

by a combination of ethical commitments and corporate interests, and enacted through technological expertise such as cloud computing, artificial intelligence, and geospatial tools.

Beyond reinforcing existing CSR theory, particularly stakeholder theory (Freeman, 1984) and Porter and Kramer's shared value model (2006), the TEC Response framework offers practitioners and policymakers a practical lens for accountability and depth of corporate engagement. It distinguishes genuine commitment from opportunistic engagement by examining whether corporate actions extend beyond short-term relief to include sustained partnerships, capacity building, and technology transfer, which are key indicators of accountability within CSR practices (Bendell, 2005; Eade, 2007; Forsyth, 2005; Jamali, 2008). These findings affirm that while CSR can mobilize important resources for disaster response purposes, it remains voluntary, uneven, and contingent, a form of engagement that risks opportunism and discontinuity if left outside governance oversight (Biersteker & Hall, 2002; Clapp & Thistlethwaite, 2012).

Second, building on this understanding of corporate motivation, this dissertation positions ICT MNCs within the evolving fields of disaster management. Historically, disaster response has been a reactive, state-centered process focused on immediate relief. Over time, it has evolved into a broader governance model under the Sendai Framework, emphasizing risk reduction, preparedness, and resilience through multi-stakeholder cooperation (Henstra & Thistlethwaite, 2017; UNISDR, 2015). The research presented here shows that ICT MNCs now engage with multiple dimensions of disaster governance. They act as rapid responders through financial donations, in-kind contributions, and partnerships with humanitarian organizations, while simultaneously investing in DRM by leveraging data systems, communication networks, and technological infrastructure to strengthen preparedness. However, these activities remain voluntary and CSR-driven rather than formally embedded within multi-stakeholder disaster governance mechanisms envisioned by the Sendai Framework, highlighting the gap between the private sector initiative and the governance mechanisms required to support it. The case of the 2024 Cyclone Hidaya floods in Kenya in Chapter 4, demonstrates this dual role: corporate expertise in connectivity, data analytics, and geospatial mapping enabled more effective response coordination between the Kenya Red

Cross and local communities, underscoring the private sector's capacity to act as a vital intermediary in crisis situations.

However, this expanded corporate role also exposes critical governance and equity challenges. Despite an overall increase in engagement, the data in Chapter 3 reveal a declining share of corporate disaster responses directed toward developing countries, which represent regions that are most vulnerable to climate-induced disasters. This geographical imbalance reflects what CSR scholarship identifies as the "home-region effect" (Muller & Whiteman, 2009; Oh et al., 2020), where corporations concentrate aid near their markets or headquarters. Such selectivity suggests that humanitarian needs are influenced by business considerations, raising concerns about privatized disaster governance, in which equity and accountability are subordinate to corporate strategy (Thistlethwaite & Henstra, 2019). As governments in capacity-constrained contexts increasingly depend on corporate actors to bridge resource and technological gaps, the sustainability of these arrangements becomes uncertain. A shift in corporate priorities or market conditions could abruptly disrupt these fragile governance networks, leaving vulnerable communities exposed.

Third, the intersection of corporate disaster response and climate security adds another dimension to this analysis. As Chapter 2 affirms and empirically reinforces the well-established natural-disaster and global-security literature through a systematic bibliometric review, disasters triggered by natural hazards act as threat multipliers, eroding social stability and amplifying the risks of conflict, terrorism, and displacement (Berrebi & Ostwald, 2013). Furthermore, countries that are fragile or in conflict-affected situations are the most climate-vulnerable and least ready to adapt to climate change (Battikh, 2024; ICRC, 2022). These countries face amplified risks due to weakened societal foundations, which undermine their capacity for climate adaptation and response. In this context, ICT MNCs have emerged as potentially significant non-state actors in mitigating or exacerbating security risks. Through disaster response efforts that include vital technological infrastructure and capacity, they can enhance resilience, improve early warning systems, and facilitate effective crisis communication. However, as the findings show, private sector engagement remains selective and contingent on strategic alignment. When corporations withdraw or neglect engagement in highly vulnerable regions, it can exacerbate fragility and perpetuate the security risks that such

interventions aim to reduce. This duality positions ICT MNCs as both enablers and potential destabilizers within the climate-security nexus. Their capacity to reduce vulnerabilities depends on how effectively their interventions are coordinated, regulated, and held accountable within broader disaster governance systems. Accountability mechanisms are therefore essential. This underscores a persistent accountability gap in the climate-security nexus, where private actors shape security outcomes without formal mechanisms of oversight or legitimacy. The TEC Response framework can incorporate explicit accountability indicators to evaluate private governance outcomes, such as the transparency of decision-making criteria, duration of commitment, and the degree of technology and knowledge transfer. Without these accountability mechanisms, corporate participation risks deepening global inequities and normalizing dependency on private goodwill in fragile contexts. On the other hand, when incorporated into well-organized governance frameworks, ICT MNCs can serve as essential partners for enhancing climate resilience and mitigating instability.

Taken together, this dissertation reveals that ICT MNCs are increasingly implicated in disaster governance at the intersection of CSR, disaster management, and climate security. Their unique technological resources and global reach allow them to act as enablers of resilience. However, their engagement remains discretionary, uneven, and strategically selective. The TEC Response framework developed in this study offers both an empirical contribution and an evaluative lens. It affirms and grounds established CSR and private governance theories in the understudied context of disaster response and climate security. Mapping the interplay of triggers, motivation, and technological commitment reveals that corporate disaster response efforts are simultaneously ethical, strategic, and fragile.

The overarching conclusion is that the increasing dependence on MNCs for disaster response necessitates a significant adjustment in policy frameworks. The Sendai Framework provides a foundation for multi-actor collaboration; however, it must evolve from the symbolic inclusion of the private sector to the establishment of enforceable standards of transparency, equity, and accountability. ICT MNCs should be recognized as important partners in disaster and climate security governance. However, their contributions must be subject to mechanisms that ensure the legitimacy of developing countries and prioritize the needs of vulnerable populations. Some accountability mechanisms already exist, such as the OCHA/UNDP Connecting Business

Initiative, and the World Food Programme's Emergency Telecom Cluster, but these remain voluntary with limited enforceability (CBi, 2023; WFP, 2025). Although tighter accountability always carries the risk of reduced voluntary participation, evidence from existing frameworks suggests that clear, predictable rules often increase long-term corporate engagement by reducing reputational uncertainty and creating a level playing field (Zyck, 2014). Ultimately, this dissertation highlights that while corporations can accelerate climate adaptation and resilience-building (Averchenkova et al., 2016), their interventions must be governed within systems that safeguard state legitimacy, ensure the equitable allocation of resources, and prevent dependency on voluntary corporate goodwill (Hall & Biersteker, 2002; Tierney, 2012). Only under such conditions can corporate contributions to disaster response and climate resilience be sustainable, accountable, and aligned with the public interest.

5.1 Contribution to Research

5.1.1 Contribution to Knowledge

This dissertation contributes significant empirical knowledge to the fields of CSR, disaster management, and climate security by providing detailed evidence on the role of ICT MNCs in disaster response, particularly in developing countries.

