Innovation novelty and performance of humanitarian organizations: boundary roles of innovation intensity and external communication

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Abstract

Purpose – This purpose of this study is to explore the connection between organizational innovation novelty and operational performance. Grounded in the resource-based view and dynamic capabilities theory, the authors hypothesize that while initial increases in innovation novelty improve performance, excessive novelty can strain resources and capabilities, leading to diminishing returns. The authors also examine how innovation intensity and external communication moderate this relationship.

Design/methodology/approach – The study adopted a quantitative approach, and survey data was collected from 203 humanitarian organizations from Ghana.

Findings – Data collected from 203 humanitarian and relief organizations (HROs) operating in Ghana support the proposed positive relationship between innovation novelty and efficiency performance, although this was not observed in disaster responsiveness. Moreover, both innovation intensity and external communication positively influence this relationship, enhancing the beneficial effects of innovation novelty on operational performance when present at high levels.

Research limitations/implications – This study contributes to the literature by providing detailed insights into how innovation novelty affects HRO operational performance and underscores the critical roles of innovation intensity and external communication.

Practical implications – The study suggests that HROs should introduce and scale innovative initiatives cautiously, using incremental, phased approaches to ensure efficiency. High-intensity innovations can reduce flexibility during disaster response, so managers should maintain low-to-moderate intensity. External communication is crucial for efficiency performance, but localized, on-the-ground communication systems are essential. Strategic resource allocation is essential, with low-cost, high-impact innovations prioritized during early crises. Building innovation portfolios that balance radical innovations with smaller, incremental ones can help HROs remain agile and responsive in both stable and crisis periods.

Originality/value – This study explores the relationship between innovation novelty at both moderate and extremely high levels, and how it drives disaster responsiveness and operational efficiency under different conditions of innovation intensity and external communication.

Keywords Innovation novelty, Innovation intensity, Humanitarian supply chain, Operational performance

Paper type Research paper

1. Introduction

The increasing frequency and severity of natural disasters globally have placed unprecedented demands on humanitarian and relief organizations (HROs) (UNDRR, 2022). For instance, Ghana

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has, over the past decade, grappled with an alarming increase in natural and human-induced disasters, from devastating floods displacing thousands in Accra to prolonged droughts crippling agricultural communities in the Northern regions (Ghana Statistical Service, 2022). These events not only disrupt livelihoods but also place immense pressure on HROs tasked with providing swift and effective assistance (IFRC, 2023). The dynamic phases of disasters – from preparedness and immediate response to recovery and mitigation – introduce complex challenges that require HROs to be resourceful, adaptive and efficient in their operations (OCHA, 2022). These challenges include resource constraints, logistical hurdles and the need for rapid coordination among multiple stakeholders (IFRC, 2021). The recent COVID-19 pandemic compounded these challenges by straining HRO capacities and exposing the vulnerabilities in their operational models (WHO, 2023). As a result, HROs in Ghana, like their counterparts in all parts of the world, face mounting pressures to enhance their operational performance to meet the urgent needs of affected populations in emergencies.

Innovation has been identified as a vital mechanism for organizations to overcome challenges and develop novel solutions, particularly in complex and uncertain environments (Drucker, 2015; Crossan and Apaydin, 2010). Previous studies link innovation to enhanced adaptability, efficiency and sustained competitive advantage (Rosenbusch *et al.*, 2011). The literature distinguishes between radical innovation – introducing groundbreaking changes that disrupt existing processes – and incremental innovation – implementing continuous, small-scale improvements (Oke, 2007). This spectrum of innovation, as defined by the concept of innovation novelty, reflects the degree of newness and uniqueness introduced into organizational processes and solutions (Wang and Dass, 2017). Firms that effectively manage innovation novelty are better positioned to navigate challenging circumstances and maintain operational viability (Bessant *et al.*, 2015). Consequently, innovation is often portrayed as a solution for organizations facing complex problems, enabling them to remain viable and thrive amid adversity (Tidd and Bessant, 2020). However, the application and impact of innovation within HROs remain underexplored, particularly regarding how different degrees of novelty affect operational outcomes. Given the unique challenges HROs face, particularly in resource-constrained and disaster-prone settings, understanding how innovation influences their operational performance is critical (Brown and Osborne, 2013).

Literature offers limited insights into the role of innovation in enhancing HRO efficiency and responsiveness, especially regarding the nuanced effects of innovation novelty (Damanpour and Aravind, 2012). Despite the acknowledged importance of innovation in enhancing organizational performance, research has predominantly focused on profit-oriented businesses, leaving a significant gap in understanding its impact on HROs and social enterprises (Phillips *et al.*, 2015). The unique operational dynamics, resource constraints and mission-driven objectives of HROs differentiate them from traditional businesses, necessitating a tailored examination of how innovation affects their performance (Krlev *et al.*, 2018). This oversight hampers our ability to comprehend how innovation can be leveraged to enhance HRO operational performance when the world is increasingly susceptible to disasters (Salunke *et al.*, 2019). Moreover, the boundary conditions that might affect this relationship have not been adequately examined (De Silva and Wright, 2019). Understanding these moderating factors is crucial, as they can significantly affect the efficacy of innovation efforts in complex environments (Taneja *et al.*, 2015). The lack of knowledge in these areas limits the development of strategies that could improve HRO operations and disaster response capabilities.

Addressing these gaps, this study investigates the impact of innovation novelty on the operational performance of HROs, specifically focusing on efficiency and disaster responsiveness. We examine the linear and quadratic (nonlinear) relationships, acknowledging that while innovation can drive performance, excessive novelty may strain resources and introduce complexities that hinder effectiveness (Salge and Vera, 2012). Notably, previous literature suggests an optimal level of innovation novelty exists, beyond which the costs may outweigh the benefits (Kobarg *et al.*, 2019; Piening and Salge, 2015). In addition, we explore how innovation intensity – the frequency and magnitude of innovation activities – and external communication – the degree of engagement with external stakeholders – moderate this relationship. Drawing on the resource-based view (RBV) theory (Barney, 1991) and the dynamic capabilities framework (Teece, 2007), we propose that innovation novelty enhances operational performance by building valuable, rare, inimitable and nonsubstitutable resources, while innovation intensity and external communication strengthen this effect by enhancing the organization's capabilities to deploy these resources effectively. The dynamic capabilities framework complements RBV by emphasizing the organization's ability to integrate, build and reconfigure internal and external competencies to address rapidly changing environments, which is particularly relevant for HROs operating in disaster contexts.

This study contributes to the theoretical understanding of innovation management within HROs by integrating the RBV and dynamic capabilities theory (DCT) to explain how innovation novelty influences operational performance, and how innovation intensity and external communication moderate this relationship. By integrating these theoretical perspectives, our research comprehensively explains how innovation novelty influences HRO operations and under what conditions. The research outlines the nuanced effects of innovation novelty and the moderating factors to provide insights into how HROs can optimize innovation strategies to enhance efficiency and responsiveness in disaster-prone environments. The findings offer valuable implications for HROs in developing countries like Ghana, where resource constraints and increasing disaster risks necessitate effective and efficient innovation approaches. Implementing innovations, guided by innovation intensity and bolstered through strategic external communication, can significantly enhance HRO operations, ultimately strengthening disaster relief efforts and building community resilience. This research, thus, provides a timely contribution to improving humanitarian operations in the face of escalating global disasters.

2. Literature review and hypothesis

2.1 Innovation novelty: Definition, conceptualization and operationalization

Innovation novelty refers to the degree of newness or uniqueness associated with an innovation an organization introduces (Garcia and Calantone, 2002). It refers to the degree of radicalness or

newness of strategies, processes and products (or services) an organization introduces (Valle and Vázquez-Bustelo, 2009; Stock and Zacharias, 2011). The concept focuses on how much an innovation differs from existing products, services, processes or practices within the firm or the market (van der Have and Rubalcaba, 2016). Conceptually, innovation novelty is positioned along a continuum, from incremental to radical innovations (Oke, 2007). Incremental innovations involve minor improvements or adjustments to existing offerings, enhancing efficiency or performance without fundamentally changing the product or service (Chistov *et al.*, 2023). In contrast, radical innovations represent significant departures from the status quo, introducing entirely new concepts or technologies that can disrupt markets and create new industries (Forés and Camisón, 2016). This spectrum reflects varying degrees of complexity, uncertainty and potential impact associated with different levels of innovation novelty (Chistov *et al.*, 2023).

In empirical research, innovation novelty is operationalized by assessing the extent to which innovations are new to the organization or the market (Garcia and Calantone, 2002). Researchers often measure innovation novelty using subjective scales, where respondents rate the degree of novelty of their organization's innovations compared to previous offerings or industry standards (Stock and Zacharias, 2011; Wang and Ahmed, 2004). These assessments may consider factors such as the use of new technologies, the introduction of new functionalities or entry into new markets (Danneels and Kleinschmidt, 2001). Alternatively, objective indicators like the number of patents filed, research and development (R&D) investment in novel areas or the proportion of new products in the organization's portfolio may be used to quantify innovation novelty (Rubera and Kirca, 2012).

2.2 Innovation novelty and performance

Research on the relationship between innovation novelty and organizational performance has generally found a positive association, suggesting that higher degrees of innovation novelty can enhance performance outcomes such as efficiency, market share and profitability (Rosenbusch *et al.*, 2011; Rubera and Kirca, 2012; Wang, 2019). Innovation novelty, encompassing radical and incremental innovations, enables firms to differentiate themselves, meet emerging customer needs and adapt to changing market conditions (Cui and Wu, 2016; Wei *et al.*, 2014). Studies across various industries and countries have consistently highlighted the strategic importance of pursuing novel innovations to achieve superior performance. Table 1 shows indicative studies conducted on how innovation novelty affects organizational performance.

