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Analysing Supply Chain Risk Management Strategies in Humanitarian Organization

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Master Thesis Degree Project in Sustainable Supply Chain Analytics

Title: Analyzing supply chain risk management strategies in humanitarian organizations

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Abstract

Purpose- This research examines supply chain risk management (SCRM) practices in humanitarian organizations compared to commercial sectors to identify areas for improvement in humanitarian supply chains.

Design/Methodology/Approach- The study employs structured interviews with 12 experts from both sectors, followed by thematic analysis to uncover common themes and patterns.

Findings- Differences emerge in risk categorization and assessment methods, with both sectors utilizing scaling and scoring systems. However, certain mitigation strategies, like logistics outsourcing and centralization, are less prevalent in humanitarian contexts due to budget constraints and security threats.

Practical Implications- The research emphasizes the importance of tailoring risk management strategies to address the unique challenges faced by humanitarian organizations to improve supply chain effectiveness.

Research Limitations/Implications- Small sample size and decentralized risk responsibilities within organizations, warranting a targeted sampling approach in future research. Additionally, the study highlights the need for sector-specific analytical models to address detailed risk

Originality/Value- This study contributes to narrowing the gap in humanitarian supply chain literature by shedding light on sector-specific risk management practices. Insights gained from comparing practices with commercial sectors offer valuable lessons and strategies for enhancing SCRM in humanitarian contexts.

Keywords Humanitarian supply chain, risk management, comparative analysis, risk management

1. Introduction

Humanitarian supply chain management (HSCM) plays a crucial role in reducing risks and improving the effectiveness of disaster relief operations worldwide, enabling the rapid provision of emergency supplies and reducing human suffering. (Cano-Olivos et al.,2022; Bag et al., 2022). These days, the increasing number and severity of natural disasters are putting significant pressure on humanitarian organizations to deliver humanitarian aid in a timely and cost-effective manner (Abidi et al., 2014). Consequently, HSCM has garnered attention from researchers, practitioners, industries, and policymakers who are seeking ways to enhance logistics processes and service delivery (Agarwal et al., 2019)

While HSCM draws certain insights from commercial logistics strategies, such as inventory management (Balcik and Beamon, 2008; Chakravarty, 2014; Kunz et al., 2014), the establishment of logistics and emergency centers (Najafi et al., 2015; Salman and Yücel 2015; Tuzkaya et al., 2015), and the routing of humanitarian aid and evacuation operations (Vargas-Florez et al., 2015; Zhen et al., 2015), it faces distinctive challenges due to the unique characteristics of humanitarian operations. It has been reported that the differences between commercial and humanitarian supply chain management, in terms of objectives (Ertem et al, 2010), demand patterns (Charles, 2023), and stakeholders (Balcik et al, 2010), influence the approach to handling humanitarian operations and risk management. These problems ultimately lead to delays in delivering aid to the affected populations.

For humanitarian organizations, risk management is essential since it helps to provide a safe working environment, reduce losses, seize opportunities, and create appropriate risk management plans that allow for well-informed decision-making (Husby, 2022). Despite encountering increasingly complex risks, they appear to be more cautious, showing a reluctance to expand their operations in riskier environments (Stoddard et al., 2016). This is due to ethical concerns, gaps in risk management frameworks, issues with national staff and partners, organizational inefficiencies, and the influence of donors and political actors, which collectively pose challenges to maintaining humanitarian principles and effective operation (Stoddard et al., 2016). While existing literature has offered insight on certain aspects of humanitarian supply chain management, it has yet to cover the specifics of risk assessment and management methodologies adopted by these organizations. Although there exists a notable knowledge gap, particularly concerning how humanitarian entities assess risks in that research exploring the specific methodologies used by these organizations for risk assessment is lacking. This gap becomes even more conspicuous when considering distinct categories of risk, such as disaster risk, operational risk, logistics risk, and demand risk (Tran et al., 2018; Cerić et al., 2013; Giannakis and Papadopoulos, 2016).

Although the majority of previous research has been undertaken to identify these risk kinds and difficulties by developing frameworks or lists, there hasn't been enough attention placed on confirming these findings or investigating any potential cause-and-effect linkages between them.

To enhance HSCM in disaster scenarios, it is vital to thoroughly investigate and analyze the underlying factors contributing to the challenges. This involves recognizing the knowledge gap

within the academic field of HSCM, indicating a lack of research in this specific area, and comparing the strategies employed in commercial logistics to identify potential areas for improvement and adaptation. The main purpose of this research is threefold. First, it aims to find out how humanitarian organizations categorize, identify, and prioritize supply chain risk management under the unique challenges and needs of humanitarian context. The utilization of Kaplan's framework offers a structured approach to understanding and addressing supply chain risks specific to humanitarian organizations. Second, this paper aims to define what challenges humanitarian organizations face in managing risks within their supply chains and what practices they employ to mitigate the risks. Third, we aim to compare with commercial sectors in regards with the risks assessment practices and provide useful lessons from them to enhance the supply chain risk management of humanitarian organizations. These three key elements serve as the foundation of the literature review, guiding the examination of current research, approaches, and findings in the fields of supply chain risk management for both commercial and humanitarian settings. The methodology, which mostly uses interviews, explains the structured strategy used in this research to attain these goals. Through interviews, insights will be acquired directly from stakeholders in humanitarian organizations and the commercial sectors, allowing for a full knowledge of their risk management procedures, which will be described in depth in Section 3.

In essence, this research not only fills the gap in the HSCM literature, but it also provides a structured investigation into challenges, practices, and comparative analysis outlined in the objective, providing insightful information for enhancing and modifying risk management techniques in humanitarian supply chain.

After introduction, the remainder of this research is organized as follows. Section 2 presents literature review on supply chain risk management of humanitarian organizations. Research methodology will be presented in Section 3. Next, Section 4 will discuss the findings of supply chain risks practices on commercial organizations and humanitarian organizations. Here we compare the findings from interviews with humanitarian and commercial organizations. Section 5 presents the analysis and interpretation of those results. Finally, section 6 concludes the paper with remarks and discussion of this research.

2. Literature Review

2.1. Literature review

This study uses a literature review to comprehensively explore central aspects of supply chain risk management methods, focusing on their categorization, prioritization, and assessment. Employing a thematic literature review as the analytical approach, typical in qualitative research (Braun & Clarke, 2006), facilitates the identification and analysis of recurring patterns or themes in existing literature. Through this approach, the study seeks insights into diverse methods used for supply chain risk prioritization and assessment and challenges in humanitarian context. In our structured literature review, this research followed three steps: Identification of key terms, searching and screening&finalizing.

2.1.1. Identification of key terms

Based on our research questions, we developed key terms to identify and evaluate the literature. At first, following set of keywords were: "supply chain risk assessment", "supply chain risk prioritization", "supply chain risk measurement", "supply chain risk evaluation", "supply chain risk classification", "humanitarian logistics", "disaster relief operation", "disaster relief logistics" or "humanitarian supply chain". However, it was rather difficult to identify focused on HSC risk literature using only keyword searches since most of the papers didn't include "risk assessment" as a specific keyword. As such, Boolean connectors (AND, OR) were used for more accurate results.

