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Cluster-Led Coordination Challenges for Humanitarian Logistics in Human-Made Disasters: Can Decision-Support Tools Assist?

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ABSTRACT

The cluster-led coordination approach supports humanitarian aid distribution by centralising coordination, addressing operational gaps, and fostering collaboration among humanitarian actors. This study examines the challenges of implementing this approach during armed conflicts and explores humanitarian actors' intention to use a decision-support tool (DST) for aid distribution planning within the cluster-led coordination framework. A qualitative approach was adopted, using semi-structured interviews with humanitarian cluster coordinators and focal points in the Palestinian territories and Syria. The findings identify key barriers to effective cluster-led coordination and examine how these challenges shape the perceived usefulness and behavioural intention to use the DST within this approach. The study provides insights into strengthening humanitarian logistics coordination and integrating decision-support technologies into cluster-led humanitarian operations in conflict-affected settings.

Keywords: *cluster-led coordination, humanitarian aid distribution, challenges, armed conflict disaster, decision-support tool (DST), technology acceptance model.*

1. INTRODUCTION

Humanitarian aid distribution planning lies at the heart of humanitarian logistics (Yılmaz & Kabak, 2024). However, in emergencies involving armed conflicts, this process becomes significantly more complex due to security risks, access constraints, and rapidly changing operational environments (Rezeq *et al.,* 2023; Safadi *et al.,* 2026). In such settings, coordination is particularly challenging because multiple parties often control different geographical areas (UNHR, 2011; International Committee of the Red Cross, 2016). Although humanitarian organisations strive to deliver assistance effectively, inadequate coordination frequently results in duplicated efforts, delays, and inefficient use of scarce resources, ultimately reducing the impact of relief operations (Eftekhar *et al.,* 2017; Wankmüller & Reiner, 2020). One widely adopted mechanism for improving humanitarian coordination is the "cluster-led approach", which structures inter-organisational collaboration by grouping humanitarian actors into specialised sectors under designated leadership (Balcik *et al.,* 2010; Grange *et al.,* 2020; Jahre & Jensen, 2010). Institutionalised by the United Nations, it facilitates information sharing and resource pooling while bringing together governments, local authorities, affected communities, civil society, and humanitarian organisations under Humanitarian Coordinator leadership (Ruesch *et al.,* 2022; UNHCR, 2023). Despite these intended benefits, previous disasters have revealed persistent coordination gaps that can limit the efficiency of relief operations across different disaster phases (Ruesch *et al.,* 2022; Schwarz *et al.,* 2023).

In the Middle East, particularly the Palestinian territories and Syria, the cluster-led coordination approach has been adopted to organise humanitarian response efforts (UNHCR, 2023). However, its implementation faces significant operational challenges in both contexts. In the Palestinian territories, movement restrictions, including roadblocks and military checkpoints, constrain humanitarian access to affected communities. Aid movements often require coordination with relevant authorities and are subject to stringent restrictions, particularly during intensified conflict (OCHA, 2023; USAID, 2023). In Syria, humanitarian coordination is constrained by insecurity, fragmented territorial control, and restrictions between areas controlled by different factions, which further complicate access and relief operations (Logistics Cluster, 2021; OCHA, 2023). Against this backdrop, the present study examines the perspectives of humanitarian cluster coordinators and focal points in the Palestinian territories and Syria to identify key barriers to effective cluster-led coordination and provide practical insights for strengthening aid distribution in complex conflict settings.

Although qualitative research on humanitarian coordination remains limited, the topic has become increasingly important within humanitarian logistics (Jahre & Jensen, 2021). Existing studies call for a greater understanding of how coordination barriers undermine relief operations (Dubey, 2022), particularly with respect to inter-organisational data sharing, trust among humanitarian partners (De Boeck *et al.,* 2023), and the structural causes of coordination failures, including information disruption and coordination imbalance (Xu *et al.,* 2023). Previous research has also highlighted the need to examine leadership and group dynamics in humanitarian operations, where organisations must coordinate under resource constraints and high-pressure conditions (Altay & Pal, 2014; Shayganmehr *et al.,* 2024).

On the other hand, decision support tools are increasingly used in humanitarian supply chains, yet their practical applicability remains a concern (Heaslip *et al.,* 2018). Further research should examine their intended use from the perspectives of local humanitarian organisations and implementing partners, whose experiences remain underrepresented (Altay *et al.,* 2024). Understanding how these tools shape supply-chain decisions is essential for improving humanitarian effectiveness and efficiency. Involving humanitarian decision-makers throughout tool development and implementation can also enhance usability, contextual fit, and responsiveness to affected communities (Kunz *et al.,* 2017; Rojas Trejos *et al.,* 2023; Rodríguez-Espíndola *et al.,* 2023; Altay *et al.,* 2024). This study bridges the gap in humanitarian logistics literature by integrating two research streams that have largely developed independently: cluster-led coordination and decision-support technologies. Rather than examining coordination challenges and technology adoption separately, it investigates how operational barriers affect humanitarian practitioners' perceptions of the usefulness of, and behavioural intention to use, a previously developed decision-support tool (DST) for relief distribution (Rezeq *et al.,* 2024). This integration provides a more comprehensive understanding of how DSTs can support coordination in complex humanitarian settings.

Accordingly, this study aims to address three issues: (1) identifying operational barriers to cluster-led coordination for aid distribution in armed-conflict settings; (2) examining humanitarian coordinators' perceived usefulness of and behavioural intention to use a DST for relief distribution planning; and (3) linking these dimensions to assess whether DSTs are perceived as viable mechanisms for addressing coordination challenges. To address these objectives and the identified research gaps, the study adopts an exploratory approach guided by the following research questions:

(1) **RQ1.** What obstacles can impede the implementation of cluster-led coordination for aid distribution in times of armed-conflict disasters?

(2) **RQ2.** How do humanitarian cluster coordinators perceive the usefulness of, and behavioural intention to use, a decision-support tool (DST) for aid distribution within a cluster-led coordination approach during armed conflicts?

To address the research questions, we conducted a qualitative exploratory study using practice-driven, open-ended questions rather than theory-derived hypotheses. Semi-structured interviews were conducted in July 2024 with humanitarian cluster coordinators and focal points in the Palestinian territories and Syria. Thematic analysis examined coordination challenges under armed-conflict conditions **(RQ1)** and, guided by the TAM framework (Davis, 1989), participants' intention to use the proposed DST for relief distribution planning **(RQ2)**.

This study makes three main contributions. First, it extends research on cluster-led coordination by identifying key operational barriers to aid distribution in armed-conflict settings, based on empirical evidence from the Palestinian territories and Syria. Second, it bridges humanitarian coordination and decision-support technologies research by examining how these barriers shape coordinators' perceptions of DST usefulness and their behavioural intention to use such tools. Third, by incorporating the perspectives of cluster coordinators across multiple humanitarian sectors, the study provides empirical insights into the organisational and operational conditions required for the effective design and implementation of DSTs to strengthen coordination and support evidence-based decision-making in conflict-affected settings. The remainder of the paper is structured as follows: Section 2 reviews the related literature; Section 3 describes the methodology; Section 4 presents the findings; Section 5 discusses the findings, propositions, and implications; and Section 6 concludes the paper.

2. THEORETICAL BACKGROUND

2.1 Humanitarian Logistics Coordination Through Clusters

Coordination in humanitarian logistics literature involves aligning supply chain activities and managing relationships among organisations and stakeholders (Jensen & Hertz, 2016). It enables organisations to align operational processes and manage interdependencies, particularly in unstable environments where effective coordination becomes increasingly important (Cinti *et al.,* 2025). Although some existing literature addressed coordination within the cluster approach (Grange *et al.,* 2020; Jahre & Jensen, 2021), our study focuses specifically on its effectiveness in armed conflict disaster response. Effective coordination is critical because poor coordination and cooperation among humanitarian organisations can result in inefficient use of human and material resources and, ultimately, unmet needs among affected populations (Kaynak & Tuğer, 2014; Jensen & Hertz, 2016; Lee & Ha, 2025).

Theoretically, the cluster-led coordination approach has become central to humanitarian logistics research. First implemented following the 2005 Pakistan earthquake (UNHCR, 2023), the approach was conceptually examined by Jahre & Jensen (2010) as a mechanism for addressing coordination gaps in disaster response. By bringing humanitarian actors together through specialised clusters, it promotes cross-sector collaboration, clarifies roles, addresses service gaps, and reduces duplication, thereby improving the efficiency and effectiveness of humanitarian operations (Akhtar *et al.,* 2012; Jensen & Hertz, 2016; Jahre & Jensen, 2021).

Humanitarian coordination operates across three interdependent levels: operational (field response), tactical (regional implementation), and strategic (global oversight),

requiring alignment between immediate interventions, resource mobilisation, and policy coordination (Jensen & Hertz, 2016). At the operational level, intra-cluster coordination enhances field effectiveness through the allocation of responsibilities, needs assessment, information sharing, and logistical resource management. Inter-cluster coordination complements these efforts by promoting cross-sector collaboration, information exchange, and integrated service delivery (Akhtar *et al.,* 2012; Wankmüller & Reiner, 2020; Grange *et al.,* 2020; Partiwi *et al.,* 2023). As Jahre & Jensen (2010) note, the cluster approach primarily functions horizontally at the operational level. According to the United Nations High Commissioner for Refugees (IASC, 2013), the cluster approach encompasses six core functions: (1) providing support in delivering services; (2) supporting strategic decision-making; (3) planning and developing cluster strategies; (4) advocating on behalf of cluster participants and affected individuals; (5) monitoring and reporting progress; (6) and undertaking contingency planning and preparedness.

More recently, scholars have advocated a shift from coordination toward orchestration in humanitarian logistics. Orchestration extends beyond aligning activities by actively managing relationships, resources, and interdependencies among humanitarian actors to enable more coherent and integrated service delivery (Ruesch *et al.,* 2022). In practice, designated cluster leads, such as WFP for logistics and WHO for health, may assume this role by adapting supply network configurations to changing requirements across disaster-response phases. Its effectiveness depends on factors including coordination intensity, contextual conditions, technological infrastructure, and supply chain integration. This orchestration perspective encompasses key dimensions of cluster-led coordination, including resource disparities and conflicts, organisational roles, swift trust, and information accuracy (Ruesch *et al.,* 2022; Anjomshoae *et al.,* 2025). Building on this literature, the present study examines the challenges affecting the effectiveness of cluster-led coordination from the perspective of humanitarian cluster coordinators operating in armed-conflict settings. By focusing on conflict-specific challenges, the study extends existing humanitarian logistics research and provides a context-specific understanding of the barriers to effective coordination and response.

2.2 Behavioural Intention to Use Decision Support Tools in Humanitarian Settings: A TAM Framework

In humanitarian settings, collaborative activities are often challenged by time constraints, poor communication and teamwork, uncertainty, and work-related stress (Wassenhove, 2006). Effective disaster relief therefore depends on well-coordinated humanitarian logistics to ensure timely aid delivery. Decision-support tools (DSTs) have emerged as valuable instruments for improving and optimising these processes (Starr & Van Wassenhove, 2014; Gupta *et al.,* 2016). Accordingly, researchers have increasingly developed and applied DSTs to optimise the flow of relief aid through distribution networks across various disaster contexts (Peres *et al.,* 2012; Paz-Orozco *et al.,* 2023; Ikaditya *et al.,* 2026). These tools often incorporate key performance metrics such as response speed, time efficiency and cost-effectiveness, ensuring supply availability, fairness, prioritisation, and dependability (Vitoriano *et al.,* 2011; Gralla *et al.,* 2014; Anaya-Arenas *et al.,* 2018; Chen, 2021). Building on this body of work and drawing on the Technology Acceptance Model (TAM) (Davis, 1989), this study explores humanitarian cluster coordinators' behavioural intention to use our previously developed decision-support tool (DST) for relief distribution planning (Rezeq *et al.,* 2023, 2024), designed for the response phase of armed-conflict disasters. Unlike prior studies, it examines this intention from the perspective of humanitarian cluster coordinators, providing new insights into how decision-support tools can strengthen cluster-led coordination and improve operational decision-making in complex humanitarian settings.