The nature of this relationship, however, is not always straightforward. While the literature often portrays innovation positively, empirical evidence suggests significant uncertainty associated with novel introductions, and the success rate of new innovations is often modest (Hughes *et al.*, 2021; Rubera and Kirca, 2012). Some studies have found that while innovation could enhance sales, its impact on profitability is disputed (Löfsten, 2014). Others have found that innovation potentially possesses the "too-much-of-good-thing" effect on performance, where innovation beyond a certain level diminishes marginal returns (Kobarg *et al.*, 2019; Piening and Salge, 2015). This suggests a potentially nonlinear relationship between innovation and performance (Laursen and Salter, 2006). Thus, while initial increases in innovation novelty can enhance performance, excessively high levels may lead to diminishing returns or adverse outcomes due to increased complexity, resource strain and implementation challenges (He and Wong, 2004). Beyond the empirical papers, several theoretical positions caution against overly focusing on innovations, as innovation may result in a "destructive creation," leading to a long-term productivity reduction (Soete, 2013). Thus, the optimal level of innovation novelty appears to depend on the organization's ability to manage the risks and uncertainties associated with highly novel innovations.

1 As Table 1 shows, several contingency variables have been examined in the innovation-performance relationship, as researchers seek to understand the conditions under which firms can optimally benefit from their novel products, processes and marketing. These studies often focused on a resource and capabilities perspective to examine how innovation enhances organizational performance outcomes via its interaction with internal and external variables. Some contingencies in the existing literature include absorptive capacity (Hughes *et al.*, 2021), market dynamism (Wang, 2019), R&D intensity (Bustinza *et al.*, 2019), environmental competitiveness (Prajogo, 2016) and technological turbulence (Piening and Salge, 2015). While many of these studies find positive outcomes of innovation, a few studies, such as (Wang, 2019) find differential effects of different levels of innovation.

Key observations in the literature indicate that empirical research on innovation and its organizational outcomes focuses on profit-making enterprises. Thus, the outcome variables are often financial metrics and market-related performance outcomes such as financial performance, business survival, sales, profitability and even export performance (Azar and Ciabuschi, 2017; Cefis and Marsili, 2019; Löfsten, 2014; Prajogo, 2016). There is a noticeable paucity of research examining innovation novelty in HROs and other not-for-profit enterprises. The unique characteristics of HROs – such as mission-driven objectives, resource constraints and the critical nature of their services – necessitate a different understanding of how innovation novelty affects operational performance in these contexts (Krlev *et al.*, 2018; Brown and Osborne, 2013).

Given this gap, the current literature lacks insights into the applicability of existing theories and findings to HROs. Specifically, there is limited understanding of whether the positive effects of innovation novelty on performance observed in profit-making firms hold for HROs or what contingency factors will moderate this relationship in a nonprofit context.

2.3 Theoretical review

2.3.1 Resource-based view

The RBV posits that an organization's sustainable competitive advantage stems from its unique resources and capabilities that are valuable, rare, inimitable and nonsubstitutable (Barney, 1991). In innovation research, RBV suggests that firms can achieve superior performance by developing and leveraging innovative capabilities that competitors cannot easily replicate (Azar and Ciabuschi, 2017; Kobarg *et al.*, 2019). These capabilities include specialized knowledge, skills and processes that facilitate the creation and implementation of novel innovations (Jeble *et al.*, 2020). HROs that possess unique resources – such as specialized expertise, innovative technologies or strong partnerships – can implement novel solutions that

Table 1 Indicative studies on the performance outcome of innovation novelty

Author(s) and year	Context and research method	Independent variable	Mediators/ moderators	Dependent Variable	Theories used	Summary of findings	Indicated contribution
Hughes *et al.* (2021)	Survey of 2,820 Taiwanese business units	Business unit radical innovation	Absorptive capacity	Financial performance	Dynamic capabilities theory	Radical innovation is positively related to financial performance. This relationship is moderated by absorptive capacity	This mini-model contributes to understanding the conditions under which radical innovation enhances performance
Bustinza *et al.* (2019)	Survey of 370 manufacturers worldwide	Product-service innovation (servitization)	R&D intensity: In-house vs. partnership provision	Overall performance	Resource-based view	Product–service innovation positively enhances overall performance. R&D intensity and partnerships with knowledge-intensive business services enhance this relationship	Contributes to theory by reinforcing assumptions about the servitization–performance relationship by analyzing the roles of strategic partnerships and R&D intensity
Cefis and Marsili (2019)	Panel data of 2,329 firms in the Netherlands	New venture innovation (innovative capabilities)	Type of innovations (process, product vs. marketing, organizational)	Business survival	Resource-based view	New firms that innovate within two years of their founding enjoy a long-term adaptive survival premium during and after crises. Process and product innovations entail a more effective and enduring premium	This study contributes to understanding how organizational adaptation is shaped by the early ability of new firms to innovate and the nature of the innovation
Duhaylongsod & De Giovanni (2019)	Survey of 173 European organizations	Supplier integration (SI)	Innovation strategies (radical and incremental)	Operational performance (internal and external)	Resource-based view	Adopting an incremental product innovation strategy improves the relationship between internal and external operational performance and leads to more effective SI	This research suggests how the impact of SI on OP can be improved by adopting certain innovation strategies
Kobarg *et al.* (2019)	218 Innovation projects in German manufacturing firms	Project level collaboration (breadth and depth)		Innovation performance (radical and incremental)	Knowledge-based view and resource-based view	There is an inverted U-shaped relationship between collaboration breadth and radical innovation performance and between collaboration depth and incremental innovation performance	This study contributes to our understanding of project-level open innovation and the overall performance effects of innovation collaboration
Lee *et al.* (2019)	856 firms from the 2014 Korean Innovation Survey	Product innovation (incremental, radical) and process innovation	Marketing innovation and organizational innovation	Firm performance	Not explicitly outlined	Process innovation encourages both radical and incremental product innovation. For high-tech firms, introducing marketing innovation increases the relationship between a new product and firm performance. In the case of low-tech firms, process innovation has direct and positive impacts on a firm's performance with organizational innovation	The study shows that the synergy effects of innovation exist and can be changed depending on the innovativeness levels and industrial categories
Wang (2019)	Survey of 135 firms in Taiwan	Radical innovation and incremental innovation	Market dynamism	Firm performance	Not explicitly outlined	Radical innovation is positively associated with firm performance, while incremental innovation is negatively related to firm performance. Market dynamism moderates the positive effect of radical innovation	Highlights the mediating role of environmental dynamism when examining the relationship between innovation novelty and firm performance

(*continued*)

Table 1

Author(s) and year	Context and research method	Independent variable	Mediators/ moderators	Dependent Variable	Theories used	Summary of findings	Indicated contribution
Azar and Ciabuschi (2017)	Survey data from 218 Swedish export ventures	Innovation capabilities	Technological innovation novelty (radicalness and extensiveness)	Export performance	Socio-technical system theory and resource-based view	Organizational innovation positively affects both dimensions of technological innovation novelty. While extensiveness is positively related to export performance, radicalness is not	The study contributes to understanding how adopting innovations in the development of a foreign market benefits export performance
Prajogo (2016)	Survey of 207 manufacturers in Sweden	Innovation strategies (process and product)	Environmental dynamism and Environmental competitiveness	Business performance	Contingency theory and resource-based view	Dynamic environments strengthen the effect of product innovation on business performance. Competitive environments weaken the effect of product innovation on business performance but strengthen the effect of process innovation on business performance	This study appropriates the competitive value of different innovation strategies in different environments
Piening and Salge (2015)	Survey of 5,476 German firms	Process innovation novelty (propensity)	Technological turbulence and market turbulence	Financial performance	Dynamic capabilities	Process innovation propensity increases financial performance up to a point beyond which negative marginal returns set in	The study highlights the importance of considering the diminishing marginal benefits of innovation activities for process innovation propensity
Löfsten (2014)	Survey of 99 medium-sized technology firms in Sweden	Product innovation		Firm performance (sales and profitability)		Product innovation success enhances sales but does not significantly impact profitability	The study contributes to understanding product innovation processes and how innovation influences performance
Rosenbusch *et al.* (2011)	Meta-analysis of 42 firms	Firm innovativeness		Firm performance		The study found that innovation–performance relationship is context dependent	The study synthesized knowledge in the area based on previous studies
This study	Survey of 203 humanitarian organizations in Ghana	Innovation novelty	Innovation intensity and external communication	Operational performance (efficiency performance and disaster responsiveness)	Resource-based view and dynamic capabilities theory	Innovation novelty has a J-shaped relationship with efficiency performance. Innovation intensity and external communications play differing roles in this relationship	This study comprehensively examined when HROs benefit from innovation novelty. The curvilinear analysis provides new insights into the relationship

Source(s): Authors' own work

enhance efficiency and effectiveness in disaster response (Wagner *et al.*, 2023). By leveraging these resources, HROs can better meet the needs of beneficiaries and achieve mission objectives (Damoah, 2022). However, unlike profit-oriented firms, HROs may face resource constraints due to funding limitations and may prioritize social impact over competitive advantage (Lettice and Parekh, 2010). Thus, RBV highlights the importance of building and using unique resources to support innovation novelty in enhancing operational performance within HROs.