2.1.2. Searching

We searched for the selected keywords using Boolean connectors in the title, abstract, and the keywords of articles found in Google Scholar, EBSCO, PROQUEST, Science Direct, Springer, Emerald, Scopus, and Elsevier. As articles were reviewed, other cited articles were added by looking at the references list of shortlisted articles using "snowballing" method. This yielded a total of 699 articles.

2.1.3. Screening and Finalizing

To identify the papers focused on humanitarian supply chain risk assessment, mitigation strategies and challenges we adopted the criteria for inclusion and exclusion of articles. First, we eliminated duplicates based on titles and authors of the articles. Then, we scrutinized these articles by reading the abstracts to ensure that the article is mainly about assessing and mitigating risk and challenges in humanitarian supply chains. Removing papers based on these criteria reduced the total number of articles to 144.

In the last step, we aimed to focus specifically on papers addressing risk assessment, mitigation strategies, and challenges within humanitarian supply chains. Despite the initial efforts to narrow down the selection to articles relevant to humanitarian supply chains, it became apparent that some literature still encompassed both commercial logistics and humanitarian supply chain topics, or delved into case studies of specific countries that were not directly related to the thesis topic. Therefore, in this final screening stage, we employed a more rigorous content analysis approach to ensure that the selected articles were indeed centered on assessing

and mitigating risks within humanitarian supply chains. This thorough examination led to the identification of 42 articles that directly addressed the methods employed by humanitarian organizations in risk assessment and mitigation, as well as the challenges they face in this regard (Figure 1).

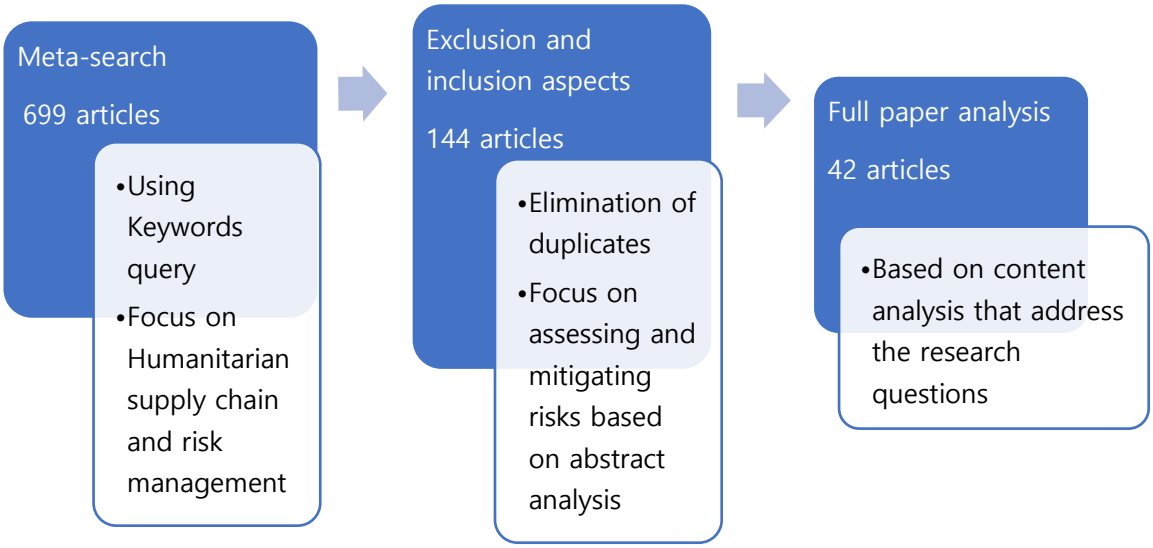

Figure 1. Article Screen methodology

2.1.4. Descriptive Analysis

In this step, we analyzed the distribution of the 42 articles over the time period between 2004 and 2023 which is shown in Figure 2. In most of the articles (69 percent) the primary focus is on introducing risk assessment and mitigation. Also, 45 per cent of the papers (19 articles) specifically delves into the humanitarian supply chain. Most of these articles find their publication in logistics and supply chain management research journals, with an additional 5 articles emerging from university sources.

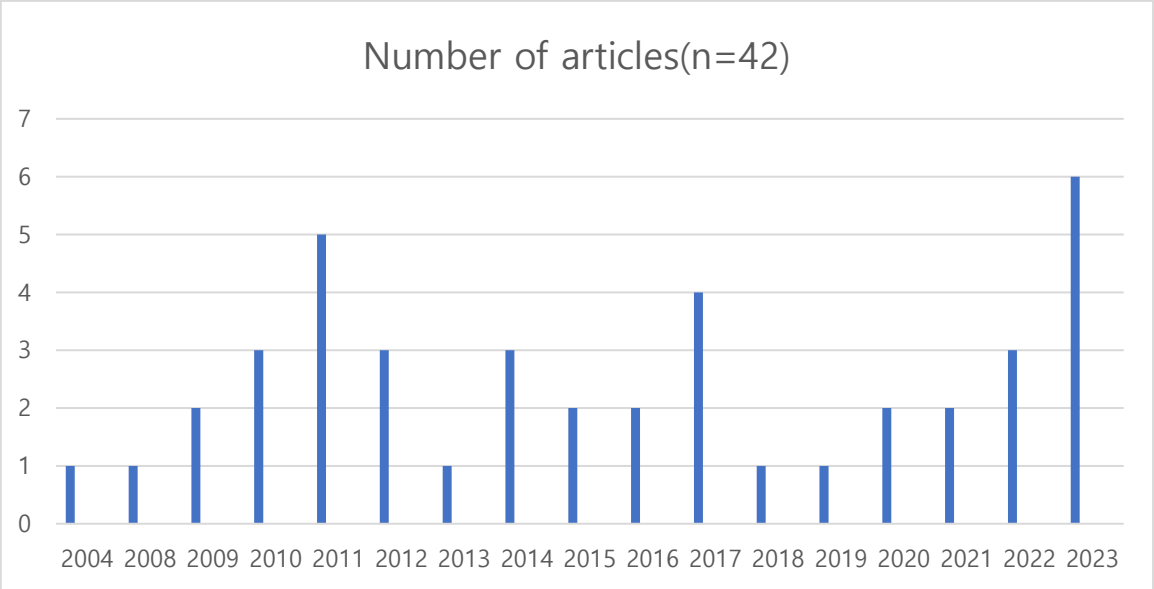

Figure 2. Number of articles published in the period 2004-2023

2.2. Risk categorization in humanitarian organizations

When offering disaster support, humanitarian organizations have to deal with unpredictable and dynamic situations while transporting, storing, and distributing goods, which exposes them to a variety of risks. The categorization of risks is based on existing literature specific to humanitarian supply chain management.

According to Christofferson, J. and E. Müller (2017) and Chukwuka (2023), risks in the supply chain might be internal or external. Demand, supply, process and control, network malfunction, and organizational hazards are examples of internal risks. Environmental variables and other external dangers are beyond the organization's direct control. Likewise, Pontré et al. (2011) categorized risks into endogenous risks and exogenous risks. Governance, coordination, supplier, and procurement-related risks are examples of endogenous hazards. Politics and the environment are examples of exogenous dangers. Moreover, Mohaghar et al. (2017) concentrated on the risks associated with providing humanitarian aid, such as low knowledge, the disappearance of rescuers in times of crisis, inadequate education, and insufficient assistance for those who need help.