3. METHODOLOGY

We adopt an inductive thematic methodology as outlined by Byrne (2022), employing semi-structured interviews with humanitarian cluster coordinators and focal points to gather first-hand insights into the coordination process (Gioia *et al.,* 2013). Using a purposive sampling strategy, we target coordinators from various clusters in the Palestinian territories and Syria to explore the challenges, barriers and weaknesses, as well as the potential improvements of the cluster-led coordination approach for aid distribution during armed-conflict disasters. In addition, we aim to explore the behavioural intention to use our decision-support tool developed by Rezeq *et al.* (2023, 2024) within this approach. The interview protocol followed a sequential design aligned with the research objectives. In the first stage, participants discussed the operational and coordination challenges of cluster-led humanitarian response (RQ1). In the second stage, participants were provided with a detailed description of the proposed DST, including its objectives, key functionalities, and intended application in aid distribution. Based on this description, they reflected on its potential usefulness, perceived ease of use, and behavioural intention to use in addressing the coordination challenges identified earlier (RQ2). Rather than evaluating the tool through direct interaction, participants assessed its perceived value based on the information provided and their professional experience in humanitarian coordination. This sequencing enabled participants to relate the proposed capabilities of the DST to the operational challenges they encounter in practice, thereby providing contextually grounded insights into its perceived applicability and intention to use.

We developed a semi-structured interview protocol using Google Forms, comprising 25 open-ended questions and one closed-ended (yes/no) question designed to elicit detailed and context-rich responses from participants. The semi-structured interviews started with collecting background information about the coordinators. We sought to include a range of organisational variables (e.g., organisation, cluster and region) as well as individual characteristics (e.g., gender and position). The next set of questions focused on the challenges encountered when implementing the cluster-led coordination approach at the

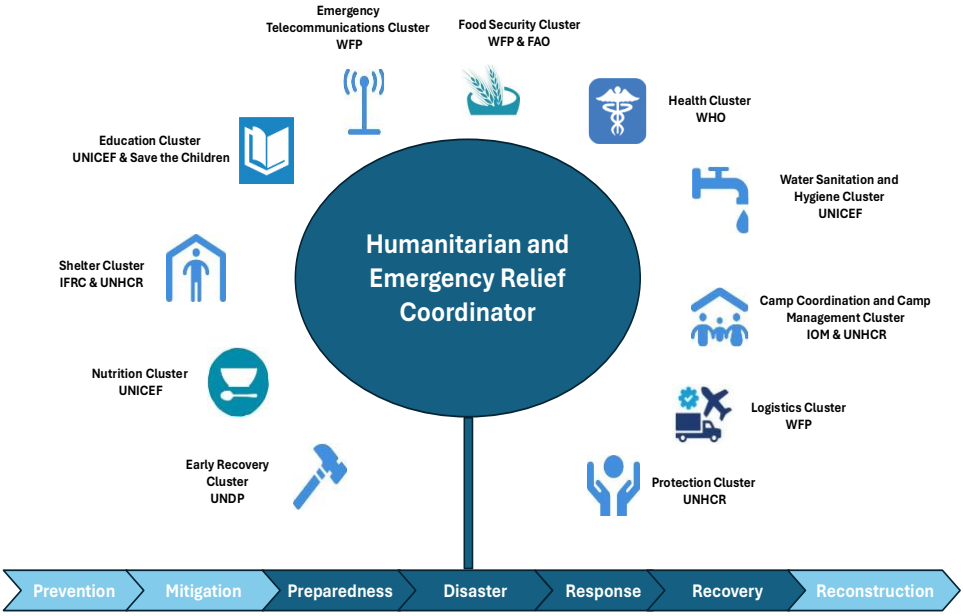


Figure 1 The Cluster Approach. Source: Adapted from (www.emergency.unhcr.org)

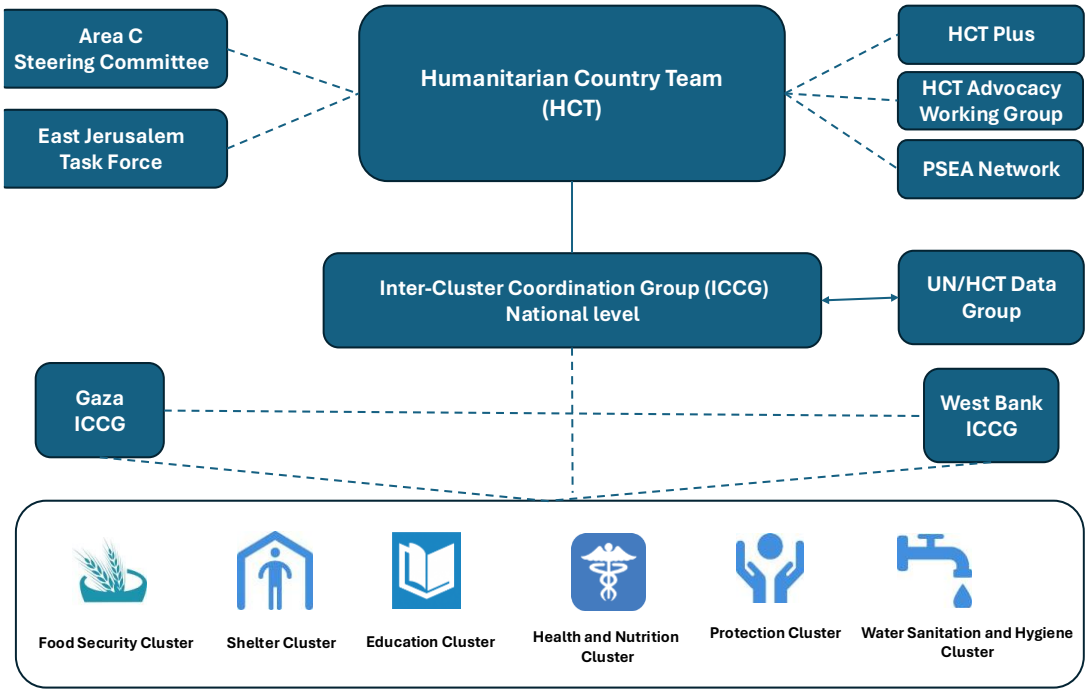


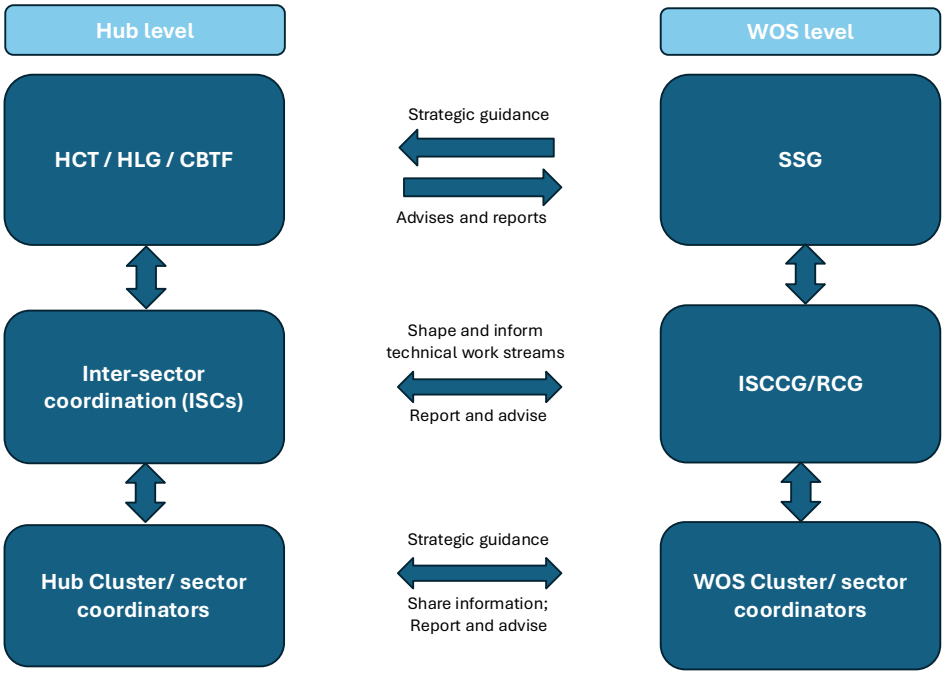
Figure 2 The Coordinating Framework for Cluster-Led Humanitarian Organizations in Palestinian Territories. Source: Adapted from (www.unocha.org)

country level for aid distribution during armed-conflict disasters, following the six fundamental functions outlined in the guidance (IASC, 2013) and discussed in the previous section. Detailed information about the semi-structured interview questions and the six fundamental functions is provided in Appendix A. Additionally, we formulated questions to explore the intention to use of our decision-support tool for relief-aid distribution planning with the cluster-led coordination approach based on the TAM framework, which is elaborated upon in subsection 3.2.

3.1 Cluster-Led Coordination Approach in the Palestinian Territories and Syria

This section provides a brief overview of the Cluster-Led Coordination Approach in the Palestinian territories and Syria, highlighting its implementation and key contextual characteristics in these conflict-affected settings. The overall structure of the approach is illustrated in Figure 1.

Palestinian territories: Humanitarian coordination is organised through seven main clusters: Protection, WASH, Health and Nutrition, Food Security, Education, Shelter, and



Note: HCT: Humanitarian Country Team; HLG: Humanitarian Liaison Group; CBTF: Cross Border Task Force; SSG: Strategic Steering Group; ISCCG: Inter Sector Group; RCG: Response Coordination Group.

Figure 3 Cluster-Led Coordination Framework in Syria. Source: Adapted from (www.ennonline.net)

NFI, supported by several thematic working groups (OCHA, 2023). The Resident/Humanitarian Coordinator, in consultation with the HCT and Emergency Relief Coordinator, oversees the designation of cluster lead agencies, while OCHA facilitates inter-cluster coordination (Health Cluster oPt & WHO, 2022; OCHA, 2023). The coordination framework is shown in Figure 2.

Syria: In northwest Syria, the cluster system comprises 11 sub-clusters covering major sectors, including food security, health, logistics, shelter/NFI, protection, education, and WASH. The system is led by UNHCR and co-chaired by CARE International, with participation from international and national NGOs and UN agencies. Coordination is supported by subnational hub teams and information-management units, particularly across Aleppo and Idleb governorates (Global Protection Cluster, 2017; Logistics Cluster, 2021; OCHA, 2023). Figure 3 above presents the Syrian coordination structure.

3.2 Decision Support Tool for Humanitarian Distribution Planning

The decision-support tool (DST) is built on a Humanitarian Distribution Planning (HDP) model Rezeq *et al.* (2023, 2024) designed to assist planners and policymakers in humanitarian organisations during armed conflicts. The model supports cost-efficient distribution planning during armed conflicts by accounting for transportation, inventory, backorders, and checkpoint congestion. Within the cluster approach, the DST provides a shared basis for decision-making, resource allocation, and cross-cluster information exchange. It can, for example, align Logistics Cluster transport decisions with Food Security and Shelter Cluster needs while enabling scenario analysis of alternative routing, warehousing, and resource-allocation strategies.