First, the quantitative content analysis of sustainability reports presented in Chapter 3 reveals macro-level trends in disaster responsiveness, highlighting growth in involvement and a critical geographical disparity in resource allocation. The findings demonstrate a significant decline in response efforts in developing countries despite their greater vulnerability to natural disasters and the increasing profitability of the ICT sector. This empirical finding challenges assumptions of equitable or purely needs-based allocation of corporate aid, suggesting that factors such as proximity to headquarters and strategic market interests may outweigh ethical considerations and vulnerability metrics. This insight contributes to CSR scholarship by identifying a persistent "geographical bias" in corporate philanthropy, prompting a re-evaluation of the drivers and limitations of corporate social action in a global context (Ballesteros et al., 2017; Muller & Whiteman, 2009; Oh et al., 2020). Furthermore, this dissertation quantifies and compares predominant response mechanisms, revealing that cash

donations and in-kind contributions (e.g., communication infrastructure, equipment, and data services) remain equally prominent across reporting cycles.

Second, the qualitative case study in Chapter 4 offers insights into the operational dynamics of corporate interventions. This study details how MNCs deploy technologies such as cloud computing, geospatial tools, and AI to enhance situational awareness, streamline logistics, and support early warning systems. These findings underscore the unique capabilities of ICT MNCs to bridge critical gaps in disaster response, particularly in resource-constrained developing regions. For instance, the rapid analysis of post-flood satellite imagery facilitates coordination among responders, directly improving relief outcomes. This empirical evidence advances disaster management and risk reduction research by documenting the concrete mechanisms through which private sector resources complement public disaster governance and demonstrating how technology-based interventions can both improve operational efficiency and reshape power relations among response actors (Valente, 2010; Valente & Crane, 2010).

Finally, this dissertation provides empirical evidence on the mechanisms, benefits, and challenges of multi-stakeholder collaboration between ICT MNCs, government entities, and humanitarian organizations in disaster settings. Chapter 3 demonstrates that partnerships with the Red Cross remain the preferred channel for corporate disaster engagement, while Chapter 4 provides detailed empirical accounts of collaboration with local entities like the Kenya Red Cross and government agencies, including the Kenya Space Agency. These relationships are typically enabled by pre-existing relationships, reputational trust, and local presence. This dissertation also identifies practical challenges encountered in coordination, such as bureaucratic hurdles, data-sharing issues, and the need for clear protocols. Together, these findings provide empirical clarity on the complexities of multi-actor disaster governance, revealing that while partnerships enhance efficiency and legitimacy, they can also reproduce dependency and asymmetry when accountability mechanisms are weak.

5.1.2 Methodological Contributions

This dissertation contributes to the scholarly understanding of ICT MNCs' role in disaster response efforts by applying distinct yet complementary methodological approaches across its

constituent studies. Each manuscript employs methods tailored to its specific research questions, collectively offering unique insights and methodological advancements in their respective fields.

The first paper, focusing on the intellectual structure of research on disasters triggered by natural hazards and security, leverages a quantitative bibliometric network analysis using term co-occurrence and co-citation network analysis. This approach represents a novel application of metaknowledge methodologies that moves beyond traditional literature reviews. This unique methodological contribution lies in its ability to quantitatively map the conceptual landscape and scholarly communities within this interdisciplinary field, thereby revealing key areas of focus and distinct disciplinary contributions.

The second paper examines the disaster response efforts of FG500 ICT MNCs in developing nations from 2015 to 2019 using quantitative content analysis of 246 sustainability reports. This study offers a unique methodological contribution by systematically quantifying the disaster response activities, such as cash donations, in-kind contributions, and partnerships reported by a large sample of global ICT corporations over a period of five years. The development and validation of keywords for identifying disaster types and response activities, coupled with the use of MAXQDA software for text analysis, provides a rigorous and transparent method for analyzing large volumes of qualitative data. This approach allows for the identification of trends in corporate disaster responsiveness, such as increasing overall involvement but a concerning geographical disparity favoring developed countries.

The third paper investigates the role of ICT MNCs in the disaster response to the 2024 Cyclone Hidaya floods in Kenya, employing a qualitative case study approach. This study makes a unique methodological contribution by developing a grounded theory model (TEC framework). This framework emerged from the triangulation of semi-structured interviews and document analysis. Following the principles of grounded theory, the iterative coding process allowed for identifying key dimensions influencing disaster response, such as triggering mechanisms, engagement motivations, and the championing of technology. This context-specific application of grounded theory in the underexplored area of ICT MNCs' reactive disaster response provides a nuanced understanding of corporate behavior beyond traditional CSR perspectives.

To my knowledge, these innovative methodological combinations have not been previously applied to corporate behaviour research. The diverse approaches utilized in this dissertation, ranging from quantitative bibliometric and content analyses to qualitative case studies and grounded theory development, make unique contributions to various academic fields. The innovations and adaptations within these methodologies and the insights gained from their application offer a valuable foundation for future scholarly exploration of the multifaceted aspects of corporate social responsibility and disaster management.

5.1.3 Contribution to Theory

This dissertation makes its primary theoretical contribution at the intersection of CSR, disaster management, and private governance literature. Empirical analyses of ICT MNCs' disaster response efforts, particularly in developing countries, align closely with the established logic of strategic CSR (Carroll, 1991; Freeman, 1984; Porter & Kramer, 2006).

First, this dissertation contributes to CSR theory through the development of the TEC Response framework (Triggering response–Engagement motivation–Championing technology), introduced and elaborated in Chapter 4. Emerging from an inductive qualitative analysis of ICT MNCs' interventions during the 2024 Cyclone Hidaya floods in Kenya, this framework serves as an empirically grounded diagnostic tool for understanding the mechanisms of MNCs engagement following natural disasters. In line with established CSR perspectives that distinguish between philanthropic and strategic drivers, it demonstrates strategic CSR in action during disasters by delineating the critical stages of engagement: the factors that *trigger* a response, the multifaceted *motivations* that drive involvement (CSR, ethical imperatives, strategic interests, business dynamics), and the crucial role of their core *technological* capabilities in shaping their interventions (cloud computing, geospatial analysis, drones, AI). By mapping the interplay of triggers, depth of motivation, and technological commitment, the framework illustrates precisely how well-established strategic CSR motives are operationalized in high-visibility crisis settings, contributing to emerging research that highlights the alignment of societal value creation with business imperatives during disasters. The TEC Response framework supports stakeholder theory (Freeman, 1984) by demonstrating how ICT MNCs disaster response is shaped by interactions with diverse stakeholders,

including governments, local communities, employees, and humanitarian organizations like the Red Cross. The framework also affirms the shared value model (Porter & Kramer, 2006) by illustrating how MNCs leverage their core technological competencies, such as cloud computing, AI, and geospatial tools, to address societal needs, such as disaster resilience, while advancing strategic business interests, such as technological showcasing, market expansion, and brand loyalty.