Furthermore, The infrastructure-related hazards in humanitarian logistics are also highlighted by Awan and Ali (2022) and Chari et al. (2021), who address the ports, storage, transportation network, warehousing facilities, and electricity. The many risk environments in supply chain management are comprehensively viewed through these classifications. The specific risks in humanitarian supply chains are shown in Table 1, which is based on scattered data found in the literature and identifies risk factors that are common in emergency supply chains.

Table. 1. Categorization of risk types in humanitarian logistics

Authors	Risk types	Risk examples
Pontré et al. (2011)	1.Endogenous Risks 2.Exogenous Risk	- poor procurement planning - lack of accredited suppliers - inadequate oversight of contractor - issues related to governance, legislation, training, and coordination with national authorities. - adverse natural environments - civil/military activity - poor delivery infrastructure - political environment
Christofferson and Müller (2017)	Internal Risks: 1. Organizational Risks 2. Process and Control Risks 3. SC-Related Risks and Uncertainties Network-Related Risks: 1. Suboptimal Interaction 2.Humanitarian Logistics Context External Risks: 1. Environmental Risk 2. Macro-Environmental Risks 3.Contextual Disruptions/Constraints	- Labor and production uncertainties -Information technology-related uncertainties - Process risks arise from internal activities and asset performance - Control risks result from rule application and misapplication, affecting supply policies - Internal disruptions like process issues and standard procedures - External disruptions within the supply network, involving partners and suppliers - Chaos and inertia within organizations in the same supply chain - Demand risks (downstream disruptions) and supply risks (upstream disruptions). - Endogenous factors related to internal management processes (information systems, personnel, coordination). - Accidents (fire, production failures), socio-political actions, and natural phenomena - Catastrophic events disrupting supply chains - Contextual risks like physical elements, socio-economic factors, governmental decisions, security issues, and infrastructural problems - Situational exogenous factors related to the immediate environment - Non-situational exogenous factors like demand uncertainty, stakeholder involvement, time pressure, and general complexity
Mohaghar et al. (2017)	1.Integrated Management 2.Systems risks 3.Logistical risks: 4.Operational risks: 5.Humanitarian Support risks	- Integrated management system - Cooperation and coordination - Cost Management Systems -Foreign rescuers management -Poor supervision and tracking reconstructions

	6.Information and Technology risks: 7.Cultural context risk	- Delays in the delivery and distribution aids - Concentrate resources in one area - Block the communication paths On-time presence in the disaster zone - Impact of boycott - Security - International regulations - Weak advertising - Disability to meet the needs - Little awareness - Loss of rescuers during the disaster - Poor education - Psychological support for the injured - Insufficient accurate information from the affected areas - Shortage of specialized tools - Lack of GPS system
Chari et al. (2021)	1. Infrastructure Risk 2. Environmental Risk 3. Politics and Government Risk 4. Economic Risk 5. Social Risk	- Communication Networks -Transport Network - Warehousing Facilities - Electrical Power - Bad Weather - Politicization of Aid - Financial Deficit - Sexual Harassment and Theft
Awan and Ali (2022)	Not classified	- Natural disaster, - Terrorism and war, - Regulatory changes -strikes (labor and transport) - epidemics - port delays - ecosystem changes -depletion of natural resources - political, economic stability - lack of existing infrastructure (dry ports, cold storage)

		- smuggling and corruption - political issues on mega projects of organization
Chukwuka et al. (2023)	1.Internal: demand risk, supply risk, process risk, control risk 2.External: environmental risk	-forecast - inventory, - procurement - supplier - quality -transportation - warehousing decision-maker - social, political disruption

2.3. Conceptual Framework

Frameworks have been developed in response to the rising hazards in supply chain environments and the need for creative solutions. A conceptual basis is necessary due to the complexity of contemporary supply chains, and several researchers have provided frameworks that emphasize the critical role that systematic procedures play in efficiently managing risks. This section focuses on conceptual frameworks developed to address supply chain risks in general. While frameworks include categorization of risks which may overlap with the categorizations of risks discussed in section 2.2, their primary objective is to provide a structured approach based on theoretical foundation for managing risks within supply chains. These frameworks are comprehensive guides, not only identifying and classifying risk factors but also in outlining systematic approaches based on established theories to proactively mitigate and address risks. Several examples of frameworks described below are not only applicable to humanitarian supply chain but to supply chains in general.

For example, Rangel et al. (2015) introduced a comprehensive risk classification system based on the operations of plan, source, make, deliver, and return processes and categorized risks into 14 types. This system simplifies risk identification in supply chains, offering a structured approach to address vulnerabilities. Similarly, Musa (2012) devised a framework centered on make, source, and deliver, categorizing risks into three essential flows: material, financial, and information flow. Their systematic approach aids in understanding and managing risks across these critical supply chain components.

Diabat et al. (2012) contributed a framework derived from literature and consultations with food industry experts, outlining five key risk categories: product/service management, macro-level, demand management, supply management, and information management. This categorization serves as a foundation for identifying and implementing mitigation strategies.

Bandaly et al. (2012) suggested a comprehensive framework classifying risks based on three constructs: domain of risk, source of risk, and identified risk. By assigning risk management approaches to functional areas and external stakeholders, the framework encourages integration across the supply chain. The domains include Internal Operations, External Stakeholders, Marketplace, and Environment. This framework assists supply chain managers in evaluating and implementing strategies based on corresponding payoffs.

Ritchie and Brindley (2007) provided insights into systematic and unsystematic risks, dividing them into external industry-wide factors and internal entity-specific factors. This categorization facilitates a nuanced understanding of risk nature, aiding in the determination of appropriate risk management strategies and prioritizing risks based on their impact.

Christopher and Peck (2004) emphasized the impact of strategic decisions on supply chain vulnerability. Their framework categorized risks into three main categories: internal to the firm, external to the firm but internal to the supply chain network, and external to the network. This categorization clarifies the origin of risks, the organization's control extent, and the collaborative efforts needed for effective risk management.

Kaplan and Mikes (2012) stressed the importance of understanding the qualitative distinctions among different types of risks and tailoring risk management strategies accordingly. Their framework categorizes risks into three types: internal(preventable), strategic, and external risks.

Gaonkar and Viswanadham (2007) developed a framework focusing on designing a robust supply chain capable of handling deviations and disruptions. Their categorization, based on the nature and impact of risks, identified three broad forms: deviation, disruption, and disaster.

In a more recent contribution, Chu et al. (2020) presented a global supply chain risk management framework. Through three phases, this framework categorized risks into seven types and identified underlying risk factors, providing real-time insights and supporting decision-makers in crafting effective risk management strategies.

2.3.1. Selection of Kaplan's framework

Selecting Kaplan's risk categorization framework (Kaplan & Mikes, 2012) for our research on supply chain risks in humanitarian organizations is based on its comprehensive and tailored approach. Kaplan's framework provides a holistic view of risks, categorizing them into Internal Risks, Strategy Risks, and External Risks. Its value lies in offering specific risk management strategies for each category, addressing preventable internal issues, strategic risks willingly accepted, and external events beyond control. The framework's emphasis on integrating risk conversations into strategic decision-making aligns well with the dynamic nature of humanitarian work. Kaplan's adaptability to the strategic and operational landscape of humanitarian organizations distinguishes it as a practical and valuable tool for developing effective risk management strategies amid uncertainties. Through this framework, our research aims to contribute to the refined understanding and mitigation of risks in humanitarian supply chains.