2.3.2 Dynamic capabilities theory

DCT extends the RBV by focusing on an organization's ability to integrate, build and reconfigure internal and external competencies to address rapidly changing environments (Teece *et al.*, 1997). Dynamic capabilities enable organizations to sense opportunities, seize them through resource reconfiguration and maintain effectiveness in volatile contexts (Teece, 2007). In innovation research, dynamic capabilities are critical for successfully implementing novel innovations, as they facilitate learning, adaptation and transformation (Hughes *et al.*, 2021; Piening and Salge, 2015). For HROs operating in disaster-prone environments, dynamic capabilities are essential for responding effectively to unexpected challenges by rapidly deploying innovative solutions (Tabaklar *et al.*, 2021). The theory suggests that HROs with strong dynamic capabilities can better leverage innovation novelty to improve operational performance. This includes integrating new technologies, adapting processes and collaborating with external partners (Polater, 2021; Son *et al.*, 2024). In this study, DCT underscores the role of factors such as innovation intensity and external communication in enhancing these capabilities, thereby strengthening the impact of innovation novelty on performance.

2.4 Hypothesis development

2.4.1 Innovation novelty and operational performance

Innovation novelty drives competitive advantage by enabling organizations to transform technological processes, open new markets and create unique product applications (Henderson and Clark, 1990). Groundbreaking innovations allow early adopters to set industry standards, making it challenging for competitors to displace them. A corporate reputation for product innovation fosters consumer excitement and loyalty, increasing tolerance for occasional failures (Henard and Dacin, 2010). Being perceived as a novel innovator enhances consumer awareness and broadens the appeal of an organization's offerings. In HROs, innovation novelty is critical in improving disaster responses and enhancing mitigation and social interventions (Cosh *et al.*, 2012). Novel products, processes and technologies enable HROs to address complex challenges more effectively, essential for fulfilling their missions (Bessant *et al.*, 2015). Moreover, innovation novelty is linked to how agencies secure donor funding, as innovative approaches can attract greater support and credibility (Ramalingam *et al.*, 2009). Drawing on the RBV, innovation novelty represents a valuable, rare and inimitable resource that enhances an organization's operational capabilities and adaptability (Barney, 1991). In HROs, introducing novel innovations can improve efficiency, optimize resource utilization, and enable more effective responses to humanitarian crises (Bruder and Baar, 2024). Empirical studies consistently demonstrate the positive relationship between innovation novelty and organizational performance across various contexts. For instance, Rosenbusch *et al.* (2011) found that innovation positively impacts the performance of small and medium-sized enterprises performance, highlighting innovation's importance in resource-constrained settings. In the humanitarian sector, innovative solutions have been shown to enhance service delivery, beneficiary satisfaction and overall mission effectiveness (Trejo-Rangel *et al.*, 2023). For example, the introduction of mobile technology for disaster response coordination has significantly improved efficiency in relief operations by enabling real-time communication and resource allocation (van den Homberg *et al.*, 2014). Moreover, the integration of digital innovations such as blockchain for supply chain transparency, drone technology for delivering medical supplies and RFID for tracking product movement in relief operations exemplifies how novelty in innovation can revolutionize operational performance in HROs (Scott and Scott, 2017; Wagner *et al.*, 2023). These innovations not only enhance efficiency but also improve organizations' responsiveness and adaptability in unpredictable environments.

Based on the theoretical underpinnings of the RBV and supported by empirical evidence, it is reasonable to expect that HROs adopting higher degrees of innovation novelty will experience enhanced operational performance. Based on this rationale, we propose the following hypothesis:

H1. Organizational innovation novelty is positively related to operational performance.

While innovation novelty is generally associated with enhanced operational performance, its benefits may not increase indefinitely. DCT suggests that as the degree of innovation novelty rises, organizations face increasing uncertainty, complexity and resource demands (Teece, 2007). Excessive novel innovations for HROs with limited resources can strain capacities, lead to implementation challenges and potentially decrease operational performance. This suggests an optimal level of innovation novelty beyond which the negative effects outweigh the benefits (Seelos and Mair, 2012). Empirical studies across various sectors support this notion that while initial increases in innovation novelty enhance performance beyond a certain point, the relationship turns negative (Salge and Vera, 2012; Piening and Salge, 2015). This pattern reflects the balance between the advantages of being innovative and the costs associated with higher levels of novelty. When organizations invest heavily in valued functions like R&D, there is a risk of depriving other critical areas of essential resources. This resource misallocation can lead to losing key personnel, strained partnerships and damaged reputations, ultimately impacting stakeholder collaborations (Mitchell *et al.*, 1997). Moreover, as levels of innovation novelty increase, customers may become more risk-averse due to the heightened potential for social, performance or financial risks associated with adopting novel offerings (Szymanski *et al.*, 2007). Radical innovations often require customers to engage in higher-order learning and reorientation (Baker and Sinkula, 2007), increasing the complexity of evaluation and adoption processes (Tellis *et al.*, 2009). Consequently, firms must invest more in sophisticated communication and marketing strategies to overcome customer skepticism, requiring substantial additional

resources (Luoma-aho and Vos, 2010). This intensifies the strain on organizational resources, potentially leading to underfunding in other critical areas like production and service delivery. In the humanitarian sector, similar challenges arise. Major disasters often attract significant attention, leading relief agencies to focus their R&D efforts on innovative products and processes to address these high-impact events (IFRC, 2017). While this focus can lead to groundbreaking solutions, it may divert resources and attention from other essential disaster response activities. As organizational innovation novelty increases, HROs risk depleting their slack resources, compromising the viable operation of other vital business processes and capabilities. This resource depletion can result in diminishing returns, as the costs of sustaining high levels of innovation outweigh the operational benefits. Therefore, contrary to the assumption of a consistently positive linear relationship, the evidence suggests that the relationship between organizational innovation novelty and operational performance could be nonlinear. Based on this reasoning, we propose the following hypothesis:

H2. There is an inverted U-shaped relationship between organizational innovation novelty and operational performance.

2.4.2 The moderating role of innovation intensity.

The extent to which firms engage in innovation activities – referred to as innovation intensity – may significantly influence the relationship between innovation novelty and organizational performance (Liao and Tsai, 2018). Innovation intensity reflects the frequency and magnitude of innovation efforts within an organization. (Choi and Williams, 2014). As innovation intensity increases, a firm's innovation profile expands accordingly, enabling it to introduce a continuous flow of innovations across products, processes and technologies (Garcia and Calantone, 2002; Story *et al.*, 2014). Organizations with high innovation intensity tend to perform better than those with lower intensity levels, as they can respond more effectively to market changes and technological advancements (Banbury and Mitchell, 1995). Organizations in the humanitarian sector consider lead time – a critical measure of their ability to respond swiftly to disasters – essential for their performance (Alexander, 2014; Kabisch *et al.*, 2017). The increasing frequency and complexity of global disasters necessitate that HROs continuously seek innovative solutions, highlighting the importance of high innovation intensity in this context (Ramalingam *et al.*, 2009). Organizations with high innovation intensity possess stronger dynamic capabilities, enabling them to adapt, integrate and reconfigure internal and external resources to address rapidly changing environments. High innovation intensity fosters a culture of innovation, builds experiential knowledge and allocates necessary resources, thereby enhancing an organization's capacity to effectively implement novel innovations (Wang *et al.*, 2015).

Under high levels of innovation intensity, organizations are better equipped to handle the complexities and uncertainties associated with innovation novelty (He and Wong, 2004; Pavlou and El Sawy, 2011). Frequent engagement in innovation activities enhances organizational learning, encourages experimentation and reduces the risks of implementing novel innovations. In this scenario, the positive relationship between innovation novelty and operational performance is strengthened, as the organization's robust capabilities enable it to capitalize on novel innovations effectively.

Conversely, under low levels of innovation intensity, organizations may lack the necessary infrastructure, culture and experiential knowledge to support and implement novel innovations successfully. The absence of frequent innovation activities can lead to resistance to change, inadequate resource allocation and a limited ability to manage the complexities of novel innovations (Damanpour, 1991). In such cases, the positive impact of innovation novelty on operational performance is weakened, as the organization struggles to realize the potential benefits of novel innovations.

Based on this rationale, we propose the following hypothesis:

H3. Innovation intensity positively moderates the relationship between organizational innovation novelty and operational performance, such that the relationship is stronger when innovation intensity is high and weaker when it is low.

2.4.3 The moderating role of external communication.

In crisis management, an organization's efficiency heavily depends on the leader's ability to communicate effectively with internal teams and the broader society (Chari and Novukela, 2023). This underscores the importance of external communication in disaster management, as it facilitates the dissemination of crucial information and coordination with stakeholders (Trejo-Rangel *et al.*, 2023). Studies have shown that effective communication aids in the psychological recovery of disaster victims, helping them cope with stress, trauma and other psychological effects caused by disasters (Chari and Novukela, 2023). Scholars have identified external communication as a structural determinant of innovation (Damanpour, 1991; Mathisen and Einarsen, 2004; Mahajan and Peterson, 1985), further elaborated by Rogers (2003), who assert that internal and external communication is crucial for adopting innovations. Souitaris (2002) found that external communication variables – such as stakeholder engagement, networking, acquisition of external information and cooperation with external organizations – positively influence organizational performance.

External communication involves engagement and information exchange with external stakeholders, including partners, donors, beneficiaries and other organizations (Taneja *et al.*, 2015). Effective external communication provides access to new knowledge, resources and support critical for implementing novel innovations (De Silva and Wright, 2019). DCT suggests that external communication enhances an organization's sensing and seizing capabilities by facilitating environmental scanning, learning and collaboration (Teece, 2007; Appiah, 2024). In the context of HROs, higher levels of external communication may strengthen the positive impact of innovation novelty on operational performance. By engaging with external stakeholders, HROs can leverage external expertise, share best practices and reduce uncertainties associated with implementing novel innovations (Salunke *et al.*, 2019). Engaging with external partners helps HROs overcome resource limitations, adapt innovations to local contexts and

improve implementation effectiveness (Lettice and Parekh, 2010).

Under high levels of external communication, organizations can effectively disseminate information about their novel innovations, receive valuable feedback and collaborate with external partners to successfully refine and implement these innovations. This collaborative approach enhances the organization's ability to capitalize on innovation novelty, thereby strengthening the baseline positive relationship between innovation novelty and operational performance.