Second, this dissertation offers novel empirical insights of direct interest to private governance scholars. Building on the bibliometric mapping in Chapter 2 and the empirical analyses in Chapters 3 and 4, this thesis provides a novel empirical account of how ICT MNCs exercise private authority in disaster risk reduction through voluntary mechanisms of cash and in-kind aid, partnerships with humanitarian organizations, and technology deployment. In addition, this dissertation shows that ICT MNCs increasingly perform governance-like functions in disaster contexts (coordinating information flows, enabling connectivity, shaping preparedness capacities, and filling gaps left by overstretched states), yet they do so outside formal accountability structures. This reflects broader patterns of private authority in global governance (Biersteker & Hall, 2002; Cashore, 2002) and brings these debates into the previously underexamined domain of disaster risk reduction. By documenting how corporate actors simultaneously enable resilience and introduce new vulnerabilities, this study bridges disaster-governance and private-governance scholarship and underscores the need for clearer standards to evaluate the effectiveness, efficiency, and legitimacy of corporate disaster interventions.

Finally, this dissertation contributes to the emerging field of climate security by empirically linking natural disasters to security vulnerabilities and examining the role of corporate actors in mitigating these risks. Chapter 2 establishes the connection between disasters triggered by natural hazards and instability, such as conflict or terrorism, while Chapters 3 and 4 explore ICT MNCs' responses to climate-related events like cyclones and floods. These findings highlight the potential, although uneven, capacity of MNCs to address climate-induced vulnerabilities such as displacement and infrastructure damage that exacerbate security challenges in developing countries (Berrebi & Ostwald, 2011). This research extends climate-security theory by introducing the private sector as a governance actor capable of either

mitigating or exacerbating insecurity, depending on how its interventions are structured and regulated (Dalby, 2014).

5.1.4 Contribution to Practice

The insights derived from this dissertation offer practical guidance for both governmental decision-makers and MNCs seeking to enhance natural disaster response and resilience, particularly in vulnerable regions frequently impacted by climate change-induced events. By examining the motivations, mechanisms, and impacts of corporate engagement, this research provides actionable recommendations grounded in the analysis of ICT MNC involvement in disaster settings and the broader literature on corporate disaster responsiveness.

Policymakers Perspective

The findings highlight several avenues through which government agencies can effectively integrate MNC capabilities into national disaster response strategies and foster a more resilient landscape.

- **Integrating MNC Capabilities:** Governments can leverage the presence and resources of ICT MNCs for rapid and effective disaster response, by proactively establishing local liaison, pre-disaster relationships, and clear understanding of their technological capabilities and resources, such as cloud computing, geospatial technologies, AI-driven assessment tools, and communication platforms. Moreover, because ICT MNCs, motivated by strategic CSR and operational incentives, tend to focus on high-risk, high-visibility events where governments often under-invest because of data shortages and political priorities, policymakers can also partner with them to secure critical risk data (e.g., real-time satellite imagery and AI risk models) and strengthen risk-based DRR in the most vulnerable regions.
- **Enhancing Collaboration through Policy and Frameworks:** To enhance collaboration, policymakers can implement policies that provide incentives for MNC involvement, such as tax benefits or recognition programs. Creating an enabling regulatory environment is also critical, which includes streamlining customs procedures for emergency equipment and ensuring adequate spectrum availability for communication services during crises, particularly in developing countries where

infrastructure may be fragile. Governments should work towards transparent and accountable frameworks for corporate disaster response efforts, potentially by standardizing communication channels and protocols. Addressing bureaucratic hurdles and challenges related to data sharing, as observed in the Kenyan flood case, is essential for facilitating swifter corporate support. This study also suggests the need for a clear framework to delineate the roles and responsibilities of private sector actors in disaster scenarios to prevent dependency and foster genuine resilience.

- **Encouraging Sustainable, Long-Term Investments:** Policymakers can encourage MNCs to move beyond short-term, spontaneous relief actions towards sustained, long-term strategies that build community resilience. This involves prioritizing investments in resilient telecommunication infrastructure and collaborating with ICT MNCs to leverage their expertise in building and maintaining such systems. Encouraging MNCs to engage in capacity building by training local personnel on using technologies like drones and mapping tools, as highlighted in the Kenya case, can enhance the long-term self-sufficiency of local organizations. Policies should support partnerships that focus on technology transfer and localized adaptation to ensure that interventions are effective despite challenges like unstable infrastructure or low literacy levels in developing regions. Leveraging such ethically motivated corporate involvement can help enhance disaster response and build resilience in vulnerable regions.

Multinational Corporation Perspective

For MNCs, this research provides insights into how to strategically engage in disaster response in a manner that aligns with corporate objectives while significantly contributing to community resilience.

- **Leveraging CSR and Technological Expertise:** MNCs, particularly those in the ICT sector, can proactively integrate disaster responses into their CSR strategies, driven by ethical imperatives and a sense of obligation to communities. Their unique technological capabilities in communication and data systems position them as critical responders, enabling them to provide essential services like connectivity, data analytics, and geospatial support where local infrastructure fails or is under-dimensioned. By deploying core technological competencies (in-kind contributions)

alongside financial aid (cash donations), MNCs can enhance relief efforts. This aligns responsiveness with their strengths, and moves beyond generic aid.

- **Strategic Approaches for Partnerships:** Engaging through partnerships with established humanitarian organizations like the Red Cross is a key strategic approach, leveraging their global reach and local expertise to enhance efficiency and ensure that aid reaches affected communities. MNCs should actively seek to integrate local knowledge and capacity into their response efforts, as highlighted by the success of their collaboration with the Kenya Red Cross. Leveraging their local presence and personnel can facilitate the rapid deployment of resources and expertise on the ground, enhancing effectiveness. Strengthening these partnerships before disaster strikes and establishing clear communication channels and protocols can significantly improve coordination during emergencies.
- **Aligning Corporate Objectives and Community Resilience:** MNCs can align their disaster response with both corporate objectives and community resilience goals by viewing relief efforts as a strategic imperative that enhances competitive advantage and secures operational stability. Engaging in disaster response can showcase the capabilities and resilience of their services, potentially build long-term relationships, and enhance brand loyalty and market presence. By focusing on capacity building and technology transfer, MNCs can help local organizations become more self-sufficient in managing future crises, contributing to sustainable community resilience rather than fostering dependency. Addressing the ethical implications of data collection and usage in disaster response is also crucial for maintaining trust and ensuring responsible interventions. While balancing ethical obligations with strategic interests is complex, prioritizing aid to vulnerable zones where disasters hit hardest, using in-kind strengths, and tailoring deployment plans to local needs can align corporate actions with humanitarian impact.

5.2 Limitations and Future Research Directions

Limitation

The interdisciplinary research presented in this dissertation offers valuable insights into the interconnected domains of natural disasters and corporate social responsibility in disaster response. While each study contributes uniquely through its chosen methodological lens, it is important to acknowledge certain inherent limitations that may have influenced the findings and interpretations, which provide promising avenues for future scholarly inquiry.

The first paper, employing a bibliometric network analysis, is primarily limited by its reliance on a single database for academic journals. Although this database provides comprehensive coverage, the exclusion of other significant databases due to software compatibility might have resulted in the omission of relevant publications, potentially skewing the identified thematic areas and scholarly communities. The temporal scope, concluded in 2017, also means that more recent scholarship, which may reflect evolving trends and perspectives, was not included in the analysis. These limitations suggest that the identified intellectual structure and research trends offer a snapshot up to 2017, and a broader or more recent analysis might reveal additional insights.