Below explains Kaplan's three distinct categories, each requiring a unique risk management approach. (see Table 2 ~4 for more details)

I: Internal Risks (preventable risks)

These are internal risks within the organization, considered controllable and ideally eliminable. Examples include employee mistakes or inappropriate actions and operational process malfunctions. Active prevention involves monitoring processes and guiding behaviors toward desired norms.

II: Strategy Risks

Involves risks willingly accepted by an organization to yield superior returns from its strategy, not inherently undesirable. A risk management system aims to reduce the probability of assumed risks materializing, enhancing the company's ability to manage or contain these events when they occur.

III: External Risks

It is the risks that come from events outside the company and beyond its influence or control, external risks include natural and political disasters. Management of these risks focuses on identification and mitigation of their impact.

Consequently, we organized supply chain risks based on Kaplan's three categories, presenting the types of risks under each category along with examples of drivers of risks.

Table 2. Internal risks categorization(Chopra & Sodhi, 2004; Chukwuka, 2023; Kaplan & Mikes, 2012; Singhal et al., 2011; Tummala & Schoenherr, 2011)

Internal risks	**Examples of drivers of Risks**
Security	- theft of aid shipments, attacks on supply convoys, or the occupation of key logistics hubs by armed groups
Regulatory	- compliance with donor rules and local laws
Internal delays	- supply chain process delays (internal processes)
Intellectual	- Ensuring access to develop or procure specialized products (e.g., medical equipment) that are protected by intellectual property rights.
Coordination	- Communication lacking/missing, no collaboration
Systems and data – internal issues	- System failures, inaccurate data, information infrastructure failures
Procurement	- bureaucratic processes, customs clearance issues, or competition with other humanitarian organizations for the same resources - corruption, lack of reliable local suppliers, or difficulties in sourcing specific items required for aid.
Inventory	- Perishable goods - improper storage, or difficulties in maintaining adequate stock levels in remote or insecure locations
Revenue (funds)	- uncertainty of receiving funds or donations needed to sustain relief operations

Table 3. Strategic risks categorization

Strategic risks	**Examples of drivers of Risks**
Human Resource	- Staff shortages, skills gaps, or the inability to attract and retain qualified personnel during crises
Facilities	- Limited storage and distribution capacity
Forecast and planning	- predicting demand for aid during dynamic and unpredictable humanitarian crises. (involves uncertainties in estimating the quantity and types of aid needed)
Balancing program delivery, risk reduction & cost efficiency	- competing objectives, resource allocation challenges, complex trade-offs, profitability impact, and considerations related to the competitive landscape, industry dynamics, stakeholder expectations, globalization, technology, regulations, and innovation

Table 4. External risks categorization

External risks	Examples of drivers of Risks
Geopolitical	- regions affected by conflict or political instability - sudden changes in government policies, border closures, and restrictions on aid delivery
Communication	-Lack of coordination among humanitarian actors
Economic	- Fluctuations in exchange rates, inflation, and economic instability in crisis-affected countries
Transportation & Infrastructure	-Weak or damaged infrastructure in crisis-affected areas - road closures, port congestion, and airport restrictions.
Systems – external issues	- cyberattacks, data breaches
Uncertainty of events happening	- Unexpected population movements, or sudden changes in the situation on the ground, unexpected events that affect demand estimation.

2.4. Challenges in Managing risks in humanitarian supply chains

Due to the large number of individuals involved, each with varying interests and perspectives, setting and prioritizing goals in humanitarian relief operations can be difficult. Balcik and Beamon (2008) identified several difficulties, emphasizing how difficult it is to cope with different points of view. Because of these challenges, humanitarian efforts are the subject of multiple discussions in the literature. Handling these complex situations calls for critical thinking and sophisticated decision-making, given the variety of potentially incompatible priorities at stake.

1. Coordination and communication:

Inefficient coordination mechanisms, such as a lack of communication between organizations and their implementing partners—NGOs, suppliers, and business partners—or between coworkers in the same organization, are important factors influencing coordination practices (Christofferson, J. and E. Müller, 2017; Kabra, G., et al., 2015; Kovács, G. and I. Sigala, 2020; Balcik, B., et al., 2010). That eventually leads to the occasional conflicts of authority and delays in decision making (Moeiny, E. and J. Mokhlesi, 2013). Additionally, the lack of a learning loop between preparedness and reconstruction and reliance on local transportation providers create obstacles to cooperation (Kovács, G. and K. Spens, 2009).

2. Governmental and Legal

Governmental and legislative challenges in humanitarian operations are related to political decisions and procedures within the government of the crisis region and how they affect the work of humanitarian organizations (Kovács, G. and I. Sigala, 2020; Kovács, G. and K. Spens, 2009; Kabra, G., et al., 2015). These challenges emerge from the ambiguity of legal and mandate, low national preparedness such as lack of policy for coordination on customs clearance procedures.

3. Human Resources:

When discussing the absence of human resources, most reviewed literature refers to the shortage of qualified humanitarian logistics experts (Kovács, G. and K. Spens, 2009; Christofferson, J. and E. Müller, 2017; Moeiny, E. and J. Mokhlesi, 2013). Lack of training appears to be a very critical factor in that it impedes the transfer of knowledge through workforces and leads to lack of experienced staffs. Also, Chandes, J. and G. Paché (2010) discussed the difficulty in transferring explicit and tacit knowledge due to high turnover and context-specific experiences.

4. Financial and Funding:

Most humanitarian organizations are heavily dependent on donor funding and usually unable to provide any assistance or relief without the physical/guaranteed availability of funding structure (Balcik et al., 2010; Moeiny, E. and J. Mokhlesi, 2013; Kovács, G. and K. Spens, 2009). This is because of severe competition for funding and the constantly seeking the effects of the media(Sawyerr, E., 2021). In most cases, the influence of donors and assessing right quality of-kind donations impedes the smooth procedure of funding. Meanwhile cost of coordination practices and local tariff and tazed on foreign aids can be a financial burden for humanitarian organizations (Hashemi Petrudi, S. H., et al., 2020).

5. Logistical and operational:

Despite the large share of logistics activities in humanitarian operations, logistics and supply are still perceived as minor supporting functions rather than a core discipline in humanitarian operations. This is reflected on lack of proactive measures for pre-positioning logistical resources, and resource scarcity/oversupply in effective handling and distribution of resources thus casing lack of logistical integration (Kovács, G. and K. Spens, 2009; Chandes, J. and G. Paché, 2010). Furthermore, while there is supply chain evolution and changing operational needs, humanitarian organizations struggle to balance standardization and adaptation in the operational process (Moeiny, E. and J. Mokhlesi, 2013).

6. Information management and technology:

The difficulty lies in the absence of a centralized integrated management and planning system which in the initial hours after a disaster, leads to high uncertainty(Moeiny, E. and J. Mokhlesi, 2013). This problem is related to computer and telecommunication systems, software and their availability or unavailability in humanitarian organizations (Christofferson, J. and E. Müller, 2017).