The development of the TAM-related questions was informed by the original TAM constructs proposed by Davis (1989) and subsequent technology-acceptance research, including (Edwards *et al.,* 2024). These constructs were adapted and contextualised to reflect the operational realities of humanitarian coordination and aid distribution in armed-conflict settings. TAM was employed as a qualitative analytical framework comprising three constructs: perceived usefulness (PU), perceived ease of use (PEOU), and behavioural intention to use (BI). Rather than statistically testing relationships among these constructs, the study used them to guide the formulation of open-ended questions and the subsequent thematic analysis of participants' responses. Perceived usefulness (PU) was operationalised as participants' perceptions of the extent to which the proposed DST could improve humanitarian coordination and distribution planning.

The questions explored its potential to enhance resource allocation, information sharing, and inter-cluster coordination, to reduce duplication, and to support timely and evidence-based decision-making. On the other hand, perceived ease of use (PEOU) was operationalised as participants' anticipated perceptions of the effort required to understand, learn, and use the proposed DST within humanitarian operations. The questions explored factors that could facilitate or constrain ease of use, including interface simplicity, training requirements, technical support, compatibility with existing systems, connectivity constraints, and users' technical capabilities. Finally, behavioural intention to use (BI) was operationalised as participants stated willingness or intention to use the proposed DST in future humanitarian coordination and distribution activities. The questions examined participants' willingness to use the tool and the conditions that could

Table 1 Operationalization of the TAM Constructs and Corresponding Qualitative Questions

TAM Construct	Operational Definition in this Study	Dimensions Explored	Representative Qualitative Questions
Perceived Usefulness (PU)	Participants' perceptions of the extent to which adopting the DST could improve humanitarian response, relief-aid distribution planning, and coordination within the cluster-led approach during armed conflicts.	Improvement in aid distribution planning; enhanced humanitarian response; decision-support functions; inter-cluster collaboration and coordination.	**1.** How do you believe the adoption of decision-support tools for relief-aid distribution planning within a cluster-led coordination approach will benefit the humanitarian response during armed conflicts? **2.** How do you think the adoption of a DST within the cluster-led coordination approach will improve humanitarian aid distribution planning during armed conflicts? What tool features or functions would contribute to this planning? **3.** How do you believe this DST will benefit collaboration between different humanitarian clusters involved in the humanitarian response?
Perceived Ease of Use (PEOU)	Participants' anticipated perceptions of the effort required to understand, learn, and adopt the DST within the operational context of cluster-led coordination during armed conflicts.	Ease of adoption; simplicity and clarity of tool interactions; anticipated implementation challenges and advantages; training requirements.	**1.** What aspects of the DST do you find simple and straightforward to adopt within the cluster-led coordination approach? Can you describe any specific interactions that you think would be particularly easy? **2.** How do you perceive the ease of adopting the DST within the cluster-led coordination approach during armed conflicts? Are there any particular challenges or advantages you anticipate? **3.** Do you believe training staff to use the DST would be straightforward? Can you provide any insights or experiences related to the training process?
Behavioural Intention to Use (BI)	Participants stated willingness or intention to adopt and use the DST for relief-aid distribution within the cluster-led coordination approach in future humanitarian responses.	Intention to adopt; willingness to use; factors influencing adoption decisions.	**1.** What are your intentions regarding the adoption of the DST for aid distribution within the cluster-led approach in the future? Can you elaborate on the factors that influence your willingness to adopt this tool?
Modifications / Contextual Requirements	Participants' recommendations regarding changes needed to improve the DST's adaptability and suitability for use within the cluster-led coordination approach during armed conflicts.	Tool adaptability; contextual requirements; improvements to functionality and implementation.	**1.** From your perspective, what modifications would make this DST more adaptable to the cluster-led coordination approach during armed-conflict disasters?

strengthen or constrain this intention, including perceived operational value, reliability, system integration, ease of learning, and training requirements.

The three TAM constructs served as initial deductive categories, while inductive subthemes captured context-specific factors emerging from participants' responses. This combined approach maintained the TAM framework while accounting for factors influencing technology acceptance in conflict-affected humanitarian settings. Because participants did not interact with a functioning DST, PEOU reflects anticipated ease of use, and BI reflects stated intention to use rather than observed adoption. Thus, the findings represent participants' perceptions and anticipated responses based on the proposed tool and their professional experience. Table 1 presents the TAM constructs, operational definitions, and corresponding qualitative questions.

3.3 Data Collection and Analysis

Participants were identified through the Inter-Cluster Coordination Group List, which includes national and sub-national cluster coordinators, focal points, and standing invitees at the national level in both the Palestinian territories and Syria. Table 2 illustrates the clusters and organisations targeted in this study, with a sample of 28 humanitarian clusters and organisations. To ensure the relevance and depth of our sample, we employed purposive sampling as mentioned above, selecting participants based on their leadership roles within clusters and their direct experience with coordination challenges in conflict settings. Participants were required to meet three eligibility criteria: (1) active involvement as a cluster coordinator or focal point, (2) affiliation with a recognised lead organisation or humanitarian cluster, and (3) operational presence in the Palestinian territories or Syria. We discerned emergent patterns from individuals who articulated the viewpoints of their respective organisations, thereby representing an organisational standpoint (Gioia *et al.,* 2013). We analysed the responses from participants. This analysis allowed us to compare the insights from these two regions, highlighting unique challenges and commonalities. By exploring the answers from responders in each area, we aim to better understand the distinct dynamics at play in each context. The final sample in Table 3 comprised several humanitarian cluster coordinators and focal points along with their demographic data. This sample was crucial for analysing regional differences and exploring the unique characteristics of each area.

Table 2 Inter-Cluster Coordination Group List in Palestine & Syria

Cluster / Sector/ Palestine	Organization
Protection	OHCHR/OCHA
Food Security Cluster	FSS/FAO
Shelter & NFIs	NRC
Health & Nutrition	Health Cluster/WHO
WASH Cluster	UNICEF
Education	UNICEF
CWG	AAH
Standing Invitees	
WB Protection Consortium	NRC
AIDA	AIDA
Save the Children	Save the Children
Anera	Anera
ActionAid	ActionAid
Caritas Jerusalem	Caritas
Gender Focal Point	UN Women
Gender Mainstreaming	WHO
PSEA Focal Point	UNICEF
UNRWA Gaza	UNRWA
UNRWA WB	UNRWA
OCHA Secretariat National ICCG	OCHA
OCHA Secretariat Gaza ICCG	OCHA
OCHA West Bank Focal Points	OCHA
Cluster / Sector / Syria	
Camp Coordination & Camp Management	UNHCR
Early Recovery & Livelihoods	OCHA
Education	OCHA
Emergency Telecommunications	OCHA–UNICEF–UNHCR–WFP–UNDSS
Food Security	WoS/FSS – WFP & FAO
Health	WHO
Logistics	Logistics Cluster
Nutrition	UNICEF
Shelter/NFIs	UNHCR
Protection	UNHCR
WASH	UNICEF

Note: United Nations Office for the Coordination of Humanitarian Affairs (OHCA), Office of the United Nations High Commissioner for Human Rights (OHCHR), Action Against Hunger (AAH), Association of International Development Agencies (AIDA), United Nations Relief and Works Agency for Palestine Refugees in the Near East (UNRWA), United Nations Department of Safety and Security (UNDSS), Whole of Syria (WoS), United Nations High Commissioner for Refugees (UNHCR), United Nations Children's Fund (UNICEF), World Food, Programme (WFP), World Health Organization (WHO), Norwegian Refugee Council (NRC), Food and Agriculture Organization (FAO), Food Security Standard (FSS), American Near East Refugee Aid (Anera).

Table 3 The Collected Demographical Data of the Respondents

Responder	Organization	Cluster Name	Country of Operations	Gender	Position
C1	NRC	Shelter Cluster	Palestine	Male	Shelter Cluster Coordinator
C2	Save the Children	Education Cluster	Palestine	Male	WB Education Cluster Coordinator
C3	UNRWA	West Bank Humanitarian Cluster	Palestine	Male	Deputy Chief Area Office
C4	Anera	Health and Nutrition Clusters	Palestine	Female	Health Program Manager
C5	ActionAid	GBV/Advocay, Logistic, Eduation	Palestine	Female	Advocacy & Communication Coordinator
C6	Caritas Jerusalem	Logistics Cluster	Palestine	Male	Social Worker
C7	Caritas Jerusalem	Health, Humanitarian	Palestine	Female	Project coordinator
C8	World Food Programme (WFP)	Food Cluster	Syria	Female	Program coordinator
C9	Save the Children	Logistics Cluster	Syria	Male	Logistics Coordinator
C10	WHO	Health Cluster	Syria	Female	Coordinator in a health sector
C11	UNICEF	WASH Cluster	Syria	Male	WASH Sector Coordinator

Note: World Food Programme (WFP), World Health Organization (WHO), Norwegian Refugee Council (NRC), Food and Agriculture Organization (FAO), Food Security Standard (FSS), Occupied Palestinian Territory (oPt), United Nations High Commissioner for Refugees (UNHCR), American Near East Refugee Aid (Anera), United Nations Children's Fund (UNICEF).

Participants were invited by email to complete a semi-structured interview administered through Google Forms and were subsequently contacted by telephone to clarify the questions and explain the response process. Participants provided their responses directly through the online form, offering a flexible and convenient means of participation. Over the course of one month, we conducted 11 semi-structured interviews with cluster coordinators and focal points: seven based in the Palestinian territories and four in Syria. After completing the seven interviews, we found that additional respondents did not provide new insights into the key challenges facing the cluster-led coordination approach for aid distribution in the Palestinian territories and Syria, suggesting that data saturation had been reached. Repetition became evident as the respondents consistently restated the same challenges. Nevertheless, additional interviews confirmed and deepened our understanding of the main topics and their respective insights. This repetition is a result of the consistent conditions created by the armed conflict, which we elaborate on in the following section.

We regarded the participants as well-informed individuals who explained their ideas, intentions and behaviours (Gioia *et al.,* 2013; Ruesch *et al.,* 2022). The semi-structured interviews employed a flexible yet systematic protocol (Appendix A), initiated with broad questions exploring participants' organisational roles and coordination objectives. Subsequently, the dialogue progressed to targeted inquiries addressing sector-specific challenges in aid distribution amid armed conflict conditions. Probing techniques were strategically employed to elicit nuanced perspectives on participants' anticipated acceptance of the decision-support tool (DST), capturing rich, contextually grounded insights. To enhance methodological robustness, the interview framework underwent preliminary validation through pilot testing with two seasoned humanitarian practitioners, ensuring question clarity and thematic relevance. Finally, participants were assured of anonymity and confidentiality, and interviews lasted an average of 30 minutes.

Data analysis was performed using NVivo software. This software allows researchers to efficiently sort, code, and analyse responses, as noted by Ahmad *et al.* (2024), providing a comprehensive understanding of the coordinators and focal points' perceptions of the cluster-led coordination approach and their intention to use the decision-support tool. For our qualitative data analysis, we followed a structured process. Initially, we employed open (initial) coding to identify information-centric terms, categorising statements into factors that challenge the implementation of the cluster-led coordination approach and factors that facilitate the intention to use our decision-support tool with this approach. We conducted an open-coding analysis of the interview transcripts by selecting, categorising, and labelling the themes. Each interview was individually coded based on terms or phrases used by the participants, followed by a cross-analysis to identify emergent patterns across different interviews. To enhance reliability, we conducted peer debriefing sessions where colleagues reviewed and critiqued the emerging themes. We also triangulated our findings by comparing interview data with secondary sources, such as operational reports and policy documents from humanitarian organisations, to verify consistency and contextual relevance. This iterative process continued until no new distinct patterns emerged (Byrne, 2022; Ruesch *et al.,* 2022).