Conversely, under low levels of external communication, organizations may struggle to implement novel innovations effectively due to isolation from valuable external knowledge and resources. Limited engagement with external stakeholders can lead to challenges in understanding beneficiary needs, restricted access to funding or expertise and difficulties in scaling or adapting innovations. As a result, the positive impact of innovation novelty on operational performance is weakened, as the organization cannot fully realize the benefits of its novel innovations.

Based on this rationale, we propose the following hypothesis:

H4. The relationship between organizational innovation novelty and operational performance will be stronger when external communication is higher.

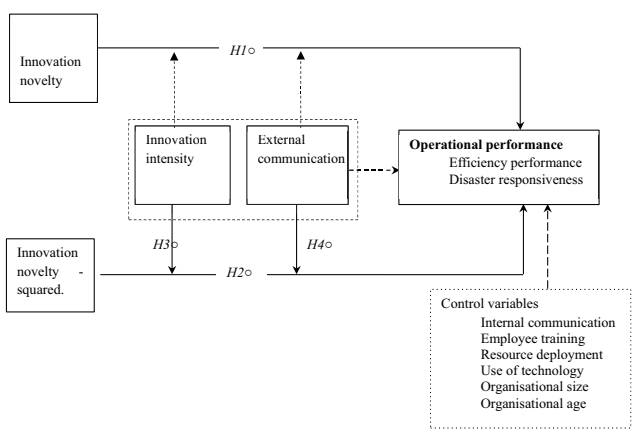
The hypothesized links and the relationships between the variables are presented in Figure 1.

3. Research methods

3.1 Research context

This study's proposed model was tested using data from Ghana's humanitarian-focused organizations. Ghana's economy is increasingly gaining importance and attention following its constant growth rate over the past few decades (IMF, 2018 and ADB, 2015). Despite its socioeconomic prospects, Ghana, compared to other African countries, has high exposure to several hazards and disaster types (United Nations Development Programme (UNDP), 2017). The climatic forces of the Sahel and two oceans affect the country, given that it is in one of the world's most complex climatic regions (United Nations Development Programme (UNDP), 2017). Historically, Ghana has been exposed to natural disasters such as floods, earthquakes, droughts, coastal erosion, storm surges, tropical storms and wildfires; and in recent times, its susceptibility to floods, pest infestation, disease epidemics, droughts and wildfires has increased, particularly in the Northern and the Southern parts of the country (Oteng-Ababio, 2013; United Nations Development Programme (UNDP), 2017) and the menace of illegal mining – known locally as Galamsey (Afriyie *et al.*, 2016). Other disasters, such as road accidents, internally displaced persons and social conflicts, have been on the rise lately. For example, in 2013, the country recorded 5,489 fire outbreaks, resulting in an economic loss of GH¢25,081,919.05, injuring 1,128 persons and causing 213 deaths. Again, 2,076 and 2,341 persons were killed in road accidents in 2017 and 2018, respectively. Estimates are that road accident injuries and deaths cost the country $230m annually. Further, the 2015 Accra flood, coupled with an explosion at a Goil filling station, claimed over 152 lives (Asumadu-Sarkodie *et al.*, 2015). Moreover, in 2017, the damage to livelihood and infrastructure caused by floods was more than $130m, and it affected more than 265, 000 in the Northern parts of the country, with about 100,000 of them requiring support in various forms to cope and restore livelihoods (United Nations Development Programme (UNDP), 2017).

Figure 1 Research model



Source(s): Authors' own work

3.2 Sampling and data collection

The target population comprises all HROs in Ghana, which consist of semiautonomous and regular HROs. These include the National Disaster Management Organization, the security forces (The Ghana Armed Forces, Ghana National Fire Service, Ghana Police Service and Ghana Immigration Services), the Ghana Ambulance Service, UN relief affiliated agencies, Ghana Red Cross/Crescent Society, faith-based agencies and other nongovernment organizations. Relying on the HROs' websites and that of the United Nations Office of Coordinated Humanitarian Aid (UNOCHA), we estimated the target population size to be 1,449 organizations.

The unit of analysis for this study is at the organizational level. 295 humanitarian organizations operating in Ghana were initially identified and approached to respond to the questionnaire. Following prior research (e.g. Boso *et al.*, 2013), the delivery-and-collection approach was used to administer the questionnaire. This approach works best in the Ghanaian context (particularly for firm-level studies) due to the poor address system and internet access. Three fieldworkers were each assigned to collect data from one of the three geographical demarcations in the study (i.e. the Southern belt, the middle belt and the Northern belt of the country). The key informants targeted are individuals holding senior/managerial positions such as managing director, director, administrative head, operational manager and area manager. Reminder calls were made five days after the questionnaires were delivered to increase the response rate. All questionnaires received within the first six months were classified as early responses, while those received within the last six months were classified as late responses. The field study started in October 2018 and ended in December 2019.

Out of the 295 firms approached, we obtained completed questionnaires from 215 firms. After thoroughly reviewing the returned questionnaires, 12 were excluded from further analysis due to substantial missing data, resulting in a final sample size of 203 valid responses. The profiles of respondents and participating companies are presented in Table 2.

3.3 Questionnaire and measures

We used two approaches to develop and refine the questionnaire used for this study. First, a literature survey was used to collect, study and adapt measures developed for the study's key constructs. Second, we conducted a pilot study to refine the measures and improve the wording, scaling and arrangement of the items in the questionnaire. Details of the measurement items are available in Table 3. The conceptualization and measurement of the variables are presented below:

Innovation novelty: Innovation novelty refers to the degree of radicalness or newness of strategies, processes and products (or services) an organization introduces (cf. Valle and Vázquez-Bustelo, 2009; Stock and Zacharias, 2011). Regarding each dimension, this study focused on three key areas where innovation can manifest. They include strategy (Seo *et al.*, 2014), process (Seo *et al.*, 2014; Murat Ar and Baki, 2011) and product (Story *et al.*, 2014; Murat Ar and Baki, 2011). Therefore, five items were adapted/developed from relevant literature to the strategy, process and product aspects of innovation novelty. A seven-point scale that ranged from "not at all (=1)" to "a substantial extent (=7)" was used to measure all items capturing the aspects of innovation novelty.

Innovation intensity: Innovation intensity refers to the frequency at which an organization introduces new strategies, processes and products (or services) (cf. Stock and Zacharias, 2011; Story *et al.*, 2014). Seven items that capture the product, strategy and process aspects of innovation intensity were developed to measure the construct (Story *et al.*, 2014; Murat Ar and Baki, 2011; Stock and Zacharias, 2011). A seven-point scale that ranged from "strongly disagree (=1)" to "strongly agree (=7)" was used to measure all items tapping into innovation intensity.

Operational performance: Operational performance is multifaceted (Wong *et al.*, 2011). Prior studies have operationalized the concept in different ways: multidimensional (see, e.g. Wong *et al.*, 2011) versus unidimensional (see, e.g. Flynn *et al.*, 2010). Consistent with the operational context of the study (i.e. HROs), two conceptual aspects of operational performance were considered: efficiency performance and disaster responsiveness. Efficiency performance refers to the extent to which an organization uses resources economically (i.e. minimizes operational costs and reduces wastes in operations). Four items were adapted from Wong *et al.* (2011), Gligor *et al.* (2015) and Ward and Duray (2000) to tap into efficiency performance. Disaster responsiveness refers to the speed and flexibility at which an organization swiftly and flexibly responds to disasters. Four items were developed with insights from Ahmad and Schroeder (2003), Flynn *et al.* (2010), Thomé *et al.* (2014) and Peng *et al.* (2011) to capture disaster responsiveness. A seven-point scale that ranged from "below average (=1)" and "above average (=7)" (compared with the humanitarian space average) was used to measure each item, measuring either efficiency performance or disaster responsiveness.

External communication: External communication refers to the extent to which an organization communicates and shares information with relevant external stakeholders (Wu *et al.*, 2014; Fawcett *et al.*, 2007). Seven items developed from relevant literature tap into external communication using a seven-point scale anchored where "strongly disagree (=1)" and "strongly agree (=7)".

Control variables: Consistent with prior literature, we controlled for the effects of employee training, resource deployment, use of technology, internal communication, organization size and organization age in the model. Employee training refers to the extent to which an organization invests in or develops employees' competencies and knowledge base (Akhtar *et al.*, 2008). Consistent with this definition, four items were adapted from Chadwick *et al.* (2014) and Akhtar *et al.* (2008) to measure employee training using a seven-point scale that ranged from strongly disagree (=1) to strongly agree (=7).

Resource deployment is about an organization's ability to gather and channel new and available resources into and exploit disaster management opportunities (cf. Sirmon *et al.*, 2008). Three items were developed to measure resource deployment using a seven-point scale that ranged from strongly disagree (=1) to strongly agree (=7).

Technology usage refers to the extent to which an organization's disaster management operation is technologically enabled. Using a seven-point scale that ranged from not satisfied at all (=1) to extremely satisfied (=7), the informants were asked to indicate the level at which they are satisfied with the level of "growth in technology use (tracking and tracing, drones, apps, software, etc.)," compared to yearly projections over the past three years in their organizations.

Internal communication refers to the extent to which relevant information is shared within an organization (cf. Fawcett *et al.*, 2007). Seven items were developed from relevant literature to tap into internal communication using a seven-point scale that ranged from "strongly disagree (=1)" and "strongly agree (=7)".

Organizational size was measured in terms of full-time employees, while organizational age was measured in terms of the number of years in operation.