7. Infrastructure:

This refers to the availability/unavailability/usability of transportation and electricity networks (Christofferson, J. and E. Müller, 2017). Usually, the local governments are lacking financial resources to afford restoration measures where lack of support equipment extends beyond transportation-related assets to Information and Communication Technology (ICT) infrastructure in developing countries (Hashemi Petrudi, S. H., et al., 2020; Kovács, G. and K. Spens, 2009).

8. Geopolitical:

Geopolitical challenges refer to difficulties arising from the interactions between different countries or regions, involving corrupt officials, political decisions by the government, volatility of the local political climate, international relations, and territorial issues, which can impact various aspects such as trade, security, and humanitarian efforts (Christofferson, J. and E. Müller, 2017; Sawyerr, E., 2021). Especially, it includes security situation in the crisis region, including armed conflicts, forces hindering aid, and pilferage of relief supplies.

9. Educational:

Hashemi Petrudi et al. (2020) highlighted the educational challenges in disaster response such as a weak educational system, limited mock disaster drills, and insufficient training for affected individuals during post-disaster relief efforts. Additionally, the author emphasized the inadequacy of efforts in raising awareness among the general population, particularly regarding humanitarian activities. The findings underscore the importance of addressing these educational challenges to enhance disaster preparedness and response.

2.5. Mitigation practices in humanitarian supply chains

In volatile contexts, relief organizations' strategies must be able to address risks and uncertainties in terms of demand, supply, and operations (Balcik & Beamon, 2008). To improve their responsiveness and resilience in the face of disasters, humanitarian supply chains use a variety of tactics, including prepositioning, delay, cooperation, and a flexible supply base. Table 5 provides an overview of the recognized risk reduction techniques being used in disaster relief and commercial sectors.

1. Stock

Retaining additional safety stock during pre-just-in-time periods is essential for ensuring smooth supply chain operations for humanitarian organizations(Tang, 2006). Storing Inventories at certain 'strategic' locations (warehouses, logistics hubs, distribution centers) that can be deployed quickly in case of a disaster(Caunhye et al., 2012). This strategy involves preposition stocks of basic relief items in various regions(Kovács & Sigala, 2020; Sabbaghtorkan et al., 2020) and Utilized by large international organizations such as IFRC, UN Humanitarian Response Depots, CARE, UNHCR, and WFP (Toyasaki et al., 2017).

2. Postponement

With postponement, inventory commitment is delayed until after client orders are received, hence reducing the anticipated risk associated with logistics (Oloruntoba & Gray, 2006). For flexibility, it combines the storage of goods at several locations with non-earmarked storage(Besiou et al., 2014; Jahre & Heigh, 2008) and standardization (Jahre & Fabbe-Costes, 2015). Nonetheless, understanding the potential, infrastructure, and resources of the local market is essential for this strategy to be implemented successfully (Commission et al., 2022).

3. Collaboration

Effective coordination and collaboration among these actors are essential for a responsible and efficient supply chain because of the multitude of organizations involved in disaster relief efforts (Bui et al., 2000). A wide range of stakeholders are involved, including the military, suppliers, funders, emergency relief organizations, governments, and vendors. Additionally, Balcik et al. (2010) emphasized how crucial it is to collaborate with the media in order to raise money and enlighten the public. Using technology to share knowledge and take risks may also improve it.

4. Centralization

Centralization occurs when one entity, such as a government agency, a commercial company, or a non-profit organization, has authority over logistical operations (Dolinskaya et al., 2011). For instance, during occurrences like the floods in Mozambique, United Nations organizations demonstrate consolidated power in managing logistics. Due to the geographical dispersion of the catastrophe and the involvement of several players, this technique may work well in small-scale disasters but not in large-scale events (Charles et al., 2010).

5. Flexible Transportation

Natural catastrophes disrupt transportation networks, making it difficult to reach impacted areas where prompt delivery of relief supplies and personnel is essential (Azmat & Kummer, 2020). Moreover, other excavation routes should be investigated because time is of significance during the reaction phase. To accelerate the delivery of relief supplies, it is recommended that several transportation modes, such as road, rail, and air, be examined (Besiou et al., 2014).

6. Speculation

According to Tomasini et al. (2009) speculation is the opposite of postponement, which is the act of creating or obtaining commodities in advance in response to expected demand. The advantages of decentralized prepositioning in raising NGOs' levels of professionalism were covered by Balcik et al. (2010). Governments use ahead purchasing to guarantee the availability of materials needed for efficient disaster response, as Mac Abbey (2008) explained. Furthermore, it is necessary to accelerate the import of goods under a state of emergency by delaying customs clearance procedures (Kunz & Gold, 2017).

7. Flexible Supply Base

In humanitarian supply chains, suppliers play a critical role since their location, capacity, coverage, commitment requirements, and price schedule all affect how well disaster response occurs. In an emergency, the consequences of supply chain disruption might be minimized using multiple sourcing strategies, which include multiple participants (Ertem et al., 2010; Torabi et al., 2016). Building supply alliance networks across national borders is another strategy that may be used, according to Chopra and Sodhi (2004) as well as flexible sourcing and adaptive entity capacity by (Day, 2014).

8. Logistics Outsourcing (Make and Buy)

Approximately 80% of the funds allocated to disaster relief activities are used for logistics operations (Trunick, 2005). Emergent relief outsourcing, however, has several challenges, including inadequate infrastructure, sluggish coordination, fragmented technology, and high employee turnover rates (Van Wassenhove, 2006). Therefore, Majewski et al. (2010) and Gossler et al. (2020) recommend that logistical activities including tactical, operational, and strategic aspects be outsourced to trained providers.

9. Flexible Supply Contract

Given the unpredictability of disasters, the lack of resources for preparation, and the competition for supplies after a disaster, procurement planning is an essential component of disaster relief logistics, ensuring that the relief organization can meet operational needs in the aftermath of a disaster (Aghajani et al., 2020; Duran et al., 2011; Wang et al., 2015). Flexibility in supply base management necessitates the use of contracts such as long-term agreements (Balcik and Ak, 2014), option contracts (Liang et al., 2012; Wang et al., 2015), and framework agreements (Balcik and Ak, 2013). These agreements allow customers to modify order quantities based on demand.

10. Risk Awareness/Knowledge Management

By ensuring that reliable and current information on disasters is always available and accessible and by encouraging the most effective learning possible, knowledge management has the potential to play a critical role (Seneviratne et al., 2010).