The first-order themes were subsequently distilled into broader second-order themes. These researcher-induced themes were more abstract and theoretically distinctive, although we aimed to stay close to the informants' labels when they represented theoretical concepts. We managed our interview transcripts based on the guidelines of Byrne (2022). The final themes were assessed based on frequency, participant emphasis, and theoretical relevance, ensuring that they represented substantive, clear challenges rather than incidental remarks. To validate our findings, we employed triangulation by cross-referencing emerging themes with secondary sources, including operational reports and policy documents published by humanitarian organisations relevant to our study. Additionally, we conducted a cross-regional comparison of interviews from the Palestinian territories and Syria to determine whether the identified challenges were context-specific or broadly applicable. This comparative analysis further refined our themes, enhancing their robustness and consistency across different conflict settings. Supplementary Material includes the full data structure (from codes to aggregate themes), exemplary quotes for each theme, and reflexivity notes on researcher positioning to ensure reproducibility and transparency.

4. FINDINGS

The findings are presented in two sequential stages. First, the analysis identifies the principal coordination challenges affecting cluster-led humanitarian logistics during armed conflicts. Second, building on these findings, the study explores humanitarian coordinators' perceptions regarding the intention to use the decision-support tool as a potential mechanism for addressing these operational challenges. The challenges of the cluster-led coordination approach during armed conflicts (RQ1) are detailed in Appendix B, and the intention to use a decision-support tool (DST) within this approach (RQ2) is detailed in Appendix C. To improve conciseness, the respondents' full statements (interview quotations) have been moved to the appendices.

- **RQ1:** What obstacles can impede the implementation of cluster-led coordination for humanitarian aid distribution in times of armed-conflict disasters?
- **Primary goals and responsibilities**: What are the primary goals and responsibilities of the cluster-led coordination approach for humanitarian aid distribution?

The analysis indicates that the cluster-led coordination approach primarily aims to improve the effectiveness of humanitarian aid delivery in conflict settings through timely and efficient distribution, stronger inter-organisational coordination, reduced duplication, and optimised resource allocation. Its implementation involves several key responsibilities, including needs assessment and prioritisation, sector-specific planning, information sharing and coordination, capacity building of local partners, advocacy for sectoral priorities, and monitoring and evaluation. Together, these functions support a more coordinated, needs-based, and accountable humanitarian response. The detailed responsibilities are presented in Table 4. Overall, the results presented in Figure 4 demonstrate respondents' perceptions of the effectiveness of the cluster-

Table 4 Summary of Goals and Responsibilities of the Cluster-Led Coordination Approach for Humanitarian Aid Distribution

	Theme	Respondents	Details
Primary Goals	Effective and Efficient	C1, C2, C8, C9	Ensuring effective, efficient, and timely humanitarian aid distribution; improving overall effectiveness.
	Enhance Coordination	C1, C3, C5, C8, C10	Enhancing coordination and collaboration among various humanitarian actors; coordinating all efforts toward humanitarian aid distribution.
	Avoiding Duplication	C2, C8, C9	Harmonizing efforts to avoid duplication and fill gaps in humanitarian aid distribution.
	Resource Optimisation	C2, C9	Maximizing efficient use of resources; enhancing efficiency of humanitarian aid distribution through resource sharing.
Primary Responsibilities	Needs Assessment and Prioritisation	C2, C6, C7	Conducting and coordinating needs assessments; prioritizing interventions based on identified needs.
	Strategy Development	C2, C4, C6, C7, C11	Developing and implementing sector-specific strategies and humanitarian aid distribution plans; creating guidelines and standards.
	Information Exchange	C2, C5, C7, C9	Facilitating the exchange of information among stakeholders; managing information.
	Coordination and Facilitation	C2, C6, C7, C8, C11	Organizing and facilitating regular coordination meetings; aligning activities with strategic priorities; coordinating between humanitarian organizations.
	Capacity Building	C2, C6, C7, C10	Supporting and building the capacity of partners, including local organizations; providing policy/operational guidance.
	Advocacy and Representation	C2, C6, C7	Advocating for sectoral needs and priorities; representing in broader humanitarian coordination mechanisms for humanitarian aid distribution.
	Monitoring and Evaluation	C6, C7	Monitoring and evaluating the humanitarian aid distribution efforts to ensure effectiveness.

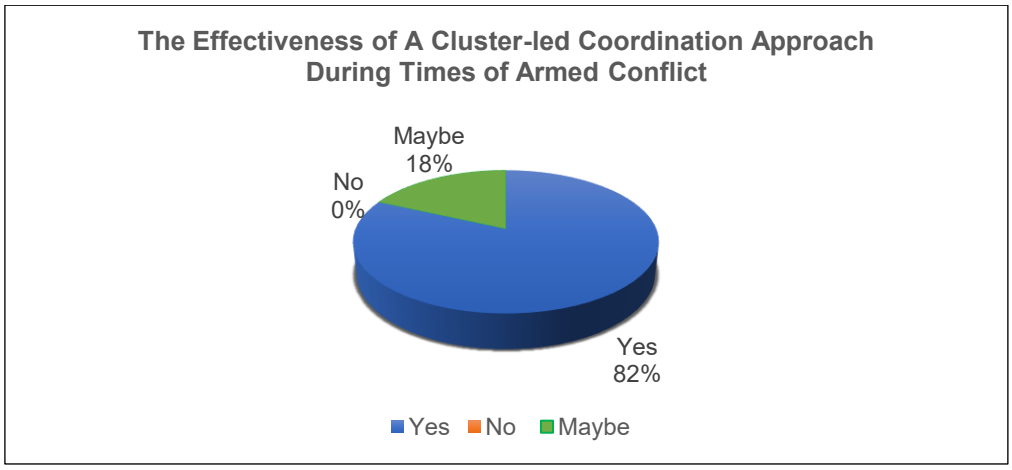


Figure 4 Respondents' Perceptions of the Effectiveness of the Proposed Approach in Enhancing Humanitarian Aid Distribution During Armed Conflict Disasters

led coordination approach during times of armed conflict. The findings indicate that the majority of respondents (82%) agreed that the approach could improve the effectiveness of aid distribution, while 18% were uncertain (Maybe). Notably, none of the respondents disagreed with this view (0%). Overall, these findings suggest a positive perception among respondents regarding the potential of the cluster-led coordination approach to enhance aid distribution effectiveness during armed conflict.

We now turn to the challenges facing the core functions of the cluster-led coordination approach, beginning with the first function, as detailed in Appendix B. The analysis identified challenges across the six core functions of the cluster-led coordination approach: service delivery, strategic decision-making, strategy formulation, advocacy, monitoring and reporting, and contingency planning and preparedness. Participants in both the Palestinian territories (C1–C7) and Syria (C8–C11) identified several common challenges, particularly limited resources, fragmented information, communication difficulties, security and access constraints, and rapidly changing operational conditions. However, the cross-case analysis also showed differences in how these challenges affected coordination in the two settings.

4.1 Enhancing Service Delivery

The first cluster function focuses on supporting humanitarian service delivery and strengthening coordination among aid organisations. Participants identified resource constraints, fragmented information, weak communication, logistical difficulties, security and access

restrictions, and divergent organisational priorities as key barriers. Limited financial and human resources constrained coordination, while fragmented and delayed information hindered the identification of service gaps and duplication. Differences in operational standards and priorities further complicated coordination, while security and access restrictions limited movement, data collection, monitoring, and field coordination. The cross-case comparison indicates that these challenges were present in both the Palestinian territories and Syria, but with some differences in emphasis. Palestinian participants more frequently highlighted access, logistics, resource limitations, and fragmented coordination, whereas Syrian participants more frequently referred to communication barriers, security concerns, and rapidly changing operational conditions. Thus, the effectiveness of service delivery depends on both the ability of clusters to coordinate actors and their ability to operate within the specific constraints of each context.

4.2 Enhancing the HC/HCT's Strategic Decision-Making Process

Strategic decision-making was strongly dependent on the availability and quality of information. Participants identified security constraints, data accuracy and reliability, limited resources, fragmented assessments, communication problems, and rapidly changing needs as major obstacles to preparing comprehensive needs assessments and setting priorities. Participants reported using several mechanisms to identify emerging gaps and duplication, including data collection and sharing, coordination meetings, field assessments, resource and activity mapping, feedback mechanisms, technology, and monitoring and evaluation. However, the usefulness of these mechanisms was limited when information was incomplete, outdated, inconsistent, or difficult to share across organisations. The two cases showed both similarities and differences. Participants in both contexts reported difficulties obtaining reliable information and maintaining updated needs assessments. Syrian participants emphasised rapidly changing conditions and communication challenges, while Palestinian participants highlighted access restrictions, logistical constraints, and limited resources. These challenges hindered the ability to maintain priorities as needs evolved. Reported feedback from affected populations reflected practitioners' accounts rather than direct community interviews and, although useful for identifying emerging needs, was constrained by weak feedback mechanisms.

4.3 Formulating and Implementing Strategies

The third function involves developing sectoral plans, objectives, indicators, standards, and operational procedures. Participants identified outdated information, volatile conditions, unclear roles, coordination challenges, changing needs, and conflict-related uncertainty as key barriers to maintaining relevant plans. They stressed the importance of clear standards, protocols, regular coordination, training, monitoring, and flexible planning, but implementation was constrained by limited resources, security risks, communication gaps, varying organisational capacities, and changing local conditions. Funding was another challenge, as needs, costs, priorities, and crisis duration can shift rapidly during armed conflict, although some participants found urgent requirements easier to identify for essential services such as food, shelter, and health. The cross-case comparison suggests that planning flexibility is a common requirement in both settings, while the factors creating uncertainty vary. Palestinian participants referred more often to access, resources, and operational constraints, whereas Syrian participants highlighted rapidly changing conditions and the difficulty of aligning formal strategies with changing conflict realities.

4.4 Advocate on Behalf of Individuals, Communities and Those Affected by Clusters

The advocacy function was constrained by limited evidence, unreliable information, restricted access, communication barriers, diverse needs and priorities, and limited resources. Participants noted that outdated information weakens clusters' ability to communicate priorities and provide credible evidence to decision-makers. Security and access restrictions also hindered data collection and stakeholder engagement, while poor infrastructure and technological limitations affected communication. Differences in organisational and population priorities, together with weak feedback mechanisms, further complicated advocacy, prioritisation, and timely responses. The cross-case comparison indicates that access and security constraints affected advocacy in both the Palestinian territories and Syria, while Syrian participants placed greater emphasis on communication barriers and security-related restrictions. Palestinian participants also highlighted difficulties related to evidence, representation, and resource constraints. These findings suggest that effective advocacy depends on reliable information, coordination among actors, and the ability to communicate priorities despite operational restrictions.

4.5 Monitoring and Reporting

Monitoring and reporting were also strongly affected by conflict conditions. Participants identified security risks, restricted access, inadequate reporting mechanisms, limited resources, communication problems, and poor data quality as major barriers to monitoring the effectiveness of aid distribution. Participants explained that ongoing violence and movement restrictions can prevent monitoring teams from reaching relevant areas. Damaged infrastructure and unreliable communication networks can further limit data collection. In addition, incomplete, outdated, or potentially biased information can affect the reliability of monitoring results. Resource constraints also reduce access to trained personnel, equipment, and other requirements for effective monitoring. The challenges were evident in both cases, but their operational manifestations differed. Palestinian participants more frequently referred to movement restrictions, infrastructure damage, and access limitations, whereas Syrian participants more frequently highlighted insecurity, communication disruption, and rapidly changing conditions. Nevertheless, participants in both contexts emphasised the need for reliable information and continuous monitoring to assess whether humanitarian activities remain effective.