The second paper, employing quantitative content analysis of sustainability reports to examine ICT MNCs' disaster response in developing countries, is constrained by its reliance on self-reported data. Sustainability reports, while providing valuable insights into corporate activities, are subject to self-presentation biases, potentially leading to an underestimation of efforts in developing countries or an overemphasis on CSR optics. Furthermore, the focus on the period between 2015 and 2019 provided a specific temporal snapshot, and trends may have evolved since then. However, this period happened before COVID-19, and it could be a baseline for future research to explore MNCs' response' to 'crisis' during-and-following the pandemic.

The third paper, a qualitative case study investigating the role of ICT MNCs in responding to the 2024 Cyclone in Kenya, is subject to limitations inherent in a single case study design. While the in-depth analysis provides rich contextual understanding, the findings related to the TEC Response framework may be specific to the Kenya context and to the particular ICT

MNCs involved. Furthermore, the limited number of interviewees, although deemed sufficient for achieving theoretical saturation within this specific context, restricts the generalizability of the proposed TEC Response framework to other disaster events or different sectors.

Future Research

This dissertation has made several contributions to the CSR and disaster management literature by examining the role of MNCs in disaster response and emphasizing a critical perspective on **how**, **why**, and to **what** extent they engage in disaster response efforts. Each of the three empirical papers offers opportunities for further scholarly exploration.

Methodologically, building on the bibliometric analysis in Chapter 2, future work could expand the scope of literature reviews by incorporating multiple databases and more recent publications to gain a more nuanced understanding of the evolving intellectual landscape. Future research related to the sustainability reports analysis in Chapter 3 should aim to triangulate the findings with other data sources, such as reports from NGOs and government agencies, to provide a more comprehensive picture of MNC disaster response. Moreover, extending the content analysis to a more recent time-period, such as post-Covid-19, would capture any shifts in corporate behavior and priorities for disasters response including 'non-natural' ones. The qualitative case study approach in Chapter 4 could be extended through comparative case studies across different disaster types and geographical contexts, including the Tanzanian experience with Cyclone Hidaya for comparison, and through longitudinal studies to assess the long-term impacts of interventions. The generalizability of the proposed TEC Response framework requires further investigation across diverse disaster scenarios and a broader range of multinational corporations from different sectors.

A key direction for future research is to develop a clearer framework for understanding corporate accountability in disaster governance. As MNCs take on roles that influence preparedness, information flows, and who receives support, existing theories offer limited guidance on how to assess accountability, legitimacy, effectiveness, and equity when private actors are involved. Therefore, future work should define criteria that help determine when corporate interventions genuinely strengthen resilience and when they create dependency or reproduce inequities. Building on the TEC Response framework, researchers can develop

practical indicators. For example, continuity of engagement, transparency in decision-making, alignment with community needs, and the distribution of benefits to evaluate the quality of corporate involvement. Such work would advance the foundations needed to assess the role of MNCs in disaster and climate security governance in a more consistent and meaningful way.

Another critical area for my future research agenda involves understanding the drivers behind the observed geographical disparities in MNC disaster response, particularly the declining engagement in developing countries despite increasing climate risks. Studies over time are also needed to assess the long-term impact of corporate disaster response on community resilience and recovery, moving beyond short-term relief efforts and implications, if any, on climate security. Further research should also examine the decision-making processes of MNCs regarding geographical response locations and the types of disasters they prioritize, as well as understand if their CSR strategy of disaster response creates a competitive edge over competition. Moreover, evaluating the efficacy of public-private partnerships, especially with major actors like the Red Cross, and developing metrics to quantify the impact of MNC interventions on disaster outcomes are crucial for optimizing collaborative frameworks in disaster-prone regions.

Finally, in early 2025, there was a strategic shift in alignment by ICT MNCs toward the new U.S. administration priorities. This shift is strongly supported by both market forces and government policy and is expected to intensify as the US government links financial support and regulatory incentives to strategic alignment. As a result, U.S. tech companies are likely to further reduce their engagement and investment in countries not aligned with U.S. interests. Future research should examine how this geopolitical realignment will influence the motivation and decisions of ICT MNCs disaster response efforts, particularly regarding engagement in developing regions increasingly excluded from global corporate aid networks.

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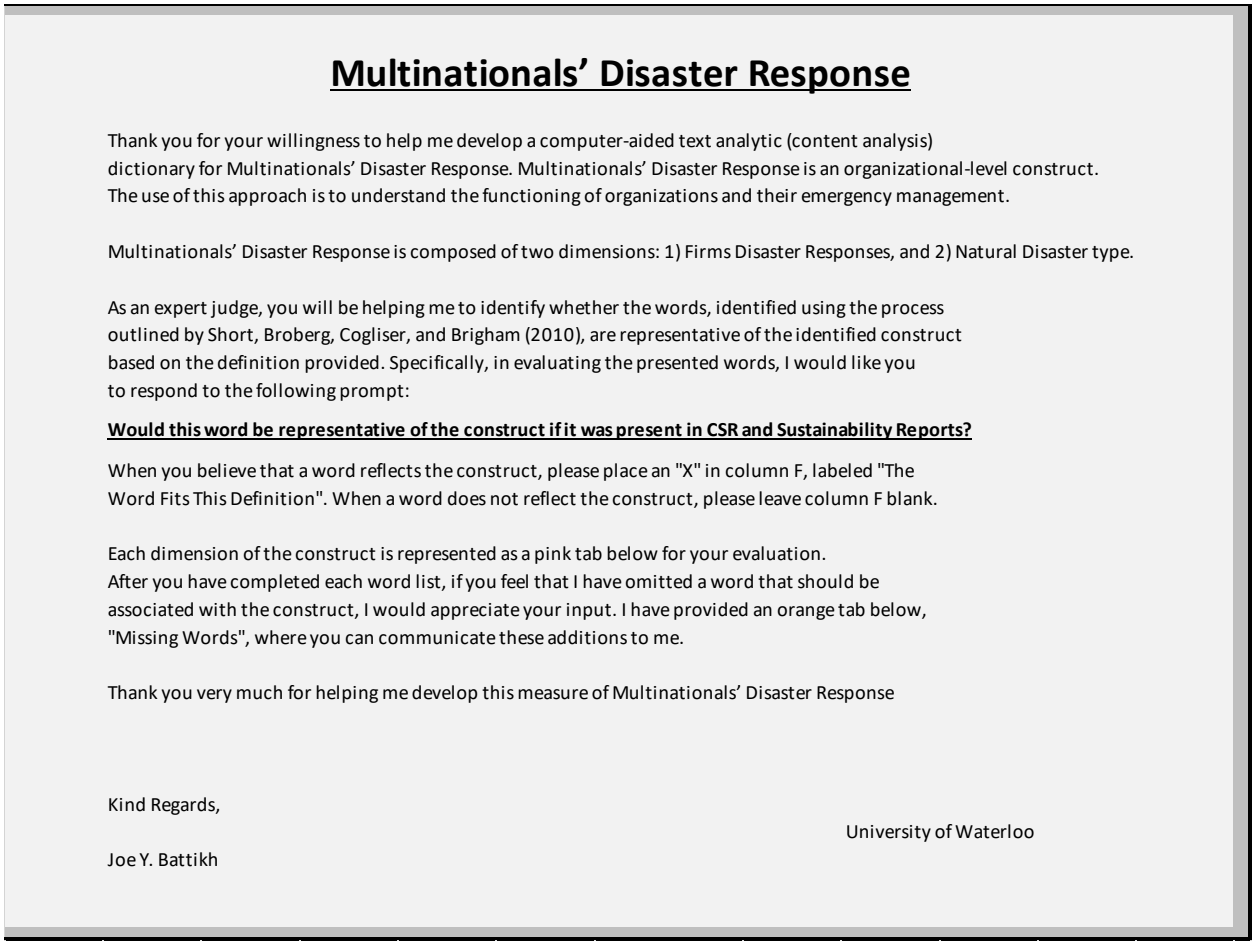
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Appendices