Table 2 About respondents and organizations

Variable	*Count*			*%*
Respondent education level				
Diploma/HND	92			45.3
Bachelor	89			43.8
Postgraduate	22			10.9
Position				
Top management level	71			34.7
Middle management level	132			65.3
	Min	*Max*	*Mean*	*SD*
Respondent experience	1	33	14.72	6.610
No. of years holding current position	1	21	7.94	4.479
Organizational age (years)	2	127	44.19	25.990
Organizational size (no. of staff)	4	200	49.23	37.405

Source(s): Authors' own work

Table 3 CFA results, tests of reliability and validity

Items	Description	Loading (t-values)
Employee training (CR = 0.889, CA = 0 0.894 and AVE = 0.727)		
Train2	Resources for employee training are readily available	0.816 (Fixed)
Train3	There are opportunities for employee development	0.824 (13.26)
Train4	Employee competencies are developed	0.915 (14.52)
Resource deployment (CR = 0.845, CA = 0.883 and AVE = 0.732)		
Resour1	We use available resources in disaster management	0.904 (Fixed)
Resour2	We use information from a variety of sources to manage disasters	0.804 (8.11)
Internal communication (CR = 0.958, CA = 0.958 and AVE = 0.765)		
iCom1	We frequently communicate internally	0.896 (Fixed)
iCom2	We internally communicate in appropriate detail with each other	0.877 (18.71)
iCom3	We openly share work relevant information internally	0.873 (18.52)
iCom4	We internally share information in a timely fashion	0.899 (19.85)
iCom5	We internally communicate accurately with each other	0.873 (18.48)
iCom6	We use an effective communication system to share information	0.837 (16.88)
iCom7	We adopt technology in our internal communication activities	0.866 (18.15)
External communication (CR = 0.883, CA = 0.862 and AVE = 0.602)		
xCom1	We openly share work relevant information with the appropriate people outside the organization	0.723 (10.84)
xCom2	We communicate with the appropriate people outside the organization in appropriate detail	0.805 (Fixed)
xCom3	We communicate accurately with the appropriate people outside the organization	0.758 (11.49)
xCom4	There is direct communication with relevant governmental agencies (e.g. national disaster management organization, Ghana fire service, etc.	0.815 (12.56)
xCom5	There is direct communication with relevant nongovernmental agencies (e.g. red cross/crescent, UNICEF, OCHA, etc.)	0.774 (11.79)
Innovation Intensity (CR = 0.948, CA = 0.905 and AVE = 0.724)		
InvIns1	Our organization has produced more new humanitarian services/products for our clients than other organizations during the past five years	0.818 (Fixed)
InvIns2	On average, each year we introduce more new humanitarian services/products in our target markets than other humanitarian organizations	0.837 (14.26)
InvIns3	Humanitarian experts would say that we are more prolific when it comes to introducing new humanitarian services/products in our target markets	0.788 (13.03)
InvIns4	We more regularly try out new humanitarian operational strategies	0.837 (14.26)
InvIns5	We more frequently come up with novel ideas for our humanitarian operations	0.856 (14.76)
InvIns6	We update our humanitarian operational processes more often than other humanitarian organizations	0.872 (15.16)
InvIns7	We innovate more often with respect to our humanitarian processes than other humanitarian organizations	0.832 (14.12)
Innovation novelty (Strategy) (CR = 0.909, CA = 0.910 and AVE = 0.768)		
Our humanitarian ideas/concepts (e.g. strategies and new service ideas) for our operations are. . .		
InvNvS1	Inventive	0.854 (Fixed)
InvNvS2	Novel	0.898 (16.35)
InvNvS3	Creative	0.877 (15.83)
Innovation novelty (product) (CR = 0.925, CA = 0.934 and AVE = 0.805)		
InvNvP2	On average, each year we introduce more new humanitarian services/products in our target markets than other humanitarian organizations	0.879 (Fixed)
InvNvP3	Humanitarian experts would say that we are more prolific when it comes to introducing new humanitarian services/products in our target markets	0.877 (17.40)
InvNvP4	On average, each year we introduce more new humanitarian services/products in our target markets than other humanitarian organizations	0.934 (19.50)
Innovation novelty (process) (CR = 0.910, CA = 0.936 and AVE = 0.771)		
The processes we use (e.g. technical, administrative, production and channels of distribution) in our humanitarian operations are. . .		
InvNvPR1	Revolutionary	0.868 (Fixed)
InvNvPR2	Inventive	0.884 (16.53)
InvNvPR3	Novel	0.882 (16.47)

(***continued***)

Table 3

Items	Description	Loading (t-values)
Efficiency performance (CR = 0.897, CA = 0.895 and AVE = 0.686)		
Efi_prf1	Efficiency in the use of resources	0.744 (Fixed)
Efi_prf2	Cost of running day-to-day operations	0.821 (11.65)
Efi_prf3	Overhead costs	0.882 (12.51)
Efi_prf4	Reducing the volume of idle resources	0.859 (12.21)
Disaster responsiveness (CR = 0.951, CA = 0.950 and AVE = 0.829)		
Resp1	Flexibility in responding to disasters/crises	0.851 (Fixed)
Resp2	Speed in responding to disasters/crises	0.925 (18.54)
Resp3	Adaptiveness in responding to disasters/crises	0.924 (18.51)
Resp4	Consistency in on-time response to disasters/crises	0.940 (19.15)

Note(s): Model fit indices: $\chi 2 = 831.62$, df = 734, $\chi 2/df = 1.133$, $p = 0.007$, RMSEA = 0.026, NNFI = 0.972, CFI = 0.975, SRMR = 0.038; CR = composite reliability, CA = Cronbach's alpha, AVE = average variance extracted
Source(s): Authors' own work

3.4 Nonresponse bias, respondent competence and common method bias

Nonresponse is a common issue in social survey research and can significantly threaten the validity and generalizability of study findings (Bryman, 2012; McDaniel and Gates, 2018). We examined the potential for nonresponse bias in this study by comparing early responses (received within 6 months of administration) and late responses (received after 6 months of administration). An independent sample t-test revealed no statistically significant difference between early and late respondents on two organizational characteristics – size and age. The study, therefore, concluded that nonresponse bias is not a major concern in the study (Armstrong and Overton, 1977).

Following prior research (Boso *et al.*, 2013), the study evaluated the respondents' competence level using five criteria: (1) knowledge of the issues that the questionnaire captures, (2) interest in the issues that the questionnaire captures, (3) confidence about responses provided, (4) understanding of items captured in the questionnaire, and (5) accuracy of the responses provided; using a seven-point scale that ranged from" strongly disagree (=1)" to "strongly agree (=7)". The results show that an average respondent was competent enough, given that the mean scores on the criteria were all significantly above the middle-point of the scale (that is, 4.00). This finding – coupled with the adequate working experience of the respondents – is a good indication that the data (and the source) could be relied on for the study.

Common method bias (CMB) is a recognized concern in single-respondent surveys (Podsakoff *et al.*, 2003). To mitigate CMB in this study, we used several procedural strategies. First, respondents were assured of the confidentiality of their responses. They were explicitly instructed to base their answers on actual operational conditions rather than aspirational or desired outcomes, reducing the risk of socially desirable responses. Second, we applied temporal and psychological separation by collecting predictor and criterion variables at different points within the survey. We also included additional, unrelated variables to prevent respondents from discerning the study's focus. Finally, we incorporated diverse response formats and scale types to limit potential response biases.

Further, we relied on some recommended approaches, as implemented by Boso *et al.* (2013), to empirically test for CMB. Two competing models – method model (Model 1) and trait model (Model 2) – were analyzed. In Model 1, all items in the study were specified to load on a single latent factor. The results indicated a poor fit to data, given $\chi 2 = 15{,}312.45$, df = 1,484, $\chi 2/df = 10.318$, $p = 0.000$, RMSEA = 0.215, NNFI = 0.253, CFI = 0.280, SRMR = 181. In Model 2, all items in the study were specified to load onto their respective theoretical construct. The results obtained showed a satisfactory fit were $\chi 2 = 23{,}74.33$, df = 1,439, $\chi 2/df = 1.650$, RMSEA = 0.057, NNFI = 0.896, CFI = 0.903, SRMR = 0.053. These results show that the study's proposed measurement model (Model 1) was significantly better than the method model. Per this finding, it was concluded that CMB did not adequately describe the data and, thus, was not much of a concern in the study.

4. Data analysis and results

4.1 Measurement model analysis

We used Confirmatory factor analysis (CFA) to examine constructs' unidimensionality and assess the overall measurement model fit. The CFA model, estimated using LISREL 8.5, comprised ten latent variables, and each item was linked to its related latent variable. The results show that the full measurement CFA provided a good fit data, given $\chi 2 = 831.62$, df = 734, $\chi 2/df = 1.133$, $p = 0.007$, RMSEA = 0.026, NNFI = 0.972, CFI = 0.975 and SRMR = 0.038, and that the hypothesized model is valid. The results, as shown in Table 3, show that factor loadings are above the recommended threshold of 0.7 and are significant at $t \geq 2.65$.

The reliability of the study's scales was tested using Cronbach's alpha (CA) and composite reliability (CR). The average variance extracted (AVE) was also examined to determine the convergent validity of the measurement scales. The results showed that all constructs had CA values above 0.7, indicating good internal consistency (Field, 2009). The CR

and the AVE values exceeded the minimum thresholds of 0.60 and 0.50 (Hair *et al.*, 2014). These results demonstrate the unidimensionality and convergence validity of the study's scales (Hair *et al.*, 2014; Bagozzi & Yi, 2012). The CFA results are presented in Table 3.

Hair *et al.* (2014) suggest a more stringent way to determine discriminant validity by comparing the AVE values with the shared variance between the scales. Higher shared variance (relative to AVE values) indicates that the scales demonstrate poor discriminant validity (Hair *et al.*, 2014). In this study, the highest shared variance (R^2) was 0.211 (see Table 4, $r = 0.459$). Comparing this to the lowest AVE value of 0.602, the study's scales demonstrate excellent discriminant validity. Table 4 presents the correlation matrix and shared variances.