4.6 Undertaking Contingency Planning and Preparedness Actions

The final function concerns preparing for changes in humanitarian needs, access conditions, security, and resource availability. Participants identified several requirements for contingency planning, including assessing

Table 5 Feedback from Affected Communities on the Efficiency of Cluster-Led Coordination Approach for Humanitarian Aid Distribution

Theme	Respondents	Details
General Appreciation	C2, C6, C8, C9, C10	Communities generally appreciate the holistic support provided by different clusters, leading to improved access to a wide range of distribution and better geographic coverage.
Improved Coordination	C2, C3, C6, C8, C9	Coordination among clusters leads to reduced duplication of efforts, more comprehensive aid distribution, and better resource utilization.
Community Involvement	C2, C10	Greater efforts to involve community members in humanitarian aid distribution planning and decision-making processes are often appreciated.
Delays and Bureaucracy	C2, C3, C6, C8, C9	Some communities report delays in response and perceive the cluster-led approach as bureaucratic and slow, which can be frustrating for those in immediate need.
Awareness and Understanding	C1, C4	Some communities are not fully aware of the cluster's specific role, leading to feedback that they are lacking in everything.
Local Engagement	C2, C9, C10	Some affected communities feel that the cluster-led approach can be too top-down with insufficient involvement of local actors and inadequate consideration of local knowledge and needs.
Feedback Mechanisms	C2, C10	While feedback mechanisms exist, some communities feel that their input is not adequately considered or acted upon.
Duplication of Efforts	C5, C9	There are complaints about the duplication of efforts, indicating coordination challenges among cluster members.

current and anticipated needs, maintaining appropriate resources, considering security and access risks, coordinating with humanitarian actors, and adapting plans as conditions change. Participants also identified substantial barriers to preparedness. These included shortages of financial, logistical, and human resources; difficulties securing transportation and storage; restricted access; unreliable information; communication problems; and the unpredictable nature of armed conflict. The availability of appropriately trained personnel was also considered important for operating under high-risk conditions. The cross-case analysis indicates that preparedness challenges were common to both the Palestinian territories and Syria. However, Syrian participants placed greater emphasis on rapidly changing conditions and the need for flexible planning, while Palestinian participants more frequently highlighted access, logistics, resource availability, and infrastructure constraints. In both cases, participants viewed continuous monitoring and adjustment as important for maintaining the relevance of contingency plans.

4.7 Feedback and Suggestions

Participants reported feedback and concerns gathered through their interactions with affected communities. These accounts represent practitioners' perceptions rather than direct evidence from affected populations and are therefore not treated as representative community views. As shown in Table 5, reported benefits included broader service coverage, improved coordination, and reduced duplication, while concerns involved delays, bureaucracy, limited understanding of cluster roles, weak local engagement, and unmet needs. Participants also reported perceptions of top-down decision-making and limited follow-up on community feedback, highlighting the importance of communication, local participation, monitoring, and responsiveness.

On the other hand, the suggestions reported by participants, summarized in Table 6, focused mainly on strengthening the existing cluster-led coordination functions. Key priorities included improved preparedness and resource availability, real-time data sharing, clearer communication and standard operating procedures, and enhanced training for cluster members and local actors. Participants also emphasised stronger local engagement, more effective resource allocation and logistics, flexible response planning, and greater use of data and digital technologies. Finally, they highlighted continuous learning, clearer activity mapping, and reduced bureaucracy to improve efficiency and responsiveness. Overall, these recommendations reinforce the six cluster coordination functions and underscore the need to adapt them to the operational realities of the Palestinian territories and Syria.

RQ2: How do humanitarian cluster coordinators perceive the usefulness of, and behavioural intention to use, a decision-support tool (DST) for humanitarian aid distribution within a cluster-led coordination approach during armed conflicts?

We begin by examining the perceived usefulness (PU) of the decision-support tool.

4.8 Perceived Usefulness

Participants in both the Palestinian territories and Syria viewed the proposed decision-support tool (DST) as potentially useful for improving humanitarian coordination and distribution planning. They expected the tool to support information sharing and resource allocation, reduce duplication, and improve decision-making. However, the emphasis differed between the cases. Palestinian participants mainly associated the DST with improving coordination, information visibility, resource allocation, and reducing duplication. Syrian participants placed greater emphasis on timely information, predictive capabilities, and supporting decisions under rapidly changing conditions. The findings therefore suggest that the perceived usefulness of the DST is context dependent. Participants valued the tool because of its potential to address problems they experience in their respective operational environments.

Table 6 Suggestions for Enhancing Cluster-Led Coordination Approach for Humanitarian Aid Distribution in Conflict-Affected Regions

Theme	Respondents	Details
Improved Preparedness and Prepositioning	C1, C2	Enhance preparedness and prepositioning of humanitarian items, secure emergency funds, and strengthen data management and sharing.
Enhanced Communication and Collaboration	C2, C3, C6, C8, C9	Improve communication, set up shared SOPs for activities involving multiple clusters, agree on communication channels, and enhance collaboration.
Training and Capacity Building	C2, C8, C9, C10	Provide training and capacity building for cluster members and local actors.
Community Engagement	C2, C6, C8, C9, C10	Foster community engagement, involve local communities in decision-making and ensure better inclusion of affected communities.
Flexibility and Adaptability	C2, C6, C8, C9, C10	Increase flexibility in funding and response mechanisms to adapt quickly to changing conditions and needs.
Improved Data Sharing	C2, C6, C9, C10, C11	Implement robust systems for real-time data exchange and analysis to enhance decision-making.
Resource Allocation and Logistics	C2, C6, C8, C9, C10	Enhance resource allocation and logistical support for more effective humanitarian aid distribution, including secure transportation and warehousing.
Partnerships and Collaboration	C2, C6, C10	Strengthen partnerships with local organizations and community leaders to create sustainable and contextually appropriate solutions.
Leveraging Technology and Innovation	C2, C10	Integrate advanced technology to track and manage operations, and leverage innovative solutions for efficient humanitarian aid distribution.
Continuous Learning and Adaptation	C2	Promote continuous learning and adaptation based on feedback and evolving conditions.
Mapping and Transparency	C3, C5	Develop clear mapping of efforts and partners, ensure transparency, and share updated news and information regularly.
Reducing Bureaucracy	C4	Minimize exhaustive reporting requirements and heavy meeting schedules to focus on field activities.

Table 7 Modifications for the DST of HDP

Question	Theme	Details
What modifications would make the tool more adaptable?	Real-Time and Offline Capabilities	C2: “Real-time data and offline functionality”. C8: “Enhanced offline capabilities and local data integration”.
	Customization and User Support	C2: “Customizable dashboards and interactive training”. C10: “Customizable features and user feedback-based updates”.
	Integration with Existing Systems	C2: “Compatibility with existing platforms”. C6: “Flexibility to accommodate changing conditions and diverse needs”.

4.9 Perceived Ease of Use

Because participants did not directly use a functioning DST, their responses reflect anticipated ease of use rather than actual usability. Participants in both contexts emphasised the importance of a simple interface, appropriate training, technical support, and compatibility with existing systems. They also identified infrastructure limitations and differences in users' technical skills as potential barriers. Syrian participants placed particular emphasis on practical training and technical support, while Palestinian participants highlighted simplicity, integration, and infrastructure requirements. Overall, participants indicated that the DST would need to be easy to understand, supported by appropriate training, and compatible with existing humanitarian work processes.

4.10 Behavioural Intention to Use

Participants generally expressed a positive intention to use the proposed DST, but this intention was conditional. They indicated that they would be more willing to use the tool if it demonstrated clear operational value, was reliable, could work with existing systems, and did not require excessive training. This pattern was evident in both areas. The findings therefore suggest that humanitarian practitioners' intention to use the DST depends not simply on the availability of new technology, but on whether the technology can provide practical value within existing humanitarian operations**.** Table 7 summarises participants’ recommendations for improving DST adaptability in conflict-affected settings. Key priorities included real-time and offline functionality, customisation and user support, and interoperability and contextual flexibility to ensure integration with existing systems and adaptation to changing conditions. Overall, an effective humanitarian DST should combine these capabilities to remain usable and responsive despite technological, organisational, and operational constraints. Table 8 summarises the main similarities and differences between the Palestinian territories and Syria cases.

Table 8 Similarities and Differences Identified Across the Two Cases

Dimension	Palestinian Territories (C1–C7)	Syria (C8–C11)	Cross-Case Interpretation
Information	Fragmentation, limited sharing, updated-data problems	Communication disruption, unreliable information, rapidly changing data	Common problem, different operational mechanisms
Security/Access	Movement restrictions, damaged infrastructure, access barriers	Insecurity, staff safety, volatile access conditions	Access constraints are common but contextually different
Resources	Resource scarcity and allocation pressures	Shortages of personnel, equipment and technology	Shared resource constraints with different manifestations
Adaptability	Changing needs and logistical/access constraints	Strong emphasis on rapid change and conflict patterns	Adaptability particularly salient in Syria
Local Knowledge	Important for needs and prioritisation	Strong emphasis on local conditions and capacities	Common requirement, more prominent in Syrian accounts
DST Usefulness	Coordination, resource allocation, information visibility, duplication reduction	Timely information, prediction, evidence-based decisions	Positive in both cases but driven by different operational needs
Ease of Use	Simplicity, integration, infrastructure	Training, technical support, user capability	Contextual usability in both cases
Intention to Use	Conditional on value, reliability and compatibility	Conditional on demonstrated value and operational fit	Positive but conditional in both cases

5. DISCUSSION, PROPOSITIONS, AND IMPLICATIONS

The analysis of the six cluster-led functions shows that coordination challenges are interconnected rather than isolated. Resource constraints affect service delivery and monitoring; fragmented information and communication hinder needs assessment and decision-making; security and access restrictions limit data collection, advocacy, monitoring, and aid delivery; and rapidly changing conditions complicate planning and contingency management. Collectively, these challenges constrain information sharing, coordination, resource allocation, and timely responses.

The cross-case comparison revealed substantial similarities between the Palestinian territories and Syria, particularly in resource limitations, information fragmentation, communication difficulties, security constraints, and operational uncertainty. However, their manifestations differed. In the Palestinian territories, participants emphasised movement and access restrictions, infrastructure damage, logistical constraints, and resource allocation difficulties. In Syria, they more frequently highlighted insecurity, communication disruptions, rapidly changing conditions, and shortages of skilled personnel and technical resources.

Despite these differences, both cases demonstrate a common coordination challenge: humanitarian organisations must perform the core cluster functions under conditions of limited resources, incomplete information, restricted access, and operational uncertainty. Thus, the challenges facing cluster-led coordination are neither entirely uniform nor entirely context-specific. Rather, common structural challenges are shaped and intensified by the particular security, access, infrastructural, informational, and organisational conditions of each conflict setting. Participants also discussed feedback and concerns that they had encountered through their interactions with affected communities. These accounts represent practitioners' perceptions of community needs and feedback rather than direct evidence from affected populations. Accordingly, such observations are treated as contextual information reported by participants and are not presented as representative views of affected communities.

Overall, the findings indicate that strengthening cluster-led coordination requires more than addressing individual coordination gaps. It requires approaches that can support the core cluster functions while remaining responsive to the operational conditions of each conflict setting.