Table.5 Mitigation strategies applied in humanitarian organizations and commercial sectors

Strategies	**Examples**	**Humanitarian**	**Commercial**
Prepositioning of relief supplies/ Strategic stock	Prepositioning, stockpiling inventories, localized prepositioning, Safety stock, certain locations at warehouse and distribution centers, vendor-managed inventory	O	O
Flexible supply base	Diverse supplier, supply alliance network in various countries, flexible sourcing, adaptive entity capacity, asset transfer mechanism	O	O
Flexible supply contracts	Long-term agreements, option contracts, framework agreements	O	O
Flexible transportation	Multiple transportation modes, speed improvement, multiple carriers/ routes	O	O
Dynamic Assortment Planning	Usable to influence choice and demand and to entice customers to purchase products that are widely available when certain products are facing supply disruptions.		O
Economic Supply Incentives	Encourage additional suppliers to stay or enter into a		O

	certain market in order to avoid monopolistic situations and to secure multiple sources should a disruption occur.		
Transferring	Either shifting risk to an insurance company (e.g. life insurance policy for employees) or to other SC partners (e.g. outsourcing of activities or moving inventory liabilities).		O
Speculation	Full speculation, decentralized prepositioning, unsolicited goods, forward placement of inventory, forward buying	O	O
Postponement	Risk reduction, generic product development, non-earmarking of items, rosters, standardization, commonality, modular design, operations reversal	O	O
Centralization	Centralized prepositioning, centralized fleet hubs	O	O
Collaboration	Doner and interorganizational cooperation, media, information sharing, risk sharing	O	O
	3PL outsourcing		O
Revenue Management	Dynamic pricing and/or promotion		O
Risk awareness/knowledge management	Integrate knowledge management with adaptability and alignment, up-to-date information, timely decision-making	O	O
Logistics outsourcing (Make and Buy)	Combination of in-house and outsourcing, resource sharing, logistics outsourcing	O	O

*Aghajani et al., 2020; Azmat & Kummer, 2020; Balcik et al., 2010; Balcik and Ak, 2013, 2014; Besiou et al., 2014; Caunhye et al., 2012; Charles et al., 2010; Chopra and Sodhi, 2004; Christofferson & Müller, 2017; Commission et al., 2022; Dolinskaya et al., 2011; Duran et al., 2011; Ertem et al., 2010; Gossler et al., 2020; Jahre, 2017; Jahre & Fabbe-Costes, 2015; Jahre & Heigh, 2008; Kunz & Gold, 2017; Liang et al., 2012; Mac Abbey, 2008; Majewski et al., 2010; Oloruntoba & Gray, 2006; Sabbaghtorkan et al., 2020; Seneviratne et al., 2010; Tang, 2006; Tomasini et al., 2009; Torabi et al., 2016; Toyasaki et al., 2017; Trunick, 2005; Van Wassenhove, 2006; Wang et al., 2015.

2.6. Risk Assessment methods in humanitarian supply chains

Supply chain risk assessment is a critical function for organizations, as it ensures the efficient allocation of resources by prioritizing essential risks and avoiding undue expenditure on less significant risks (Hallikas et al., 2002). Humanitarian supply chains are unique in the setting of unanticipated catastrophes and quickly changing situations, which inherently bring unpredictability and volatility (Chukwuka, O. J., et al., 2023). These supply chains' inherent vulnerability to different kinds of catastrophes and disasters requires adaptable risk assessment techniques. For this part, this research primarily focused on literature addressing humanitarian supply chain risks and relevant publications about humanitarian organizations' practices, such as those from UNDP discussing the unique challenges and methodologies associated with risk assessment in humanitarian contexts.

2.6.1. Risk assessment steps

According to UNDP's ERM Policy Report (Bureau for Development Policy, 2008), a comprehensive risk management policy is developed, including the roles, duties, and levels of accountability that are necessary for efficient risk management in humanitarian logistics. In general there are five main phases in the risk assessment process which are as follows: (Hachicha, W. and M. Elmsalmi, 2014; Pontré, J., et al., 2011; Tuncel, G. and G. Alpan, 2010; Tummala, R. and T. Schoenherr, 2011)

1) Risk Identification: Systematically identifies potential risks in the supply chain, considering both external and internal factors. It involves expert consultations, analysis of historical data, and scenario preparation.

2) Risk Assessment: Directs customized interventions by evaluating the probability and severity of identified risks. It uses quantitative models, perception-based tools, or a combination of both and involves associating probabilities with hazards using the company's experiences, performance data, or forecasting analysis.

3) Risk Prioritization: Ranks risks based on their importance, considering both likelihood and potential impact on the supply chain. Utilizes the formula Risk = Impact x Probability. Tools like risk matrices, fuzzy AHP, and the Best-Worst method help prioritize and focus on the most significant risks.

4) Risk Management: It involves creating and implementing plans to manage identified risks. Tactics may include developing contingency plans, increasing flexibility, and collaborating with stakeholders. It aims to reduce, transfer, or accept risks and includes actions to address pre-identified risks.

5) Risk Monitoring and Reporting: Continuously monitors the supply chain to identify hazards as they emerge. It assesses the success of risk management plans and promptly reports any deviations or new risks. Involves performance measurements, real-time data monitoring, and regular risk assessments for continuous improvement and adaptation.

2.6.2. Types of risk assessment used by humanitarian organizations

Supply chain risk assessment is an important component for organizations, and it is important to prioritize the most important risks so that resources aren't focused on the less important ones (Hallikas et al., 2002). Risk assessment is very important for humanitarian organizations, and as there is frequently a lack of actual data for quantitative models, the emphasis tends to be on techniques based on perception (Christofferson & Müller, 2017). Widely used techniques for risk assessment are mentioned in Table 6.

Table 6. Risk assessment used in humanitarian supply chain

Methods	Description	Scaling	Authors
Perception-Based Risk assessment	Relies on the intuitive understanding of industry experts and available business intelligence data when quantitative models are not feasible. And where uncertainties are prevalent, and hard data is scarce.	Low, medium, high Numerical scale (1 to 5)	Pontré et al. (2011); Christofferson & Müller (2017)
Fuzzy Analytical Hierarchy Process (AHP)	It is a multi-criteria decision-making method that structures complex decision problems into a hierarchical framework. It incorporates fuzzy logic to handle uncertainty. It is used to assess and prioritize risks associated with emergency supply chains.	Very low, low, medium, high, very high. Fuzzy numbers between 0 and 1	Chukwuka, O. (2023);
Failure Mode and Effect analysis (FMEA)	A systematic method for evaluating potential failure modes within a system, identifying their causes and effects, and assessing their criticality. It identifies and prioritizes failure modes and associated risks in humanitarian supply chains.	Risk Priority Number (RPN) calculated by multiplying scores for severity, occurrence, and detection (each rated on a numerical scale)	Minguito, G. and J. Banluta (2023); Bradley, J. R. (2014);
Grey Relational Analysis (GRA)	It establishes relations among factors based on the level of similarity and variability. Particularly useful for analyzing relations between discrete data sets. Applied to validate results obtained from other risk assessment methods, providing a different perspective on risk prioritization	Involves the normalization of data, Based on the closeness of each factor to the ideal value	Minguito, G. and J. Banluta (2023);
Monte Carlo	Involves running multiple	Each scenario is	Minguito, G. and

Simulation	iterations of a model using random sampling to account for uncertainty and variability. Used to assess the probabilistic outcomes of different risk scenarios in humanitarian supply chains	generated by sampling from Probability distribution	J. Banluta (2023)
Best-Worst Method (BWM)	A decision-making method that helps in ranking a set of alternatives based on their perceived importance. It involves determining the best and worst alternatives for each criterion. It is employed to prioritize risks by evaluating their relative importance in humanitarian supply chains.	Involves pairwise comparison where elements are ranked from best to worst. Weights assigned indicate the perceived importance or intensity	Minguito, G. and J. Banluta (2023)
Integrated risk management model with Fuzzy-AHP	Encompasses the entire risk management process for emergency supply chains and utilizes the Fuzzy-AHP model for evaluating the significance and prioritization of identified risk factors. It provides a systematic approach to enhance risk management in humanitarian organizations.	Combination of fuzzy scales and AHP scales is used. Fuzzy numbers represent uncertainty, and AHP's ratio scale is used for pairwise comparison.	Chukwuka, O. J., et al. (2023)

2.7. Literature gap

While the field of risk management in emergency supply chains has been extensively studied, there is still a lack of empirical study about the classification of the many risks and uncertainty that are present in these chains. This is because the risks and uncertainties are not well defined or categorized (L'hermitte et al., 2015). Moreover, while commercial sectors have received most attention in the literature, there are currently not many extensive studies that explore particular risk assessment and mitigation measures related to the humanitarian supply chain. Although research conducted in 2023 by Chukwuka and in 2017 by Christofferson and Müller offered insightful information about risk mitigation strategies and evaluation techniques used in humanitarian operations, the real-world applicability of these discoveries is still largely untested and, as a result, unknown.