4.2 Results

The study estimated three hierarchical models: control effects, main effects and interaction effects. The main effects model tested hypothesis one (*H1*), while the interaction effects model tested hypotheses two through four (*H2, H3, H4*). The interaction effect model was further decomposed to assess the influence of each hypothesized interaction, with each interaction path examined individually. Due to the complexity of the structural models concerning the sample size, a Multiple Indicators and Multiple Causes approach was used. This method regresses latent endogenous variables on single indicant exogenous variables. Full measurement information was retained for the endogenous variables (efficiency performance and disaster responsiveness), and the exogenous variables were represented by single indicants, supported by the reliability and validity of their measurement constructs (Hair *et al.*, 2014). The results are presented in Table 5.

Model one estimated the effects of the control variables on efficiency performance and disaster responsiveness. The results show that internal communication does not affect efficiency performance or disaster responsiveness at a 5% significance level (two-tailed test). Employee training was found to significantly affect disaster responsiveness (positive) but was found not to affect efficiency performance. Technology use significantly affected disaster responsiveness (positive) but did not affect efficiency performance. Resource deployment significantly affected efficiency performance (positive) but did not affect disaster responsiveness. Organization size and age did not have an effect on either efficiency performance or disaster responsiveness.

Model two estimates the main effect paths. The results show that at the 5% significance level (one-tailed test), innovation novelty has a significant (positive) effect on efficiency performance ($\beta = 0.15$, t = 1.84) but no effect on disaster responsiveness ($\beta = 0.11$, t = 1.40). This finding partly supports *H1*, which posited that innovation novelty will positively affect operational performance.

Model three shows that the quadratic term of organizational innovation novelty is positively related to efficiency performance ($\beta = 0.16$ and t = 2.25). The interaction plot presented in Figure 2 shows that organizational innovation novelty has a J-shaped relationship with efficiency performance, meaning that increases in organizational innovation novelty is associated with low-efficiency performance at low levels of novelty. However, as levels of organizational innovation novelty increase from moderate to high levels, efficiency performance increases accordingly. Furthermore, the study finds that organizational innovation novelty is not associated with disaster responsiveness. Thus, *H2* is rejected in favor of *H1* in terms of efficiency performance outcomes.

The study argues in *H3* that increases in the novelty of organizational innovation, and high innovation intensity would be associated with increased operational performance. Evidence from the study shows that high levels of novelty and increases in intensity of innovation are associated with higher levels of efficiency performance (Figure 3). However, disaster responsiveness increases at high levels of novelty and low-to-moderate levels of innovation intensity (Figure 4). Thus, there seems to be a contradicting operational performance outcome for innovation novelty and intensity when efficiency and responsiveness (effectiveness) outcomes are considered. Accordingly, the study finds support for *H3* as far as efficiency performance outcome is concerned.

The study contends in *H4* that operational performance would increase as organizational innovation novelty levels

Table 4 Correlation matrix and descriptive statistics

Variables		1	2	3	4	5	6	7	8	9	10	11
1	Efficiency performance	1										
2	Disaster responsiveness	0.212**	1									
3	Innovation novelty	0.172*	0.254**	1								
4	Innovation intensity	0.039	0.300**	0.475**	1							
5	Internal communication	−0.021	0.054	−0.143*	−0.067	1						
6	External communication	0.265**	0.126	0.033	−0.025	0.459**	1					
7	Employee training	0.147*	0.356**	0.196**	0.200**	−0.070	0.117	1				
8	Resource deployment	0.225**	0.133	0.150*	0.031	0.043	0.209**	0.379**	1			
9	Use of technology	0.079	0.180*	0.154*	0.184**	−0.041	0.030	0.172*	−0.075	1		
10	Organizational size (natural log)	0.088	−0.091	−0.056	−0.053	−0.035	0.000	−0.017	0.088	−0.016	1	
11	Organizational age (natural log)	0.047	−0.054	−0.074	−0.054	−0.069	−0.047	0.016	−0.034	−0.048	0.357**	1
	Mean	*5.25*	*4.14*	*4.17*	*3.62*	*5.14*	*5.05*	*4.33*	*4.88*	*3.92*	*3.66*	*3.56*
	Standard deviation	*1.268*	*1.72*	*1.33*	*1.377*	*1.411*	*1.165*	*1.407*	*1.23*	*1.85*	*0.69*	*0.76*

Note(s): *$p < 0.05$ (two-tailed) and **$p < 0.01$ (two-tailed)
Source(s): Authors' own work

Table 5 Hypothesis test results

	Standardized estimates (t-values)							
	Model 1		Model 2		Model 3		Model 4	
Independent variables	**E-perf**	**DR**	**E-perf**	**DR**	**E-perf**	**DR**	**E-perf**	**DR**
Control paths								
Internal communication	−0.03 (−0.36)	0.08 (1.22)	−0.14 (−1.80)	0.08 (1.08)	−0.15 (−1.92)	0.08 (1.11)	−0.15 (−1.93)	0.08 (1.09)
Employee training	0.06 (0.77)	0.34 (4.50)	0.03 (0.36)	0.29 (3.93)	0.03 (0.38)	0.29 (3.93)	0.03 (0.40)	0.30 (4.05)
Technology use	0.09 (1.18)	0.14 (1.98)	0.06 (0.84)	0.09 (1.38)	0.07 (0.93)	0.09 (1.35)	0.07 (0.95)	0.10 (1.48)
Resource deployment	0.21 (2.65)	0.02 (0.33)	0.15 (1.88)	0.01 (0.08)	0.15 (1.98)	0.00 (0.06)	0.15 (1.91)	−0.01 (−0.17)
Firm size	0.06 (0.82)	−0.06 (−0.89)	0.07 (0.92)	−0.05 (−0.77)	0.07 (0.92)	−0.05 (−0.77)	0.07 (0.90)	−0.06 (0.87)
Firm age	0.06 (0.67)	−0.03 (−0.39)	0.06 (0.82)	−0.01 (−0.30)	0.04 (0.49)	−0.01 (−0.11)	0.04 (0.49)	−0.01 (−0.14)
Main effects								
Innovation novelty (IN)			0.15 (1.84)	0.11 (1.40)	0.14 (1.79)	0.11 (1.43)	0.14 (1.80)	0.11 (1.44)
Innovation intensity (II)			−0.04 (−0.48)	0.18 (2.39)	−0.04 (−0.47)	0.18 (2.39)	−0.04 (−0.48)	0.17 (2.34)
External communication (EC)			0.30 (3.62)	0.05 (0.74)	0.29 (3.56)	0.06 (0.77)	0.29 (3.57)	0.06 (0.79)
Interaction effect paths								
IN^2					0.16 (2.25)	−0.04 (−0.63)	0.15 (1.90)	−0.08 (−1.16)
IN × II							0.02 (0.30)	0.11 (1.54)
IN^2 × II								
IN × EC								
IN^2 × EC								
Fit indices:								
χ^2/DF	1.660		1.510		1.500		1.490	
RMSEA	0.057		0.050		0.050		0.049	
NNFI	0.891		0.921		0.924		0.923	
CFI	0.946		0.961		0.963		0.963	
SRMR	0.072		0.055		0.053		0.051	
R^2	7.6%	16.0%	16.0%	22%	19.0%	22%	19.0%	23%
ΔR^2	—	—	8.4%	6.0%	3.0%	0.0%	0.0%	1.0%

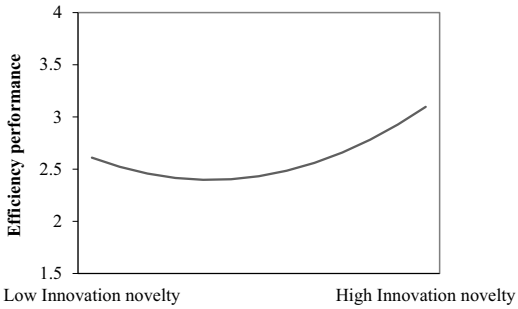
Note(s): 1. Critical *t*-values for hypothesized paths ≥ 1.645 (5%, one-tailed tests); 2. Critical value for nonhypothesized paths ≥ 1.96 (5%, two-tailed tests)
Source(s): Authors' own work

(*continued*)

Table 5 (*Continued*)