Appendix A (Chapter 3)

1. Keywords

The following indicates the process for the selection of the keywords used for the sustainability reports analysis.



Multinationals' Disaster Response

Thank you for your willingness to help me develop a computer-aided text analytic (content analysis) dictionary for Multinationals' Disaster Response. Multinationals' Disaster Response is an organizational-level construct. The use of this approach is to understand the functioning of organizations and their emergency management.

Multinationals' Disaster Response is composed of two dimensions: 1) Firms Disaster Responses, and 2) Natural Disaster type.

As an expert judge, you will be helping me to identify whether the words, identified using the process outlined by Short, Broberg, Cogliser, and Brigham (2010), are representative of the identified construct based on the definition provided. Specifically, in evaluating the presented words, I would like you to respond to the following prompt:

Would this word be representative of the construct if it was present in CSR and Sustainability Reports?

When you believe that a word reflects the construct, please place an "X" in column F, labeled "The Word Fits This Definition". When a word does not reflect the construct, please leave column F blank.

Each dimension of the construct is represented as a pink tab below for your evaluation. After you have completed each word list, if you feel that I have omitted a word that should be associated with the construct, I would appreciate your input. I have provided an orange tab below, "Missing Words", where you can communicate these additions to me.

Thank you very much for helping me develop this measure of Multinationals' Disaster Response

Kind Regards,

University of Waterloo

Joe Y. Battikh

Figure 5.1: Process for Keywords Selection

The following list of keywords is the final one agreed on and used for the analysis of the sustainability reports.

Disaster Responses	Natural Disaster Type
Emergency	Natural disaster
Disaster response	Hurricane
Disaster recovery	Flooding
Disaster relief	Tornado
Emergency rescue	Fire
Emergency response	Climate change
Disaster alleviation	Drought
Donation	Earthquake
Cash donation	Volcanic eruption
In-kind donation	Tsunami
Community development	Wildfire
Employee volunteer	Typhoon
Deployment of employees	Cyclone
Deployment of corporate resources	Extreme weather
Emergency management	Thunderstorms
Partnership	Storm
Evacuation	Snow storm
Power outage	Ice storm
Logistic support	Rising sea levels
	Heat waves
	Cold waves
	Blizzards
	Storm surge
	Coastal flooding
	Landslide
	Avalanche

Table 5.1: Final List of Keywords

2. List of FG500 ICT MNCs

The following table shows the listed FG500 ICT MNCs that were selected for this study.

2015			2016			2017		
Rank	Company Name	Sector	Rank	Company Name	Sector	Rank	Company Name	Sector
13	Samsung Electronics	Technology	9	Apple	Technology	9	Apple	Technology
15	Apple	Technology	13	Samsung Electronics	Technology	15	Samsung Electronics	Technology
31	Hon Hai Precision Industry	Technology	23	AT&T	Telecommunications	19	AT&T	Telecommunications
33	AT&T	Telecommunications	25	Hon Hai Precision Industry	Technology	27	Hon Hai Precision Industry	Technology
41	Verizon	Telecommunications	30	Verizon	Telecommunications	32	Verizon	Telecommunications
53	HP	Technology	44	Amazon.com	Technology	47	China Mobile Communications	Telecommunications
55	China Mobile Communications	Telecommunications	45	China Mobile Communications	Telecommunications	50	Nippon Tel. & Tel.	Telecommunications
65	Nippon Tel. & Tel.	Telecommunications	48	HP	Technology	65	Alphabet	Technology
82	IBM	Technology	60	Nippon Tel. & Tel.	Telecommunications	69	Microsoft	Technology
88	Amazon.com	Technology	63	Microsoft	Technology	71	Hitachi	Technology
95	Microsoft	Technology	82	IBM	Technology	72	SoftBank Group	Telecommunications
102	Deutsche Telekom	Telecommunications	90	Deutsche Telekom	Telecommunications	77	Deutsche Telekom	Telecommunications
110	SoftBank Group	Telecommunications	92	SoftBank Group	Telecommunications	79	Comcast	Telecommunications
116	Sony	Technology	94	Alphabet	Technology	81	IBM	Technology
124	Alphabet	Technology	96	Comcast	Telecommunications	83	Huawei Investment & Holding	Technology
131	Panasonic	Technology	113	Sony	Technology	105	Sony	Technology
135	Comcast	Telecommunications	128	Panasonic	Technology	110	Panasonic	Technology
136	Vodafone Group	Telecommunications	129	Huawei Investment & Holding	Technology	124	Dell Technologies	Technology
140	Telefonica	Telecommunications	132	China Telecommunications	Telecommunications	133	China Telecommunications	Telecommunications
155	America Movil	Telecommunications	133	Vodafone Group	Telecommunications	144	Intel	Technology
160	China Telecommunications	Telecommunications	137	Telefonica	Telecommunications	149	Vodafone Group	Telecommunications
175	LG Electronics	Technology	154	America Movil	Telecommunications	153	Telefonica	Telecommunications
182	Intel	Technology	158	Intel	Technology	176	America Movil	Telecommunications
199	Orange	Telecommunications	180	LG Electronics	Technology	181	Hewlett Packard Enterprise	Technology
225	Cisco Systems	Technology	183	Cisco Systems	Technology	187	Cisco Systems	Technology
227	China United Network Communications	Telecommunications	202	Lenovo Group	Technology	194	HP	Technology
228	Huawei Investment & Holding	Technology	204	Orange	Telecommunications	201	LG Electronics	Technology
231	Lenovo Group	Technology	207	China United Network Communications	Telecommunications	210	Orange	Telecommunications
251	Fujitsu	Technology	248	Fujitsu	Technology	219	KDDI	Telecommunications
267	KDDI	Telecommunications	259	Pegatron	Technology	226	Lenovo Group	Technology
300	Oracle	Technology	260	Oracle	Technology	237	Fujitsu	Technology
334	Canon	Technology	271	KDDI	Telecommunications	241	China United Network Communications	Telecommunications
355	Pegatron	Technology	312	Accenture	Technology	280	Oracle	Technology
359	Telecom Italia	Telecommunications	326	Quanta Computer	Technology	296	Pegatron	Technology
360	DirecTV	Telecommunications	329	China Electronics	Technology	305	Accenture	Technology
363	Ericsson	Technology	332	Canon	Technology	346	BT Group	Telecommunications
366	China Electronics	Technology	357	Ericsson	Technology	347	Canon	Technology
374	Accenture	Technology	366	JD.Com	Technology	362	China Electronics	Technology
389	Quanta Computer	Technology	369	BT Group	Telecommunications	369	Taiwan Semiconductor	Technology
411	BT Group	Telecommunications	400	Compal Electronics	Technology	376	Charter Communications	Telecommunications
423	Compal Electronics	Technology	403	Taiwan Semiconductor	Technology	390	Quanta Computer	Technology
444	NEC	Technology	404	Telecom Italia	Telecommunications	393	Facebook	Technology
448	Qualcomm	Technology	422	Qualcomm	Technology	415	Nokia	Technology
453	Flextronics International	Technology	429	LG Display	Technology	419	Ericsson	Technology
470	Sharp	Technology	436	EMC	Technology	437	NEC	Technology
472	Taiwan Semiconductor	Technology	441	Flextronics International	Technology	443	SAP	Technology
473	LG Display	Technology	452	NEC	Technology	455	Flextronics International	Technology
481	Telstra	Telecommunications	462	SAP	Technology	457	Heraeus Holding	Technology
487	EMC	Technology	482	Telstra	Telecommunications	458	Compal Electronics	Technology
490	Onex	Technology	483	Onex	Technology	460	Qualcomm	Technology
						473	Altice	Telecommunications
						478	Tencent Holdings	Technology
						479	LG Display	Technology
						493	Telecom Italia	Telecommunications