To elaborate further, it's noteworthy that much of the information derived from the literature review regarding humanitarian logistics practices often mirrors those employed in commercial sectors. To be specific, the practices identified for humanitarian organizations are often adaptations or derivations from existing commercial activities, rather than innovative approaches unique to the humanitarian context. Therefore, there exists a gap in the development of truly distinct risk management strategies specifically tailored to the challenges and intricacies of humanitarian operations.

To fill this gap and bridge theoretical understanding with practical challenges encountered in humanitarian contexts, additional research and empirical validation are imperative. Through extensive interviews with professionals from both commercial and humanitarian sectors, this study aims to shed light on these critical gaps. The primary objective of this research is to identify and categorize the risk management strategies utilized across various industries, with a particular emphasis on experimentation and comparison. By contrasting the approaches employed in commercial and humanitarian settings, the study endeavors to provide valuable insights that can ultimately enhance risk management practices within humanitarian supply chains.

3. Research Methodology

3.1. Interview

This research adopts an exploratory approach employing interviews to gather primary data from research participants about their practices, opinions, experiences, and expertise (Ryan et al., 2009). Hence, structured interviews will be conducted using an interview guide with carefully crafted open-ended questions to systematically explore and compare supply chain risk management practices(Creswell & Poth, 2016). The structured format of the interview guide will ensure a focused and comprehensive exploration of key aspects, aligning with the specific objectives of the thesis. The interview guide will be structured with pre-written questions that address multiple aspects of the research subject. This strategy will enable the systematic examination of relevant topics and the collection of insightful feedback from participants. The interview guideline is provided in Appendices A1.

By maintaining a semi-structured format, participants will have the flexibility to express their perspectives while allowing for a systematic and detailed analysis of supply chain risk management practices across the selected organizations. The collected data will be transcribed, analyzed using thematic analysis, and coded to identify common themes and patterns. Ethical considerations will be followed throughout the research process, ensuring confidentiality and anonymity).

3.1.1. Preparing for the Interviews

To ensure a suitable, uniform, and unbiased procedure, thorough preparation was conducted before commencing data collection through interviews. This involved the creation of interview guides and the specification of participant requirements. For this research, purposive sampling will be employed, with organizations selected based on their expertise and relevance to the research objectives(Bernard, 2017; Creswell & Poth, 2016; Silverman, 2020). The focus will be exclusively on organizations engaged in disaster relief-related activities. Additionally, interviews with commercial organizations from various industries will be conducted to understand their risk management processes. While selecting the respondents, careful consideration was given not only to their roles as supply chain managers but also to ensure alignment with the logistics sector, particularly within shipping or logistics industries rather than e-commerce. This specificity was crucial to capture insights relevant to the core operations of logistics entities, which may differ significantly from those of e-commerce companies. By including these organizations, the research aims to gather insights from experienced and knowledgeable entities in the field of humanitarian operations and commercial organizations.

Regarding the creation of interview guides, it's important to note that the process was somewhat dynamic and iterative. While the initial guideline was established based on the research objectives, adjustments were made iteratively to tailor the questions according to the characteristics and expertise of the participating entities. This approach ensured that the interview guides were effectively aligned with the specific contexts and requirements of each organization, enhancing the relevance and depth of the insights gathered during the interviews.

Interview guides consisted of two parts: the interview introduction and the interview questions.

The interview introduction covered the researcher's introduction, recording of the interview, the consent form with assurances of confidentiality and anonymity, an agreement to participate in the interview, and a reminder to begin recording (Harrell & Bradley, 2009; Ryan et al., 2009).

3.1.2. Purpose of interview

At this stage, the main objectives of the interviews are as follows. First, it is to fill the literature gap by identifying and categorizing risk management strategies used in various industries. This experimental approach aims to provide insightful information that can enhance risk management in supply chains for humanitarian aid. Through cooperative interviews with commercial companies, the study aims to gather useful advice and strategies. It is anticipated that the integration of comprehensive academic research with commercial practices would produce insightful findings that will strengthen risk management procedures for humanitarian organizations. The joint efforts aim to improve research results and expand the relevance of discoveries to a wider range of practical scenarios. Next, the above five categories of questions mentioned are derived from the literature review. From these questions, the research seeks to find what companies are implementing in terms of supply chain risk management practices. Although not covered in the interview guide, challenges of humanitarian supply chain were asked to among humanitarian organizations to address one of our main objectives. Given the diversity of sectors, each company's approach may differ based on its unique risks. About the selection criteria for organizations, organizations were selected based on various industries such as chemicals, retail, transportation, etc. The interviews were particularly focused on supply chain managers responsible for supply chain practices, ensuring a diverse perspective from different sectors.

Next, the questions were grouped into 5 categories:

1. Risk Identification and Assessment
2. Risk Mitigation and Response
3. Monitoring, Auditing
4. Risk tracking and evaluation
5. Documentation, tools and collaboration

3.1.3. Ethical Issues

Ethical issues play a significant role in research in that it represents how the relationships between researchers and research participants are handled(Hopf, 2004) and also involves the analysis and reporting of results (Creswell & Poth, 2016).

Before the interviews, participants received emails outlining the nature, structure, and length of the interviews, as well as guarantees of confidentiality and anonymity and the research's objective, enabling them to make well-informed judgments (Harrell & Bradley, 2009). To enhance the convenience of the participants, the time and venue were also decided upon together. Participants had the opportunity to ask questions about the interview prior to it, and their consent was obtained before any recordings were made to transcribe later. Even if the

interview questions did not annoy the participants, careful attention was paid to prevent frenzied probing and pressing of them for replies so as not to make them feel uncomfortable(Saunders et al., 2009; Sekaran & Bougie, 2016).

In addition to this, processing, movement and storing of the data collected were done with much care through encryption and password-protected personal computer (PC). The principles of beneficence, which is about providing a beneficial contribution to the public, and non-maleficence, which forbids a researcher from causing damage to anybody participating in the research process (Rule & John, 2011) were applied in this study. To ensure anonymity, rather than using individual pseudonyms, this research referred organizational names such as using alphabet for humanitarian entities and using number for commercial organizations. When submitting data extracts for publication, individual details are excluded, retaining only essential information which are working years and managerial level while safeguarding participant identities(Saunders et al., 2015).

Overall, much caution was taken to ensure transparency of intent, protection of individual and organizational privacy, impartiality, honesty, anonymity and interviewees' informed agreement to voluntary participation (Leedy & Ormrod, 1980).