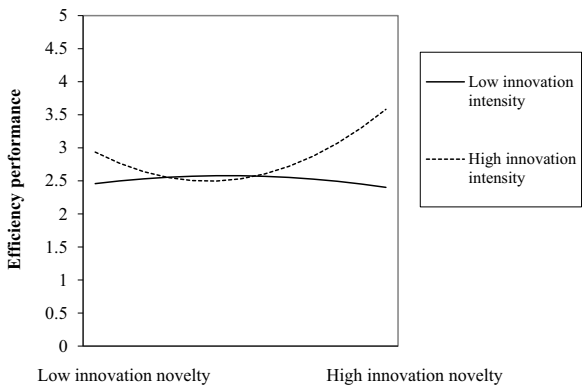
	Standardized estimates (t-values)					
	Model 5		Model 6		Model 7	
Independent variables	E-perf	DR	E-perf	DR	E-perf	DR
Control paths						
Internal communication	−0.16 (−2.10)	0.09 (1.26)	−0.17 (−2.19)	0.08 (1.04)	−0.18 (−2.30)	0.10 (1.43)
Employee training	0.04 (0.47)	0.29 (4.05)	0.03 (0.44)	0.29 (4.02)	0.04 (0.49)	0.28 (2.97)
Technology use	0.07 (1.07)	0.09 (1.40)	0.08 (1.08)	0.09 (1.42)	0.07 (0.97)	0.12 (1.81)
Resource deployment	0.14 (1.82)	−0.00 (−0.06)	0.14 (1.85)	−0.00 (−0.02)	0.14 (1.85)	0.00 (0.01)
Firm size	0.09 (1.26)	−0.08 (−1.24)	0.09 (1.23)	−0.09 (−1.27)	0.09 (1.20)	−0.08 (−1.19)
Firm age	0.02 (0.24)	0.01 (0.10)	0.02 (0.21)	0.00 (0.05)	0.01 (1.09)	0.03 (0.40)
Main effects						
Innovation novelty (IN)	0.09 (1.16)	0.15 (2.01)	0.09 (1.13)	0.15 (1.98)	0.09 (1.13)	0.15 (2.02)
Innovation intensity (II)	−0.02 (−0.22)	0.15 (2.10)	−0.03 (−0.20)	0.15 (2.12)	−0.02 (−0.23)	0.16 (2.25)
External communication (EC)	0.30 (3.75)	0.05 (0.65)	0.30 (3.80)	0.05 (0.73)	0.31 (3.85)	0.04 (0.61)
Interaction effect paths						
IN^2	0.11 (1.48)	−0.05 (−0.66)	0.11 (1.51)	−0.04 (−0.62)	0.12 (1.56)	−0.05 (−0.77)
IN × II	0.09 (1.16)	0.04 (0.60)	0.09 (1.19)	0.05 (0.65)	0.09 (1.09)	0.07 (0.98)
IN^2 × II	**0.18 (2.44)**	**−0.17 (−2.42)**	**0.18 (2.44)**	**−0.17 (−2.43)**	**0.17 (2.19)**	**−0.12 (−1.78)**
IN × EC			0.05 (0.67)	0.06 (0.91)	0.02 (0.29)	0.13 (1.95)
IN^2 × EC					−0.08 (−1.03)	**0.22 (3.20)**
Fit indices:						
χ^2/DF	1.430		1.450		1.370	
RMSEA	0.046		0.047		0.043	
NNFI	0.934		0.931		0.942	
CFI	0.969		0.969		0.974	
SRMR	0.047		0.047		0.043	
R^2	21.0%	26%	22.0%	26%	22.0%	30%
ΔR^2	2.0%	3.0%	1.0%	0.0%	0.0%	4.0%

Figure 2 Quadratic effect of innovation novelty on efficiency performance



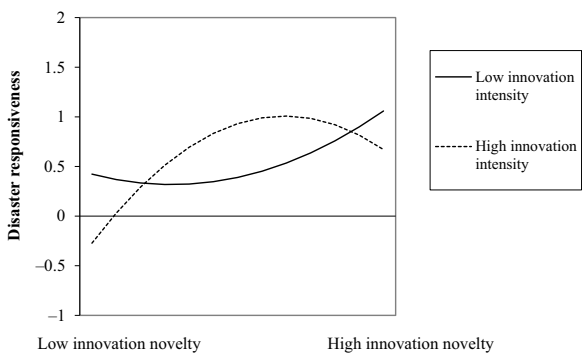
Source(s): Authors' own work

Figure 3 Quadratic effect of innovation novelty on efficiency performance moderated by innovation intensity



Source(s): Authors' own work

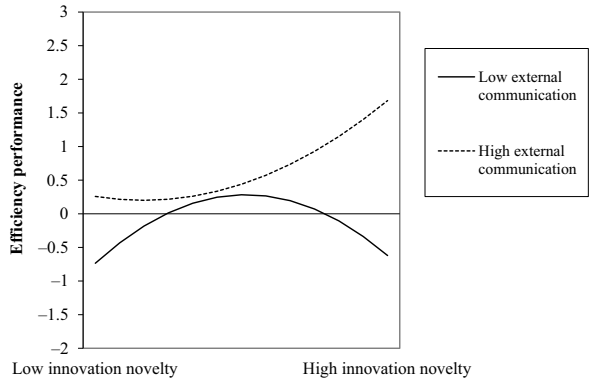
Figure 4 Quadratic effect of innovation novelty on efficiency performance moderated by innovation intensity



Source(s): Authors' own work

increase and external communication efforts take on higher values above its mean level. The study finds that increases in organizational innovation novelty and higher levels of external communication efforts are associated with increased efficiency performance (Figure 5). Thus, *H4* is supported based on the

Figure 5 Quadratic effect of innovation novelty on efficiency performance moderated by external communication



Source(s): Authors' own work

significant effect of the novelty and external communication interaction on efficiency performance outcome.

5. Discussion & theoretical implications

5.1 Discussion

The findings offer critical insights into the relationship between innovation novelty and operational performance within humanitarian organizations. At a 5% significance level, innovation novelty is positively related to efficiency performance but not significantly related to disaster responsiveness, thus partially supporting *H1*. This confirms that innovation enhances organizational efficiencies (Jiménez-Jiménez and Sanz-Valle, 2011). The absence of a significant effect on disaster responsiveness may reflect the complexity and unpredictability of disaster environments where standardized efficiency measures are less applicable (Kovács and Spens, 2007). Efficiency gains might stem from process innovations, but disaster responsiveness likely demands flexibility and real-time adaptability, which may not be directly enhanced by novel but rigid innovation strategies (Medford-Davis and Kapur, 2014).

The results also indicate partial support for *H2*, as we observe a curvilinear relationship between innovation novelty and efficiency performance. This reveals a nuanced insight into the relationship, particularly in the context of HROs. Innovation tends to enhance operational performance at lower levels of novelty, as organizations can implement improvements without overwhelming their systems (OECD/Eurostat, 2018). However, at higher degrees of novelty, efficiency performance decreases (Piening and Salge, 2015) The significant resource investments needed to support such innovations can lead to resource depletion, particularly in humanitarian organizations with limited financial and operational capacities (Rosenbusch *et al.*, 2011). Core operational functions may temporarily suffer because resources are diverted toward supporting highly novel innovations. This underscores the need for organizations to carefully balance adopting novel innovations and maintaining operational stability, highlighting the importance of strategic decision-making in managing innovation.

The partial support for *H3*, which examines the interaction between innovation novelty and innovation intensity, demonstrates a trade-off between efficiency performance and disaster responsiveness. High innovation novelty and increased intensity enhance efficiency performance, but they diminish disaster responsiveness. This aligns with DCT, which highlights the importance of an organization's ability to reconfigure resources to respond to changing conditions (Teece *et al.*, 1997). In disaster response, where conditions are rapidly evolving, excessive intensity may reduce the organization's ability to adapt quickly, as resources are often tied up in ongoing innovation efforts rather than immediate response mechanisms (Kovács and Spens, 2009). As demonstrated in humanitarian interventions such as those by the International Federation of Red Cross and Red Crescent Societies, an excessive focus on innovation processes sometimes delays immediate responses to disasters, as novel systems may not yet be thoroughly tested or integrated (IFRC, 2017).

The partial support for *H4*, where external communication positively influences efficiency performance but not disaster responsiveness, presents a fascinating contradiction. While effective external communication improves operational efficiency by facilitating the exchange of critical information between stakeholders, its lack of significant impact on disaster responsiveness could stem from the complex and decentralized nature of disaster environments. Past studies have shown that external communication often breaks down in disaster contexts due to logistical and infrastructural challenges, leading to delays in response coordination (Chari and Novukela, 2023). This might explain why organizations, despite having solid communication channels, fail to significantly improve their disaster response performance. In practical terms, humanitarian organizations such as Médecins Sans Frontières have noted the challenge of aligning innovative communication strategies with real-time disaster responses due to fluctuating external conditions (MSF, 2019).

5.2 Theoretical implications

The findings of this study contribute to the ongoing discourse on organizational innovation by offering new perspectives, particularly through the lenses of the RBV and DCT. The partial support for *H1* and *H2* enriches the RBV by illustrating that innovation novelty, while a valuable resource, has limits in terms of operational effectiveness. Specifically, the curvilinear relationship observed between innovation novelty and efficiency performance highlights that excessive novelty can strain an organization's resources, leading to diminishing returns (Rosenbusch *et al.*, 2011;Kobarg *et al.*, 2019). Innovation must be carefully managed in resource-constrained environments like humanitarian organizations to avoid overextension (Trejo-Rangel *et al.*, 2023), which could otherwise compromise operational stability. This contrasts with more resource-abundant environments where organizations can absorb the higher costs associated with radical innovations (Barney, 1991).

The curvilinear relationship also suggests a more nuanced view of innovation's role within the RBV framework, where not all innovations contribute to competitive advantage beyond a certain threshold (Teece, 2007). In humanitarian organizations, where resource scarcity is a constant constraint, the findings suggest that moderate levels of innovation are optimal. This insight is crucial for advancing the RBV, as it underscores the need to consider the context in which organizational resources (such as innovation) are deployed. Unlike traditional for-profit organizations, humanitarian organizations often operate with tight budgetary and human resource constraints, making it essential to manage innovation intensity strategically (Tabaklar *et al.*, 2021).

Moreover, the partial support for *H3*, which examined the interaction between innovation novelty and innovation intensity, expands DCT by demonstrating the trade-offs inherent in resource reconfiguration efforts. The positive relationship between innovation intensity and efficiency performance supports the view that an organization's dynamic capabilities enable it to continuously adapt and improve operational performance by refining its processes and services (Teece *et al.*, 1997). However, the negative effect on disaster responsiveness reveals that dynamic capabilities must be deployed selectively. In humanitarian contexts, where real-time responsiveness is crucial, overinvestment in high-intensity innovation efforts may reduce the organization's flexibility to respond to immediate needs (Kovács and Spens, 2009). This finding challenges the assumption that dynamic capabilities are universally beneficial and suggests that their effectiveness depends on the specific performance outcome.