2018			2019		
Rank	Company Name	Sector	Rank	Company Name	Sector
11	Apple	Technology	11	Apple	Technology
12	Samsung Electronics	Technology	15	Samsung Electronics	Technology
20	AT&T	Telecommunications	23	Hon Hai Precision Industry	Technology
24	Hon Hai Precision Industry	Technology	25	AT&T	Telecommunications
37	Verizon	Telecommunications	37	Alphabet	Technology
52	Alphabet	Technology	43	Verizon Communications	Telecommunications
53	China Mobile Communications	Telecommunications	56	China Mobile Communications	Telecommunications
55	Nippon Tel. & Tel.	Telecommunications	60	Microsoft	Technology
71	Microsoft	Technology	61	Huawei Investment & Holding	Technology
72	Huawei Investment & Holding	Technology	64	Nippon Telegraph & Telephone	Telecommunications
79	Hitachi	Technology	75	Comcast	Telecommunications
80	Comcast	Telecommunications	84	Dell Technologies	Technology
81	Deutsche Telekom	Telecommunications	90	Deutsche Telekom	Telecommunications
85	SoftBank Group	Telecommunications	98	SoftBank Group	Telecommunications
92	IBM	Technology	102	Hitachi	Technology
93	Dell Technologies	Technology	114	International Business Machines	Technology
97	Sony	Technology	116	Sony	Technology
114	Panasonic	Technology	131	Panasonic	Technology
141	China Telecommunications	Telecommunications	135	Intel	Technology
146	Intel	Technology	141	China Telecommunications	Telecommunications
158	Vodafone Group	Telecommunications	173	HP	Technology
164	Telefonica	Telecommunications	176	Telefónica	Telecommunications
178	LG Electronics	Technology	184	Facebook	Technology
180	America Movil	Telecommunications	185	LG Electronics	Technology
190	HP	Technology	196	América Móvil	Telecommunications
212	Cisco Systems	Technology	212	Lenovo Group	Technology
225	Orange	Telecommunications	217	Vodafone Group	Telecommunications
236	KDDI	Telecommunications	225	Cisco Systems	Technology
240	Lenovo Group	Technology	228	Orange	Telecommunications
264	Charter Communications	Telecommunications	237	Tencent Holdings	Technology
273	China United Network Communications	Telecommunications	245	KDDI	Telecommunications
274	Facebook	Technology	259	Pegatron	Technology
285	Pegatron	Technology	262	China United Network Communications	Telecommunications
302	Oracle	Technology	264	Charter Communications	Telecommunications
313	Fujitsu	Technology	298	Accenture	Technology
316	Accenture	Technology	307	Oracle	Technology
317	Canon	Technology	335	SK Hynix	Technology
326	Toshiba	Technology	345	Canon	Technology
331	Tencent Holdings	Technology	349	Fujitsu	Technology
354	Quanta Computer	Technology	363	Taiwan Semiconductor Manufacturing	Technology
368	Taiwan Semiconductor Manufacturing	Technology	365	Quanta Computer	Technology
369	China Electronics	Technology	371	Toshiba	Technology
377	BT Group	Telecommunications	375	China Electronics	Technology
404	Compal Electronics	Technology	390	Compal Electronics	Technology
409	Hewlett Packard Enterprise	Technology	404	Hewlett Packard Enterprise	Technology
432	Wistron	Technology	405	BT Group	Telecommunications
442	SK Hynix	Technology	409	Micron Technology	Technology
445	Altice	Telecommunications	424	Wistron	Technology
446	SAP	Technology	427	SAP	Technology
457	Nokia	Technology	466	Nokia	Technology
463	NEC	Technology	468	Xiaomi	Technology
466	Flex	Technology	470	NEC	Technology
482	Heraeus Holding	Technology	474	Flex	Technology
483	LG Display	Technology			
484	DXC Technology	Technology			
500	Ericsson	Technology			

Table 5.2: List of FG500 ICT MNCs 2015-2019

3. List of Countries where ICT MNCs Intervened

2015	Segments	2016	Segments	2017	Segments	2018	Segments	2019	Segments
Nepal	16	Japan	12	US	24	US	16	US	14
Japan	10	Nepal	7	Japan	17	Japan	10	Japan	10
China	4	Ecuador	6	Mexico	16	Mexico	8	Indonesia	6
India	3	India	6	Puerto Rico	11	China	5	China	4
Vanuatu	2	Taiwan	5	Peru	5	UK	2	India	4
Serbia	1	Italy	2	China	4	Germany	1	Australia	3
Bosnia Herzegovina	1	Norway	1	India	4	Greece	1	UK	1
Myanmar	2	Romania	1	Chile	2	Ireland	1	Portugal	1
Philippines	1	US	4	Dominica	2	Italy	2	Italy	1
Papua New Guinea	1	Chile	2	Italy	2	Portugal	2	Philippines	1
Mexico	1	China	2	Taiwan	2	Spain	2	Puerto Rico	2
Malaysia	1	Fiji	2	Vietnam	2	Puerto Rico	4	Taiwan	2
Afghanistan	0.5	Haiti	2	Canada	1	Taiwan	4	Bolivia	1
Pakistan	0.5	Malaysia	2	Caribean	1	Guatemala	2	Costa Rica	1
TOTAL	44	Myanmar	2	Colombia	1	Costa Rica	1	Mexico	1
Developing %	77%	Thailand	2	Domenican Republic	1	India	2	Mozambique	1
Developing	34	Bangladesh	1	Ecuador	1	Indonesia	1	Nepal	1
Developed	10	Guatemala	1	Haiti	1	Malaysia	1	South Korea	1
Developed %	23%	Pakistan	1	Madagascar	1	Thailand	1	Southeastern Africa	1
		Paraguay	1	Nepal	1	Peru	1	Turkey	1
		Sri Lanka	1	TOTAL	99	Colombia	1	Uganda	1
		TOTAL	63	Developing %	44%	TOTAL	68	TOTAL	59
		Developing %	62%	Developing	42	Developing %	51%	Developing %	42%
		Developing	39	Developed	57	Developing	25	Developing	25
		Developed	24	Developed %	58%	Developed	43	Developed	34
		Developed %	38%			Developed %	63%	Developed %	58%

Table 5.3: Countries where ICT MNCs Responded

Note: In 2015, Afghanistan and Pakistan have 0.5 segment because the intervention happened on the boarder of both countries.