Proposition 1**:** *The effectiveness of cluster-led humanitarian coordination is constrained by interconnected resource, information, communication, access, security, and organisational challenges, whose manifestations vary according to the operational context.*

Following the analysis of the six cluster-led functions, we discuss participants' perceptions of the proposed decision-support tool (DST) using three TAM constructs: perceived usefulness (PU), perceived ease of use (PEOU), and behavioural intention to use (BI). Because participants did not directly interact with a functioning DST, the findings reflect their expectations and intended use rather than actual system usability or adoption. The analysis also compares the perspectives of participants from the Palestinian territories (C1–C7) and Syria (C8–C11) to identify commonalities and context-specific differences.

5.1 Perceived Usefulness

Participants in both the Palestinian territories and Syria viewed the proposed DST as potentially useful for strengthening cluster-led coordination and humanitarian distribution planning. Its perceived value centred on improving information sharing and resource allocation, reducing duplication, strengthening inter-cluster coordination, and supporting timely, evidence-based decisions. Key capabilities included centralised data management, real-time information sharing, predictive analysis, route optimisation, delay prediction, and scenario analysis. However, priorities differed across contexts.

Palestinian participants emphasised coordination, information visibility, resource allocation, and reducing duplication, while Syrian participants focused more on timely information, predictive capabilities, and decision-making under rapidly changing conditions. Overall, perceived usefulness depended not only on technological capabilities but also on the DST's alignment with context-specific coordination and distribution challenges.

Proposition 2: *The perceived usefulness of humanitarian decision-support tools increases when their functions address context-specific coordination and distribution challenges*.

5.2 Perceived Ease of Use

Participants in both contexts viewed ease of use as essential to potential DST adoption. As they did not interact with a functioning system, their responses reflect perceived ease of use rather than experienced usability. They emphasised simple interfaces, intuitive navigation, training, technical support, and integration with existing humanitarian systems. However, infrastructure limitations, varying technical skills, resistance to new technology, staff turnover, and training requirements could hinder adoption. Contextual differences were also evident: Syrian participants stressed training, technical support, and adaptability to changing conditions, while Palestinian participants emphasised simplicity, system integration, and infrastructure requirements. Overall, perceived ease of use depended on both DST design and the organisational and operational conditions of conflict-affected settings.

Proposition 3: *Anticipated ease of use depends on system simplicity, training, technical support, interoperability, and the operational conditions in which the technology is used.*

5.3 Behavioural Intention to Use

The Participants in both the Palestinian territories and Syria expressed a generally positive but conditional intention to use the proposed DST. Their willingness depended on its operational value, information reliability, system compatibility, and ease of use. Technological sophistication alone was insufficient; participants emphasised the tool's ability to address coordination challenges and support operational decision-making. While Palestinian participants prioritised coordination and resource management, Syrian participants emphasised timely decisions under rapidly changing conditions. Across both contexts, reliability and contextual fit were key determinants of intention to use. These findings indicate that behavioural intention to use a DST in humanitarian settings is influenced by the perceived relationship between technological capability and operational relevance. Humanitarian practitioners are more likely to intend to use a system when they believe that it can improve their work while remaining compatible with existing processes and conditions.

Proposition 4**:** *Behavioural intention to use humanitarian decision-support tools is strengthened when users perceive clear operational value, reliability, compatibility, and contextual fit*.

5.4 Theoretical Implications

This study contributes to humanitarian logistics theory by linking cluster-led coordination challenges with the perceived value and intended use of decision-support tools (DSTs) in conflict-affected settings. Rather than viewing DSTs solely as technological innovations, the findings position them as potential responses to interconnected challenges in information, communication, resources, access, security, and organisational capacity. The cross-case comparison of the Palestinian territories and Syria further shows that, although these challenges are shared, their manifestations vary by context, highlighting the need for context-sensitive coordination capabilities.

The study also extends the Technology Acceptance Model (TAM) to humanitarian settings by showing that perceived usefulness, perceived ease of use, and behavioural intention depend on both technological features and operational conditions. Participants valued the proposed DST according to its ability to address coordination problems, integrate with existing systems, provide reliable information, and operate under challenging conditions. Thus, successful adoption requires more than technological functionality; it depends on alignment with humanitarian processes, organisational readiness, user capabilities, infrastructure, and context-specific needs. Four propositions developed from the findings capture these relationships among coordination challenges, perceived usefulness, perceived ease of use, and behavioural intention.

5.5 Practical Implications

The challenges identified in cluster-led coordination have important implications for humanitarian logistics managers in conflict settings. Resource, communication, and security constraints require structured yet adaptable coordination to reduce duplication and ensure equitable aid delivery. Strengthening data management can support timely decision-making, forecasting, inventory control, and route optimisation, while contingency plans should address access and security risks through alternative routes, safe distribution points, and regular risk assessments. Reliable communication infrastructure is also essential for effective coordination.

Decision-support tools (DSTs) offer further potential to improve operational efficiency by supporting scenario analysis, route optimisation, and dynamic resource allocation under changing conditions. Managers should therefore strengthen inter-cluster collaboration, standardise information-sharing practices, and integrate DSTs into routine logistics processes to improve transparency and coordination. Training and technical support are essential, particularly in infrastructure-constrained environments. Finally, effective community feedback mechanisms can help ensure that aid distribution remains responsive to evolving needs.

6. CONCLUSION AND FUTURE RESEARCH

This study offers important insights into the implementation of the cluster-led coordination approach for relief distribution within conflict-affected settings, with a specific focus on the Palestinian territories and Syria. It identifies key challenges that impede effective coordination, such as resource constraints, communication breakdowns and data-management issues. The research also explores the intention to use the decision-support tool within this framework, highlighting its potential to enhance efficiency, transparency and coordination in aid distribution. Overall,

the study contributes to a deeper understanding of how cluster-led coordination operates in conflict environments. It also lays a foundation for future research on the long-term effectiveness and cross-regional applicability of cluster-led coordination approaches, as well as user experience with decision-support tools. The integration of decision-support tools within the cluster-led coordination framework presents significant opportunities to enhance operational efficiency, strategic coordination, and overall humanitarian impact.

Future research should develop AI-enhanced and resilient frameworks to strengthen cluster-led coordination. These frameworks could use predictive analytics to anticipate disruptions, integrate community-led last-mile distribution, and strengthen verification, real-time monitoring, accountability, and equitable aid allocation. Future studies should also assess the long-term effectiveness of cluster-integrated DSTs across contexts, explore emerging technologies for decision support, and develop standardised protocols for cross-cluster training, localisation, data ethics, and operational sustainability. Such advances could strengthen inter-cluster coordination, improve resource allocation, and enhance the effectiveness of humanitarian response in conflict settings.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENTS

The data and supplementary materials supporting the findings of this study are available from the corresponding author upon reasonable request.

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APPENDIX

Appendix A: Detailed Semi-Structured Interview Questions

Respondents' Information

Gender:
Current Position:
location (Palestine or Syria):
Name of the humanitarian organization:
The cluster to which you belong:

Interview Questions

Cluster-Led Coordination Approach / Challenges in Times of Armed Conflict

Goals of Cluster approach
From your perspective, what are the primary goals and responsibilities of the cluster-led coordination approach in humanitarian aid distribution?
Do you believe this approach has enhanced the effectiveness of the humanitarian aid distribution during armed conflict disasters? (Yes / No)

Enhancing Service Delivery
What are the key challenges to providing a coordination platform in line with the Humanitarian Response Plan (HRP) and strategic priorities?
What are the key challenges in developing mechanisms to eliminate duplication of efforts in humanitarian aid distribution during armed conflict?

Enhancing the HC/HCT's strategic decision-making process
What are the key challenges you encounter when preparing comprehensive needs assessments of the affected civilians in areas of armed conflict across and within cluster?
How do you identify emerging gaps, obstacles, duplication issues, and cross-cutting concerns in your cluster's response to armed conflict disasters? Could you provide examples of challenges you have faced?
What are the key challenges that arise when you formulate priorities based on your needs assessments and gap analyses?

Formulating and implementing strategies
What are the key challenges you face when developing sectoral humanitarian aid distribution plans, objectives, and indicators that support the response's strategic objectives in times of armed conflict? How do you ensure that these plans are both effective and actionable?
How do you ensure that your cluster's activities adhere to the agreed-upon standards and guidelines? What are the main challenges you've encountered in this process during times of armed conflict?
Do you think funding requirements become clearer during times of armed conflict? (Yes / No) and Why?

Advocate on behalf of individuals, communities, and those affected by clusters
What are the main challenges Cluster encounters in identifying the concerns of cluster participants and affected people?
How do these challenges affect the cluster's ability to advocate effectively on behalf of themselves during armed conflict?

Monitoring and reporting
What are the key challenges Cluster faces in monitoring and reporting on the effectiveness of humanitarian aid distribution in conflict zones?
How does armed conflict affect a cluster's ability to gather accurate data and assess the impact of interventions?

Undertaking Contingency Planning and Preparedness Actions
What are the key factors Cluster considers when planning for contingencies in an active conflict environment?
What are the key challenges that Cluster faces in preparing for the escalation of armed conflict, and what resources do you find most lacking in these situations?

Feedback and Suggestions
What is the feedback you have received from affected communities regarding the efficiency of the cluster-led coordination approach for humanitarian aid distribution?
What suggestions do you have for enhancing the cluster-led coordination approach for humanitarian aid distribution in regions affected by armed conflict disasters in the future?

Decision support tool for relief aid distribution planning, adaptation within the cluster-led coordination approach

Perceived Usefulness (PU)
How do you believe the adoption of decision-support tools for relief aid distribution planning within a cluster-led coordination approach will benefit the humanitarian response during armed conflicts?
How do you think that the adoption of a decision-support tool within cluster-led coordination approach will improve the humanitarian aid distribution planning during the armed conflicts? What tools' features or functions contribute to this planning?
How do you believe this decision-support tool will benefit collaboration between different humanitarian clusters involved in humanitarian response?

Appendix A Detailed Semi-Structured Interview Questions (Cont'd)

Cluster-Led Coordination Approach / Challenges in Times of Armed Conflict
Perceived Ease of Use (PEOU) What aspects of the decision-support tool do you find simple and straightforward to adopt within the cluster-led coordination approach? Can you describe any specific interactions that you think are particularly easy? How do you perceive the ease of adopting the decision-support tool within the cluster-led coordination approach during armed conflicts? Are there any particular challenges or advantages you anticipate? Do you believe training employees to use the decision-support tool is simple? Can you provide any insights or experiences related to the training process?
Behavioral Intention to Use (BITU) What are your intentions regarding the adoption of the decision-support tool for aid distribution within the cluster-led approach in the future? Can you elaborate on the factors that influence your willingness to adopt this tool?
Modifications From your perspective, what modifications would make this decision-support tool more adaptable within the cluster-led coordination approach in times of armed conflict disasters?

Appendix B Key Challenges Facing the Core Functions of the Cluster-Led Coordination Approach

Enhancing Service Delivery					
What are the key challenges to providing a coordination platform in line with the Humanitarian Response Plan (HRP) and strategic priorities?			**What are the key challenges in developing mechanisms to eliminate duplication of efforts in humanitarian aid distribution during armed conflict?**		
Theme	**Respondents**	**Details**	**Theme**	**Respondents**	**Details**
Resource Constraints	C1, C2, C6, C7, C11	Limited financial and human resources complicate implementation and alignment with HRP.	**Data Management**	C1, C2, C3, C6, C7, C8, C9, C11	Lack of central data management systems, fragmented information, and insufficient real-time data sharing lead to duplication of efforts.
Complexity of Stakeholders	C1, C2, C6, C11	Diverse humanitarian actors with different objectives and policies make coordination complex.	**Coordination and Communication**	C1, C2, C3, C4, C5, C6, C8	Poor coordination, limited communication, and varying approaches among organizations result in overlapping activities.
Data and Information	C1, C2, C6, C9	Availability, integration, and management of accurate data are challenging.	**Security and Access**	C1, C2, C6, C7	Security concerns and access restrictions complicate effective monitoring, data gathering, and coordination.
Logistical Challenges	C1, C8	Logistical constraints and access issues hinder effective coordination.	**Resource Constraints**	C2, C4, C5, C6	Limited resources, competition for resources, and focus on immediate needs limit investment in coordination of humanitarian aid distribution efforts and long-term improvements.