The role of external communication as a moderator also offers significant theoretical contributions. The positive effect of external communication on efficiency performance supports the RBV, as communication acts as an organizational resource that enhances information flow and coordination among stakeholders (Barney, 1991). This finding is consistent with previous studies that highlight the importance of communication in driving organizational performance (Bruder and Baar, 2024). However, the lack of impact on disaster responsiveness may reflect the complexity of disaster environments, where external communication systems often break down due to logistical or infrastructural barriers (Manoj and Baker, 2007). This suggests that while external communication is a valuable resource, its utility in disaster contexts may be limited unless coupled with robust on-the-ground response mechanisms (Medford-Davis and Kapur, 2014).

This study advances our understanding of the limits and trade-offs inherent in innovation efforts within resource-constrained organizations. By exploring the curvilinear effects of innovation novelty, the moderating roles of innovation intensity and external communication and their differential impacts on operational performance outcomes, the study extends the RBV and DCT in essential ways.

6. Practical implications

The findings of this study have important practical implications for managers of HROs.

First, while innovation novelty can improve efficiency, HROs must be cautious about how they introduce and scale innovative initiatives. The curvilinear relationship between innovation novelty and efficiency performance suggests that incremental, phased approaches to innovation are more

effective than radical overhauls in resource-constrained environments. For example, rather than completely redesigning supply chains to incorporate advanced technologies, HROs could begin by piloting smaller-scale innovations, such as using drones for last-mile delivery in remote disaster areas. Organizations can assess their effectiveness and scalability by testing such innovations on a smaller scale before committing to more extensive resources. This staged approach ensures that new initiatives do not overwhelm existing operations or stretch limited resources.

In addition, the interaction between innovation novelty and intensity highlights the importance of balance. While high-intensity innovations may drive efficiency in stable periods, they can reduce flexibility during disaster response. For instance, after Typhoon Haiyan in the Philippines, some organizations initially introduced high-tech logistical systems to manage aid distribution. However, while efficient, these systems were not flexible enough to adapt quickly to the unpredictable conditions in the storm's aftermath, slowing down response times (IFRC, 2017). Based on these insights, managers should maintain low-to-moderate innovation intensity in disaster response scenarios, allowing for greater adaptability and quicker decision-making on the ground. This could mean adopting simpler, rapidly deployable solutions – such as temporary communication hubs or mobile health clinics – that can be scaled up or down depending on the evolving nature of the crisis.

The findings also emphasize the significance of external communication in enhancing efficiency performance but not disaster responsiveness. HROs should develop robust, multitiered communication strategies to benefit fully from external communication. For example, during the Ebola outbreak in West Africa, organizations that implemented layered communication approaches– linking local communities, aid workers and international stakeholders – were more effective at coordinating resource distribution and public health responses (WHO, 2015). By creating local partnerships and networks to support communication, these organizations ensured that innovations such as contact tracing and public health campaigns were rapidly adopted at the grassroots level, improving the overall operation's efficiency. However, traditional external communication networks are often disrupted in fast-moving disaster situations, such as earthquakes or floods. In these cases, localized, on-the-ground communication systems are critical.

The study also underscores the need for strategic resource allocation when managing innovations in disaster environments. Over-committing resources to high-intensity innovation projects can divert funds and personnel from immediate response efforts. For instance, during the early stages of a crisis, HROs could prioritize low-cost, high-impact innovations such as cash transfer programs for affected populations, which have proven effective in rapidly delivering aid without complex infrastructure requirements. Such programs were successfully implemented in the aftermath of the 2005 Pakistan earthquake, where direct cash transfers allowed displaced families to purchase their immediate needs, thereby reducing the pressure on aid supply chains (Bailey and Harvey, 2015). This approach, which balances innovation and immediate relief, ensures the organization remains responsive while embracing innovative methods and should instill confidence in the decision-making process during crises.

Finally, HROs should consider building innovation portfolios that balance radical innovations aimed at future improvements with smaller, incremental innovations that can be adapted as circumstances evolve. For instance, organizations could invest in cutting-edge technologies like AI-driven supply chain management systems while developing and refining community-based early warning systems for natural disasters. By diversifying their innovation investments, HROs can remain agile and responsive in both stable and crisis periods.

7. Conclusion, limitations and direction for further studies

This study provides important insights into the relationship between innovation and operational performance in HROs. The findings reveal that while innovation novelty positively influences efficiency performance, its benefits may taper off at higher levels. Furthermore, the interaction between innovation novelty and innovation intensity demonstrates that although high-intensity innovations can enhance operational efficiency, they can simultaneously reduce disaster responsiveness. This suggests that HROs must carefully balance innovation efforts, recognizing that different operational contexts – such as routine operations versus disaster response – require different innovation strategies. The study also highlights the significant role of external communication in driving efficiency performance. However, its impact on disaster responsiveness was unclear, indicating a need for further refinement of communication strategies in high-pressure environments.

While offering valuable insights into the relationship between innovation and operational performance in HROs, this study has several limitations. First, using a single-respondent survey for data collection raises concerns regarding CMB and response subjectivity (Montabon *et al.*, 2018). Future research should consider using multiple respondents from different functional areas within each organization to capture a more comprehensive and nuanced understanding of how innovation impacts performance across various organizational levels. Second, the study's focus on HROs operating solely in Ghana limits the generalizability of the findings. While Ghana presents a unique context regarding its disaster management challenges and resource constraints, the results may not fully capture the complexities of HRO operations in other regions, particularly in areas with different sociopolitical environments, resource availability and disaster profiles. Future studies should extend this research to include HROs from diverse geographical settings. Such cross-regional comparisons could provide a more comprehensive understanding of the global application of innovation in HROs. The cross-sectional nature of this study is another limitation. Cross-sectional data captures a snapshot in time, making it difficult to account for how innovation and performance evolve in response to changing environmental conditions or organizational dynamics. Future research should consider using longitudinal designs to examine how the relationship between innovation and performance in HROs develops over time. Moreover, using experimental or quasi-experimental designs could offer more robust causal inferences

by controlling for confounding variables that may influence both innovation intensity and operational outcomes.

Beyond addressing these methodological limitations, future research should also explore new areas of inquiry to broaden our understanding of innovations in HROs. For example, researchers could examine the role of digital transformation technologies such as artificial intelligence, blockchain and the Internet of Things in enhancing disaster responsiveness and efficiency performance. In addition, studies could investigate the impact of interorganizational collaboration and public–private partnerships on innovation outcomes, particularly in regions where humanitarian operations intersect with government and private sector initiatives. By expanding the scope of inquiry, future research can contribute to a more holistic understanding of how innovation can be leveraged to improve humanitarian outcomes across various contexts and challenges.

8. Executive summary for practitioner audience

This research examines the impact of innovative novelty – characterized by the distinctiveness and originality of processes or products – on the operational effectiveness of HROs, particularly those with resource constraints and dynamic, complicated contexts. The study adopts RBV and DCT to examine data from 203 HROs in Ghana, determining how innovation intensity and external communication influence the relationship between innovation novelty and performance outcomes.

The key findings include:

1 The Dual Impact of Innovation Novelty on Performance:
   - Efficiency Performance: The research establishes that moderate levels of innovation novelty improve operational efficiency by optimizing resource utilization and cost-effectiveness. This favorable link, however, diminishes at very high levels of innovation, when implementation problems and resource constraints may surpass the advantages.
   - Disaster Responsiveness: Contrary to predictions, the novelty of innovation does not substantially improve disaster responsiveness. Although fresh technologies may enhance operations in stable environments, they do not inherently augment the flexibility and rapidity essential for successful catastrophe response.

2 Moderating Roles of Innovation Intensity and External Communication: a.
   - Innovation Intensity: Regular and substantial innovation endeavors enhance the beneficial impacts of innovation novelty on efficiency. However, intensive innovation initiatives might impair catastrophe reactivity, since resources may be excessively allocated to innovation refinement, compromising flexibility in crisis situations.
   - External Communication: Elevated degrees of external communication enhance the beneficial impact of innovation novelty on efficiency performance. Collaboration with external stakeholders offers essential information and resources, facilitating efficient innovation execution. Nonetheless, this benefit does not extend to catastrophe response, where communication lines often experience failures under duress, limiting real-time flexibility.

Outlined below are the ramifications for theory and practice.

1 Theoretical Contributions: The research expands the RBV and DCT frameworks by demonstrating that in resource-limited settings, such as HROs, there exists an optimum degree of innovative novelty. Excessive innovation beyond this threshold yields declining rewards, particularly when resources are constrained. The results indicate that an organization's dynamic capabilities have to be strategically used, emphasizing low-to-moderate levels of innovation intensity that harmonize efficiency with catastrophe preparedness.
2 Practical Recommendations for High-Reliability Organization Managers:
   - Balanced Innovation Approaches: HROs should use modest, phased innovation strategies rather than drastic transformations to prevent resource overload. Assessing small-scale innovations, such as drone delivery for remote regions, facilitates the evaluation of efficacy and scalability.
   - Selective Innovation Intensity: High-intensity innovation initiatives enhance operational efficiency but may impede response in times of crisis. Managers need to prioritize flexible, quickly implementable solutions that do not consume substantial resources, such as mobile communication centers or provisional healthcare facilities.
   - Strategic External Communication: To optimize the advantages of external communication, HROs have to design multilayered plans that link local communities, field teams and worldwide stakeholders. Strong local collaborations facilitate the effective execution of innovations at the grassroots level, ensuring that resources are concentrated on immediate reaction requirements.

In conclusion, the study underscores the need of reconciling innovation with operational stability. For HROs, while innovation improves efficiency in standard operations, it requires meticulous management to maintain responsiveness during crises. The insights offered assist HROs in strategically incorporating innovation, enhancing adaptive ability without overextending resources, therefore optimizing their performance in both stable and crisis situations.

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