4. List of Missing Sustainability Reports

The table below shows which reports are unavailable from the corporates websites and therefore missing from this study:

#	2015	2016	2017	2018	2019
1	88 Amazon	44 Amazon	280 Oracle	141 China Telecom	375 China Electronics
2	124 Alphabet	483 Onex	362 China Electronics	264 Charter Communications	
3	300 Oracle		393 Facebook (1st SR in 2019)	275 Facebook (1st SR in 2019)	
4	490 Onex		457 Heraeus Holding	302 Oracle	
5				369 China Electronics	
6				445 Altice	

Table 5.4: Missing Sustainability Reports for FG 500 ICT MNCs

Notes:

1- From 2017, Fortune Magazine changed the listing of the company Amazon from technology sector to retail sector. That is why Amazon is listed in this study for the years 2015 and 2016, but not listed for the years 2017, 2018, and 2019.

2- In 2016, EMC was acquired by Dell. The 2016 EMC sustainability report is not available and the website points to Dell 2016 sustainability report. The latter was used for this research.

Appendix B (Chapter 4)

1. Research Ethics Clearance

UNIVERSITY OF WATERLOO

Notification of Ethics Clearance to Conduct Research with Human Participants

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Principal Investigator: Michael Wood

Student investigator: Yousr Battikh

File #: 46487

Title: How and Why do ICT MNCs Intervene After a Natural Disaster: The Case of Cyclone Hidaya in Kenya

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The Human Research Ethics Board is pleased to inform you this study has been reviewed and given ethics clearance.

Initial Approval Date: 07/22/24 (m/d/y)

University of Waterloo Research Ethics Boards are composed in accordance with, and carry out their functions and operate in a manner consistent with, the institution's guidelines for research with human participants, the Tri-Council Policy Statement for the Ethical Conduct for Research Involving Humans (TCPS2 2022), the Ontario Personal Health Information Protection Act (PHIPA), and all laws and regulations of the province of Ontario (as applicable). Additionally, CREB operates in a manner consistent with the International Conference for Harmonization of Technical Requirements for Pharmaceuticals for Human Use (ICH) Guidance E6(R2): Good Clinical Practice , the International Organization for Standardization of Good Clinical Practices (GCP) as set out by ISO 14155 - Clinical investigation of medical devices for human subjects, Part C, Division 5 of the Food and Drug Regulations, Part 4 of the Natural Health Products Regulations, Part 3 of the Medical Devices Regulations. Both Boards are registered with the U.S. Department of Health and Human Services under the Federal Wide Assurance, FWA00021410, and IRB registration number IRB00002419 (HREB) and IRB00007409 (CREB).

Expiry Date: 07/23/25 (m/d/y)

Multi-year research must be renewed at least once every 12 months unless a more frequent review has otherwise been specified. Studies will only be renewed if the renewal report is received and approved before the expiry date. Failure to submit renewal reports will result in the investigators being notified ethics clearance has been suspended and Research Finance being notified the ethics clearance is no longer valid.

Level of review: Delegated Review

Signed on behalf of the Human Research Ethics Board

Karen Pieters

Karen Pieters, Manager, Research Ethics, karen.pieters@uwaterloo.ca, 519-888-4567, ext. 41495

This above-named study is to be conducted in accordance with the submitted application and the most recently approved versions of all supporting materials.

Documents reviewed and received ethics clearance for use in the study and/or received for information:

file: email_interviews_recruitment_ICT-MNC_PA1.docx

file: Feedback and Appreciation-email_PA1.docx

file: Interview_Guide_PA1.docx

file: Verbal_consent_script_interview_sample_[ICT_DR_Kenya].docx

file: Interview_Info_Letter_PA1.docx

Approved Protocol Version 2 in Research Ethics System

This is an official document. Retain for your files.

You are responsible for obtaining any additional institutional approvals that might be required to complete this study.

Figure 5.2: University of Waterloo Research Ethics Clearance

2. Selection of Quotes Sourced from Diverse Data Sets

2nd order themes	1st order categories	Triangulation of data and selected quotes
T: Triggering Response		
►Local enablement	◆Senior member of the Kenyan government	"The Special Envoy for Tech within the Government of Kenya (GoK) convened various partners to support KRCS in developing digital solutions to enhance flood response and relief efforts." (ICHA, 2024)
		"So when we then heard from Phillip, it was basically, 'Now let's see how we can take what we are doing with the county already and then leverage that to see how we can support across the entire country." (Interview B, 2024)
		"I was then personally pulled into a WhatsApp group which was set up by a senior member of the of the Kenyan government." (Interview E, 2024)
	◆"…already working with partners in Kenya"	"it was not our first connection like we first started working with Kenya Space Agency and with the Red Cross ..." (Interview C, 2024)
		"we'd already started a separate engagement, for example with the Nairobi City County, where we were helping them to see how they can leverage technology to one support communication information gathering for the citizens of the County of Nairobi, which is the capital city of Kenya. " (Interview B, 2024)

		"The National Disaster Management Agency (NDMA) and the National Disaster Operation Center (NDOC) via their local connections reached out and requested some Esri technology when the disaster was becoming, you know, it was emerging. They were fulfilled and we gave some technology. " (Interview E, 2024)
		"...those are existing relationships between the Kenya and the DMO (Disaster Management Office), and the Kenya Red Cross and our Kenya based distributors...it was through that relationship that the conversation got started." (Interview F, 2024)
		"the AI for Good Lab is a part of Microsoft Philanthropy where we work with AI to do good for the world...But there's also an important team in Kenya…" (Interview C, 2024)
►Head Quarter enablement	◆Proactive Internally	"...my team started working through one of our activation partners with the Kenyan Red Cross…" (Interview A, 2024)
		"…in terms of supporting the country during the tough time that it's going through, so we then essentially reached out to the teams at large." (Interview B, 2024)
		"...we have public policy people all over the world and they are embedded with both government organizations and communities everywhere...So when this ... natural event hit the Kenya region we already had people reaching out trying to find out if we could help, how we would help..." (Interview A, 2024)