Appendix B Key Challenges Facing the Core Functions of the Cluster-Led Coordination Approach (Cont'd)

Theme	Respondents	Details	Theme	Respondents	Details
Reporting Requirements	C4, C5	Heavy reporting requirements and complicated templates overwhelm organizations and staff.	**Diverse Organizational Priorities**	C2, C5, C6, C10	Different operational standards, priorities, and methods among organizations make it challenging to harmonize efforts and eliminate duplication.
Communication Barriers	C5, C8, C9, C11	Lack of communication services and barriers to information flow among stakeholders.	**Dynamic Conditions**	C2, C6, C9	Rapidly changing conditions and the dynamic nature of conflict lead to ad hoc responses and shifting priorities, increasing the risk of duplication.
Security Concerns	C6, C8, C9, C10	Security issues and access restrictions impact operational effectiveness and coordination.	**Monitoring and Evaluation**	C6	Volatile environments hinder effective monitoring and evaluation, impairing tracking and addressing of service delivery duplication.
Changing Conditions	C2, C6, C9	Rapidly changing conditions and dynamic crises require quick adjustments and adaptation of plans.	**Accountability and Leadership**	C4, C6	Lack of clear accountability, national leadership, and a unified database for all humanitarian institutions affects coordination and effort unification.
Diverse Priorities	C6, C7, C10	Varied priorities among organizations and stakeholders' complicate alignment with national and international strategies.			
Accountability and Responsibility	C6	Ensuring clear accountability and responsibility among all parties can be difficult, leading to execution and coordination issues.			
Shrinking Funding	C7	Shrinking and reshaping funding based on other global conflicts affects resource availability.			

Appendix B Key Challenges Facing the Core Functions of the Cluster-Led Coordination Approach (Cont'd)

Enhancing the HC/HCT's Strategic Decision-Making Process								
What are the key challenges you encounter when preparing comprehensive needs assessments of the affected civilians in areas of armed conflict across and within cluster?			**How do you identify emerging gaps, obstacles, duplication issues, and cross-cutting concerns in your cluster's response to armed conflict disasters? Could you provide examples of challenges you have faced?**			**What are the key challenges that arise when you formulate priorities based on your needs assessments and gap analyses?**		
Theme	**Respondents**	**Details**	**Theme**	**Respondents**	**Details**	**Theme**	**Respondents**	**Details**
Security Concerns	C1, C2, C3, C6, C7, C8, C9, C10, C11	Security threats, restricted access, and risks to field workers impact data collection and the safety of assessment teams.	**Data Collection and Sharing**	C1, C2, C3, C5, C6, C8, C9, C11	Collection of available data, regular monitoring, and field reports help identify gaps and duplication, but sharing and coordination are often limited.	**Data Accuracy and Reliability**	C1, C2, C5, C6, C11	Ensuring the accuracy and reliability of data from assessments is challenging, particularly in conflict zones with incomplete or biased information.
Data Accuracy and Reliability	C2, C6, C8, C9, C10	Incomplete, biased, or outdated data from chaotic environments leads to inaccurate needs assessments.	**Coordination Meetings**	C2, C3, C6, C8, C9	Regular coordination meetings and discussions are essential for spotting overlaps and addressing gaps but are sometimes hindered by lack of participation or communication.	**Rapidly Changing Conditions**	C3, C6, C8, C9	The dynamic nature of armed conflicts leads to rapidly changing needs and priorities, making it difficult to maintain stable and relevant priorities.
Resource Constraints	C1, C2, C6, C7	Limited financial, human, and logistical resources hinder thorough and comprehensive assessments.	**Feedback Mechanisms**	C1, C2, C6, C8	Field assessments and feedback from local partners and affected populations help identify emerging needs and issues but require robust mechanisms.	**Resource Constraints**	C1, C2, C6, C7, C8, C9	Limited resources necessitate tough choices and prioritization, potentially leaving critical needs unaddressed and impacting the balance of response efforts.
Coordination and Fragmentation	C1, C2, C4, C6, C10	Fragmented efforts and varying methodologies among organizations cause duplication, conflicting assessments, and coordination challenges.	**Resource and Activity Mapping**	C1, C6, C9	Mapping resources and activities to find overlaps and gaps is critical but often faces challenges due to data fragmentation and inconsistent methodologies.	**Coordination Among Multiple Actors**	C2, C6, C10	Aligning priorities with multiple stakeholders and humanitarian actors can be difficult, leading to fragmented or conflicting approaches.

Appendix B Key Challenges Facing the Core Functions of the Cluster-Led Coordination Approach (Cont'd)

Theme	Respondents	Details	Theme	Respondents	Details	Theme	Respondents	Details
Communication Barriers	C1, C5, C6, C9	Communication failures and lack of internet affect response times, clarity, and coordination among stakeholders.	**Use of Technology**	C6, C11	Utilizing technology for real-time data collection and analysis is effective but requires adequate training and resources.	**Security Concerns**	C1, C2	Security concerns limit the ability to conduct thorough assessments and respond effectively to identified needs.
Rapidly Changing Conditions	C6, C8, C10	Dynamic conflict situations and rapidly changing conditions make assessments quickly outdated and require constant updates.	**Cross-Cutting Issue Reviews**	C6, C10	Addressing cross-cutting issues like protection and gender inclusion is crucial but adds complexity to the coordination efforts.	**Political and Operational Constraints**	C4, C6	Political and security factors, donor requirements, and organizational procedures affect priority setting and aid allocation.
Local Knowledge	C6, C8	Lack of understanding of local contexts and needs results in incomplete or inaccurate assessments.	**Monitoring and Evaluation**	C6	Tracking the effectiveness and coverage of activities through M&E is essential but difficult in volatile environments.	**Local Context and Needs**	C6, C7, C10	Understanding and integrating local contexts, cultural norms, and specific needs into a priority setting is crucial but challenging.
Logistical Challenges	C1, C6, C7	Roadblocks, damaged infrastructure, and movement restrictions hinder access to affected areas and comprehensive data gathering.				**Balancing Immediate and Long-Term Needs**	C6, C8, C9	Balancing immediate, life-saving interventions with long-term recovery efforts is difficult, especially with competing demands and limited resources.
Ethical and Safety Concerns	C6	Risks to the privacy and safety of affected individuals raise ethical issues and potential harm during assessments.						

Appendix B Key Challenges Facing the Core Functions of the Cluster-Led Coordination Approach (Cont'd)

Formulating and Implementing Strategies								
What are the key challenges you face when developing sectoral humanitarian aid distribution plans, objectives, and indicators that support the response's strategic objectives in times of armed conflict? How do you ensure that these plans are both effective and actionable?			**How do you ensure that your cluster's activities adhere to the agreed-upon standards and guidelines? What are the main challenges you've encountered in this process during times of armed conflict?**			**Do you think funding requirements become clearer during times of armed conflict? (Yes / No) and why?**		
Theme	**Respondents**	**Details**	**Theme**	**Respondents**	**Details**	**Theme**	**Respondents**	**Details**
Lack of Updated Data	C1, C11	Lack of updated data, instability of logistics procedures, dynamic changes in the environment	**Clear Standards and Guidelines**	C1, C11	Establish and regularly update clear standards and guidelines, conduct regular training sessions, and regular reporting	No – Increased Complexity	C1, C3, C4, C6, C8, C9, C10, C11	Indicated that funding requirements often become more complex and less clear due to the dynamic and unpredictable nature of armed conflicts.
Volatile and Unpredictable Environment	C2, C3, C4	A volatile environment makes it hard to develop plans that remain relevant over time. Developing plans that are both strategic and practical can be difficult due to the unpredictable nature of conflicts. The armed conflict significantly impacts strategies, making long-term planning difficult	**Operational Protocols**	C2	Develop operational protocols, ongoing training, internal assessments, regular meetings, transparency, community feedback		C2, C6, C8	Issues include evolving needs, increased costs, uncertain duration, and shifting priorities
Lack of Clarity and Coordination	C5, C11	Lack of clarity, role distribution, lack of specificity, scope, budget availability	**Feedback Mechanisms**	C3, C11	Feedback from beneficiaries, cluster members, and other stakeholders	Yes – Immediate Needs Clarified	C5, C7	funding requirements become clearer as the urgent needs of affected people become more apparent
Rapidly Changing Conditions	C6, C7, C8	Rapidly changing conditions, limited data, coordination issues, resource constraints, security risks, cultural sensitivities	**Coordination with Cluster Leads**	C4	Attend meetings and coordinate with cluster leads		C7	Immediate needs such as shelter, food, and basic health are prioritized

Appendix B Key Challenges Facing the Core Functions of the Cluster-Led Coordination Approach (Cont'd)

Theme	Respondents	Details	Theme	Respondents	Details	Theme	Respondents	Details
Conflict Realities	C9, C10	Reality during conflicts not align with strategies and criteria set by humanitarian organizations. Political changes, an increasing number of affected people, need for participatory approach	**Alignment with Mandate**	C5	Align activities with mandate and terms of reference of cluster, reliable data, clear coordination mechanism			
			Protocol Development	C6	Develop protocols, regular training, M&E systems, regular meetings, audits, feedback mechanisms, documentation			
			Monitoring and Evaluation	C7, C8, C9, C10	Monitoring and evaluation based on collected information. Regular training, monitoring, and evaluations. Adhering to standards and guidelines through regular training, and monitoring. Regular training, monitoring, and evaluation, close work with other clusters			

Appendix B Key Challenges Facing the Core Functions of the Cluster-Led Coordination Approach (Cont'd)

Advocate on Behalf of Individuals, Communities, and those Affected by Clusters					
What are the main challenges Cluster encounters in identifying the concerns of cluster participants and affected people?			**How do these challenges affect the cluster's ability to advocate effectively on behalf of themselves during armed conflict?**		
Theme	**Respondents**	**Details**	**Theme**	**Respondents**	**Details**
Lack of Data and Evidence	C1, C5, C11	Lack of updated data and evidence, inability to communicate effectively	**Lack of Evidence**	C1	Not based on evidence, the audience asking for more information and clarifications
Limited Access and Security	C2, C6, C8, C9, C10	Limited access to conflict zones, security risks, volatile security environment, danger to staff, threat to personal safety	**Limited Access and Security**	C2, C6, C8, C9, C10	Limited access to accurate information, security risks restricting data collection, weakened position in advocacy, reduced advocacy efforts due to threat to personnel, difficulty in engaging with affected communities
Communication Barriers	C2, C6, C9, C10	Poor infrastructure, language differences, technological limitations, miscommunication due to cultural differences	**Unreliable Information**	C3, C5, C11	Unagreed messages losing impact on decision-makers, the credibility of the cluster being questioned
Diverse Needs and Priorities	C3, C6, C11	Incompatible criteria and goals, different priorities among cluster members, diverse needs across demographics, geography, and individual circumstances	**Communication and Coordination**	C2, C6	Communication breakdowns, coordination difficulties leading to inconsistent messaging, poor infrastructure and language issues affecting information exchange, fragmented efforts among humanitarian actors
Lack of Coordination	C4, C6	Lack of clarity, vision, and leadership, poor coordination among cluster members, limited participation and representation, fragmented efforts among humanitarian actors	**Diverse Needs and Priorities**	C6	Varied needs complicating prioritization, marginalized groups being underrepresented, crisis complexity leading to interrelated issues being overlooked
Reliability of Information	C2, C6	Biased or inaccurate data, misinformation, propaganda, chaotic nature of conflict, fear of reprisals, political influences	**Feedback Mechanisms**	C6, C10	Ineffective feedback systems hinder timely response to concerns, difficulty in capturing and acting on concerns from affected populations
Cultural Sensitivities	C6, C10	Challenges in understanding and respecting cultural norms, traditions, and local contexts	**Resource Constraints**	C2, C6	Limited resources restricting comprehensive data collection, reduced ability for advocacy activities such as campaigns or public relations efforts

Appendix B Key Challenges Facing the Core Functions of the Cluster-Led Coordination Approach (Cont'd)

Theme	Respondents	Details	Theme	Respondents	Details
Resource Constraints	C6, C10	Limited resources such as time, personnel, and funding, resource allocation issues	**Strategies to Address Challenges**	C6	Enhanced security measures, improved communication infrastructure, inclusive participation, verifying and cross-checking information, cultural sensitivity training, optimized resource allocation, holistic approaches to complex needs, strengthened coordination among actors, establishing effective feedback mechanisms
Complexity of Humanitarian Crises	C6	The complexity and multifaceted nature of crises make it difficult to identify and address all relevant concerns and needs	**Protective Measures**	C7	Some organizations rely on phone calls or online questionnaires to protect field workers
Feedback Mechanisms	C6	Difficulty in establishing and maintaining effective feedback mechanisms			
Varying Experience Levels	C7	Different levels of experience among cluster participants, particularly in conflict settings			

Monitoring and Reporting

What are the key challenges Cluster faces in monitoring and reporting on the effectiveness of humanitarian aid distribution in conflict zones?			**How does armed conflict affect a cluster's ability to gather accurate data and assess the impact of interventions?**		
Theme	**Respondents**	**Details**	**Theme**	**Respondents**	**Details**
Lack of Distribution Plans	C1	Absence of clear distribution plans and low or no reporting mechanisms	**Security Risks**	C1, C2, C3, C6, C9, C10	Unsafe conditions for data collectors, safety risks, and limited access due to active combat zones
Security Risks	C2, C3, C6, C8, C9, C10	Risks from ongoing violence, including attacks or kidnappings, limiting safe operation and data collection	**Access Constraints**	C2, C4, C5, C6, C8, C9, C11	Physical barriers such as roadblocks, damaged infrastructure, blocked access routes, and movement restrictions prevent data collection teams from reaching affected communities
Access Constraints	C1, C2, C3, C6, C8, C9, C10	Limited access to certain areas due to security constraints, destruction of infrastructure, movement restrictions, and restricted access to affected areas	**Rapid Changes**	C2, C6, C9, C11	The rapidly changing nature of conflict makes it difficult to obtain up-to-date and accurate information, shifting frontlines, fluctuating violence, and evolving humanitarian needs

Appendix B Key Challenges Facing the Core Functions of the Cluster-Led Coordination Approach (Cont'd)

Theme	Respondents	Details	Theme	Respondents	Details
Resource Constraints	C2, C6, C8, C10	Limited availability of resources including transportation, equipment, funds, and personnel	**Communication Barriers**	C2, C4, C6, C9	Disruptions in communication networks including internet and phone outages hindering real-time data collection and reporting
Communication Issues	C2, C6, C8, C9, C10, C11	Unreliable or non-existent communication networks complicate data collection and reporting	**Data Reliability**	C1, C2, C5, C6, C10	The reluctance of affected individuals to provide information due to fear of repercussions, mistrust of outsiders, fragmented or unreliable data, reliance on secondary data that may be outdated or inaccurate
Data Accuracy	C2, C4, C5, C6, C10	Incomplete, outdated, inaccurate, or biased data due to misinformation, influence of conflict parties, or chaotic environment	**Resource Constraints**	C2, C6, C10	Limited availability of resources including trained personnel, technology, and equipment impacting the effectiveness of data collection and impact assessments
Ethical Standards	C2	Challenges in adhering to ethical standards such as informed consent and confidentiality	**Ethical and Psychological Factors**	C2, C4, C10	Ethical challenges such as maintaining informed consent and confidentiality, psychological stress on staff and affected populations affecting data quality
Coordination Problems	C2, C6, C11	Fragmented efforts among humanitarian actors, local authorities, and international bodies complicate monitoring and reporting	**Adapting Data Collection Methods**	C2, C6	Utilizing remote sensing, satellite imagery, and digital data collection tools, implementing rigorous safety protocols for staff, using local networks to gather information, collaborating with local organizations and communities, and conducting frequent and iterative assessments to adapt to changing conditions
Rapid Changes	C6, C10	Shifting conflict conditions make it difficult to maintain up-to-date information			
Sensitivity of Questionnaires	C7	Sensitivity of questionnaires discussing household needs and the real needs of families			
Psychological Stress	C10	Psychological stress on staff and affected populations impacts the quality and reliability of reported data			

Appendix B Key Challenges Facing the Core Functions of the Cluster-Led Coordination Approach (Cont'd)

Undertaking Contingency Planning and Preparedness Actions					
What are the key factors Cluster considers when planning for contingencies in an active conflict environment?			**What are the key challenges that Cluster faces in preparing for the escalation of armed conflict, and what resources do you find most lacking in these situations?**		
Theme	**Respondents**	**Details**	**Theme**	**Respondents**	**Details**
Needs Assessment and Prioritisation	C1, C2, C6	Assessing current and forecasted needs (e.g., winterization and summarization), size of needs, and required funds.	**Security Risks**	C1, C2, C5, C6, C10	Ensuring the safety of personnel and resources in volatile environments, and dealing with security concerns.
Security Risks	C2, C3, C6, C8, C9, C10	Ensuring staff safety, and access, and addressing security concerns and movement restrictions.	**Resource Shortages**	C1, C2, C4, C5, C6, C7, C8, C9, C10	Limited financial, logistical, and human resources, including shortages of essential supplies such as medical supplies, food, and clean water.
Resource Allocation	C1, C2, C5, C6, C8, C9, C11	Assessing and allocating necessary resources, including materials access and restrictions, and dealing with potential shortages.	**Coordination and Communication Issues**	C2, C3, C5, C6	Difficulties in coordinating with other organizations, local authorities, and international bodies, and ensuring effective communication.
Coordination and Communication	C2, C3, C5, C7, C11	Coordination with other actors, including local and international entities, and ensuring effective communication.	**Data Accuracy and Availability**	C2, C3, C6, C10, C11	Challenges in collecting accurate data due to instability, restricted access, and lack of reliable information.
Local Context and Partnerships	C2, C3, C6, C8, C9, C10, C11	Understanding and integrating local conditions, needs, and capacities of local partners.	**Financial Constraints**	C1, C2, C4, C6, C7, C8, C9, C10	Securing adequate and timely funding for conflict response operations, and dealing with donor fatigue in protracted crises.
Flexibility and Adaptability	C2, C6, C10	Designing adaptable and scalable plans to address rapidly changing conflict conditions.	**Rapid Changes and Unpredictability**	C2, C4, C6, C8, C9	Adapting plans to rapidly shifting conditions and the unpredictable nature of conflict dynamics.
Experience and Skills	C3, C4	Leveraging the experience of members, staff abilities, and readiness.	**Logistical Challenges**	C1, C2, C6, C8, C9, C10	Issues with secure transportation, warehousing, and managing material storage costs and expiry dates.
Historical Data and Conflict Patterns	C8, C9, C10	Using historical data on conflict patterns and potential escalation scenarios to anticipate future conditions.	**Skilled Personnel**	C2, C8, C9	Shortage of trained personnel who can operate effectively in high-risk environments.
Legal and Ethical Considerations	C2	Considering legal and ethical aspects in humanitarian aid distribution planning.	**Ethical and Psychological Factors**	C2	Dealing with ethical considerations and psychological stress on staff and affected populations.

Appendix B Key Challenges Facing the Core Functions of the Cluster-Led Coordination Approach (Cont'd)

Theme	Respondents	Details	Theme	Respondents	Details
Monitoring and Evaluation	C2	Continuously monitoring and evaluating the situation to update plans as needed.			
Crosscutting Issues	C4	Addressing issues such as equity, disability, and marginalized groups in planning.			

Appendix C The Adoption of a DST for HDP Within a Cluster-Led Coordination Approach to Humanitarian Response During Armed Conflicts, as Perceived by Humanitarian Cluster Coordinators

Perceived Usefulness (PU)

Question	Theme	Details
How will the adoption of decision-support tools benefit humanitarian response?	Improved Aid Coverage and Distribution	C1: "Clear distribution plans improve aid coverage". C8: "Streamline logistics and ensure efficient resource allocation".
	Efficiency and Transparency	C3: "Reduces duplication and enhances transparency". C6: "Optimize resource allocation and reduce duplication".
	Enhanced Coordination	C1: "Better communication and coordination among clusters". C2: "Streamlined coordination and better alignment across clusters".
	Improved Decision-Making	C2: "Real-time data and predictive analytics for informed decisions". C10: "Accurate, timely information for efficient aid delivery". C11: "It allows for taking decisions based on facts".
What features or functions improve relief aid distribution planning?	Data Management and Real-Time Data	C1: "Centralized data management". C2: "Real-time data feeds and predictive modeling".
	Coordination and Communication	C2: "Secure communication channels and real-time tracking". C8: "Optimize routes and predict delays".
	Adaptability and Customization	C2: "Customizable dashboards and scenario simulations". C10: "Customizable features and training modules".
How will the tool benefit collaboration between clusters?	Centralized Information	C2: "Shared platform for data and coordination". C8: "Centralized data sharing to avoid duplication".
	Improved Coordination and Communication	C1: "Enhanced communication among clusters". C2: "Better scheduling and joint planning". C11: "Support the multi sector response planning"

Perceived Ease of Use (PEOU)

Question	Theme	Details
What aspects are simple and straightforward to adopt?	User-Friendly Interface	C2: "Intuitive interface with clear menus". C10: "User-friendly dashboard and drag-and-drop functionality".
	Training and Support	C2: "Hands-on training, step-by-step guides". C8: "Comprehensive training modules and technical assistance".
How do you perceive the ease of adopting the tool? Are there challenges or advantages?	Technical Challenges	C2: "Poor infrastructure and varying technical skills". C8: "Resistance to new technology and staff turnover".
	Advantages	C6: "Centralized information and improved decision-making". C8: "Enhanced coordination and efficiency".

Appendix C The Adoption of a DST for HDP Within a Cluster-Led Coordination Approach to Humanitarian Response During Armed Conflicts, as Perceived by Humanitarian Cluster Coordinators (Cont'd)

Question	Theme	Details
Do you believe training is simple?	Training Complexity	C2: "Varies by tool interface and user skill". C3: "Change management is challenging".
	Training Methods	C2: "Hands-on workshops and ongoing support". C8: "Effective training through practical scenarios".
Behavioral Intention to Use		
Question	**Theme**	**Details**
What are your intentions regarding the adoption of the tool?	Positive Intentions	C6: "Willing to adopt to enhance efficiency and coordination". C8: "Intend to adopt based on positive pilot tests".
	Influencing Factors	C2: "Integration, reliability, user-friendly interface, minimal training requirements". C10: "Streamline processes and enhance coordination".