	◆Remote activation	"...team is centrally located, and we have access to a variety of tools that help us figure out which crises are happening anywhere in the world, and then from there we decide which ones are we gonna send a philosophic response to." (Interview D, 2024)
		"Google has a presence in Kenya, but no one from the Kenya team had reached out to us. In this case, we actually reached out to them and said, hey, we're monitoring the hurricane and the flood, and ...We are standing up a response in case they wanted to use of that activation for their local stakeholders." (Interview D, 2024)
E: Engagement motivation		
►CSR and Ethical Imperative	◆Commitment to communities	"…Amazon leadership principles, there's one where we talk about… being responsible for our communities..." (Interview B, 2024)
		"Our local communities, planet, and future generations need us to be better every day."(Amazon, 2025)
		"Nonprofit organizations use GIS to create a more equitable, sustainable, and prosperous planet. More than 12,000 charities, foundations, and mission-driven nonprofit organizations are supported by Esri's Nonprofit Program, using GIS to help amplify their impact in communities around the world." (Esri, 2025)
		"…So I think we broadly bring all this into a category we call GIS for good. So being a family owned company, we are sort of formal buckets for CSR and there's no foundation and philanthropic, but it's ultimately in our DNA to be quite in that area." (Interview E, 2024)

		"…on the one hand, it's a responsibility. So as a large corporation that has physical presence in many places…we respond in places we don't have a physical presence…but especially where we have a physical presence, we want to make sure that we are having a local face and supporting people in their time of need…" (Interview A, 2024)
	◆Corporate philanthropy	"…so the AI for Good Lab is a part of Microsoft Philanthropy where we work with AI to do good for the world…" (Interview C, 2024)
		"For Cyclone Hidaya, we did our standard response effort, which is we provide a grant and we launched an employee campaign, so that employees can donate and we'll match donations to an organization that then sub grants to provide relief and recovery efforts on the ground..." (Interview D, 2024).
►Strategic Interests and Business Synergies	◆Reliable technology partner	"…billions of people come to Google during crises to get information…" (Interview D, 2024)
		"...it's a disaster, you can't start doing lengthy processes, so it basically took me a day to actually get the credits to them. Good thing is that the Red Cross already had an AWS account, so when we give you cloud credits, you just need to tell me this is the account we're using and we dispatch this to them. " (Interview A, 2024)
		"Because we're market leader and many of these agencies are existing customers or the staff at those agencies already know about Esri from former roles etcetera, they know to come to us and being the biggest company in this space, people know to kind of come to us with these questions and you know, that's obviously why we have a response mechanism." (Interview E, 2024)

		"…we do all of that because we feel that our cloud workload capabilities really do differentiate and really help people that have been impacted by these things…" (Interview A, 2024)
	◆Demonstrate practical application	"…billions of people come to Google during crises to get information…" (Interview D, 2024)
		"…we do all of that because we feel that our cloud workload capabilities really do differentiate and really help people that have been impacted by these things…" (Interview A, 2024)
		"...we were discussing with them that there was a sort of urgent need to develop dashboards…to be able to report …on the extent of flooding and the damage and impact essentially…" (Interview E, 2024)
		"…our idea is to scale this disaster response and to make it as available to the most amount of people as possible" (Interview C, 2024)
►Collaboration and Employee Engagement	◆Building trust and legitimacy	"…our idea is to scale this disaster response and to make it as available to the most amount of people as possible" (Interview C, 2024)
		"...then interfaced with Kenya Red Cross, put together dashboards and provided them with the dashboards, I mean, they basically worked with them hand in hand for a few days until they had that." (Interview F, 2024)
		"So Kenya Red Cross would have known Esri and are a customer of Esri...So for them to say we need some extra technology, some extra help, they would know the local Esri partner because that's who they would work with on a daily basis." (Interview E, 2024)

	◆...we have people living there	“In the case of the Kenya flooding, it was a particular case because we have people living there who knew these floods were becoming more and more severe and we were actively working with an organization that was getting involved in helping or providing assistance to different places…” (Interview C, 2024)
		"I am Kenyan right? And I'm actually at the time when this was happening, I was actually in Nairobi...In terms of supporting the country during the tough time that it's going through, so we then essentially reached out to the teams at large." (Interview B, 2024)
		"And then yeah, we also provided sort of so volunteer...But if they had a problem, if they needed help setting something up, then we would impart..." (Interview E, 2024)
C: Championing technology		
►Cloud Computing and Data Infrastructure	◆“…provided cloud services”	"So Red Cross was having a challenge in terms of capacity and infrastructure for running several systems that they were then going to use in terms of the disaster response. So the first thing we were able to get them quickly was we're able to leverage Amazon AWS credits for disaster recovery." (Interview B, 2024)
		"…so we gave them some extra licenses to be able to host some stuff locally..." (Interview E, 2024)
		"So yeah, we immediately provided, you know the technology without any sort of cost implications. So that's licenses." (Interview E, 2024)

	◆Data storage & transfer	"...we're able to leverage AWS Snow family of data transfer devices, so allowing you to one collect the data in the field and then use that to transfer it in terms of aggregation, uploading and stuff like that…" (Interview B, 2024)
		"Portable devices were utilized to store extensive data in a mobile context, augmenting Help.NGO's capacity for quick and efficient disaster response." (Help.NGO, 2024)
		"AWS provided cloud-based solutions to store and manage data from various sources, ensuring seamless access to information for all disaster response stakeholders." (ICHA, 2024)
►Geospatial Technologies	◆Integrating and analyzing geospatial data	"...it was getting data from multiple sources bringing it into a single environment where you could ask questions of that data specifically questions around location…" (Interview E, 2024)
		"…which was the sort of tool that sits on people's desktops doing some of that heavy data crunching, data science work." (Interview E, 2024)
		"...well, you can't have the imagery and the statistical data and the weather data in one place, unless you've got the geospatial technology." (Interview E, 2024)
	◆Dashboards for real-time insights	"...geographic information system (GIS) technology enabled detailed geospatial analysis, helping KRCS visualize flood impacts." (ICHA, 2024)
		"...so we made we help them configure some basic dashboards, some basic common operational pictures, which is kind of your key information all in one place." (Interview E, 2024)

		"So there was a workflow that was put in place, that went from data collection and data collation, to some analysis, to this dashboard, which basically presented the situation." (Interview F, 2024)
►Imagery, AI and Data Analytics	◆Data used to identify priority zones	"…brought in drones and drone pilots" (Interview B, 2024)
		"…in Kenya in particular we use Planet, but we also used Sentinel 2, which is another open source imagery" (Interview C, 2024)
		"...where we brought in resources in form of drone pilots to come and support the team and with that they came with various equipment…" (Interview B, 2024)
	◆AI models to process satellite data & imagery	"…we run the assessment on that imagery and we identify which areas have been affected the most and we can give like a percentage of the buildings that have been affected and in which like what's the percentage of damage" (Interview C, 2024)
		"We are using our AI models to assess damaged buildings from Planet's satellite data and imagery." (smith, 2024)
		"...This is used for like a first assessment or of where the places that need the most assistance and so as to guide the first responders and on the ground people to know where to send assistance and help." (Interview C, 2024)

Table 5.5: Selection of Quotes Sourced from Diverse Data Sets