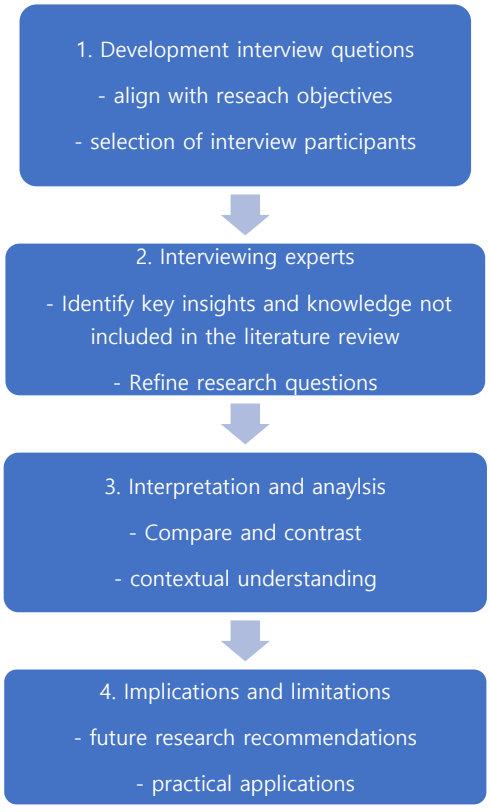

Figure 3. Interview protocol framework

Table 7. Profile of experts

Name of organizations	Work Experience(years)	Managerial level
Organization A	15 years	Technical assistance manager
Organization B	8 years	Global supply chain director
Organization C	15 years	Senior supply officer
Company 1	30 years	Head of supply chain planning
Company 2	9 hears	General manager
Company 2	20 years	Health and safety manager
Company 3	6 years	Branch manager
Company 4	23 years	Supply chain manager
Company 4	25 years	Health, safety security manager
Company 5	11 years	Supply chain manager
Company 6	2 years	Supply chain operation manager
Company 7	5 years	Logistics operation manager

4. Results

The findings from interviews are outlined in this section according to organizational characteristics (humanitarian or commercial) or the primary responsibilities of the interviewers, focusing on key topics related to supply chain risk management practices. Interviews were conducted with 3 humanitarian organizations and 7 commercial companies, which consist of diverse industries such as chemical, transportation, healthcare, and consumer goods etc. First, the findings about each risk topic will be explained respectively, detailing the common practices observed across both humanitarian organizations and commercial companies regardless of their sectors. Then, in section 4.7 and section 5 (*Discussion*) the differences in practices between the commercial sectors and humanitarian organizations, along with insights gained from these disparities, will be discussed. This approach aims to provide a comprehensive understanding of supply chain risk management practices, acknowledging both commonalities and distinctions across sectors. The summary of findings is provided in Appendix A2.

4.1. Risk Identification and assessment practices

Risks are categorized into specific types such as reputational, operation, safety, and compliance across all entities. Some companies also categorize risks based on product-related factors (Company 5,6). Both humanitarian organizations and commercial sectors did not explicitly mention a structured risk management framework akin to the Enterprise Risk Management (ERM) framework used by Organization C which is based on international standards whereas both organization A and B lacks a formalized framework for risk assessment. However, some companies have internal risk framework, for example, company 1 mentioned the formalized meetings with S&OP reviews and company 4 stressed the strict compliance with license requirements suggesting the existence of a compliance framework.

Regarding risk assessment approaches, most entities rely on historical data and data-driven approaches. To delve into detail, scenario-based planning is a common technique observed in both entities such as organization C, company 1 and 3. Company 3 uses internal historical data accumulated via their internal platform and uses external data including GPS data about port and weather information. Company 6 analyzes risks based on Supplier Assessment questionnaire responses. While there is not specific risk assessment methods, company 5 utilize S&OP for identification where trends are analyzed and potential risks are evaluated. Similarly, company 7 utilizes in internal system called OTM (Oracle Transportation Management) for identifying risks related to lead times for delivering medical devices to hospitals. Those who have structured risk assessment methods are company 4 who employs 5 why technique to analyze the root causes behind the problem especially in safety and compliance risks and organization C who utilizes a bow-tie analysis to identify multiple potential causes and consequences of risks. When it comes to conducting risk assessment, organization A and C involve multiple levels of management from country teams to global leadership quarterly or annually. Company 6 conducts risk assessments through weekly meetings involving managers.

Most entities evaluate the likelihood and potential impact of risks based on severity using low-medium high categories (Company 3,5,6,7), numerical scaling ranging from 1 to 5 or 1 to 3 (company 4,5) and five-by-five grid(organization C, company 2). However, Organization A and B didn't explicitly mention structure methods for assessing likelihood and impact indicating a less systematic approach. KPIs related to compliance performance, operational efficiency and customer satisfaction are used to prioritize the risks across all entities. Also, financial considerations such as cost of goods and intensity of impact on operations and personnel play a significant role in the risk prioritization of company 1,4 and 5.

Table 8. Findings from organizations

Risk Identification	Findings
Categorization	Reputational, Operational, Safety and Compliance Product-related
Framework	Limited structured risk management frameworks
Assessment	Historical data and data-driven approaches Frequency varies, Involvement of multiple levels of management
Likelihood and Impact	Severity categories(low-mid-high), numerical scaling(1-5), grid system
Prioritization	Key Performance Indicators(KPIs) Financial considerations

4.2.Mitigation strategies

The common mitigation strategies adopted by entities are as follows:

1) Continuous Improvement and Learning: Entities prioritize continuous improvement initiatives to adapt to changing risks and environment fostering a culture of learning and innovation. For example organization A,B and company 2 focus on regular training sessions to enhance staff understanding of adherence to compliance requirements.

2) Safety protocols: Entities like company 2 and 4 who have specific handling safety related risk manager, prioritize safety by implementing engineering controls, modifying work processes and providing specialized training to enhance employee safety and well-being. Specifically, company 2 investigates identified hazards and near-mises and organization C and company4 conduct root cause analysis with frontline staff and implement targeted intervention based on actual incidents.

3) Collaboration and partnership: Utilization of partnerships and collaboration with stakeholders are observed in all humanitarian organizations where they collaborate with ministries, other NGOs and between country programs and global teams to ensure resource allocation. Also, commercial sectors like 1,5 and 7 leverages partnerships with forwarders by enabling real-time data sharing.

4) Supply chain flexibility: To mitigate the operational risks, identifying alternative routes and suppliers to maintain operational continuity during disruptions are conducted by company 3,6 ensuring resilience and adaptability in supply chain operations. Similarity, company 1

explores alternative modes of transport and establish relationships with forwarders to pursue flexibility.

5) Contractual adjustments and diversification: Entities like organization C and company 5 modify contracts(or timeline) or diversify supply chain flows ensuring operational continuity and financial stability.

6) Hedging: where company 1 and 5 hedging against price fluctuations by projecting and fixing prices for the future.

Meanwhile, organization C's mitigation strategy stands out because they divide into proactive and reactive treatment. Proactively, they implement measure before risks occur such a terminating activities, engaging new partners or developing contingency plans. Reactively, they address consequences post-risk event, modifying contracts or operational processes.

4.3. Monitoring and Auditing

All entities emphasize the importance of regular monitoring with varying frequencies depending on operational needs; yearly(organization C, company 4), quarterly(organization B,C), monthly(Organization A, company 1,5), weekly(Company1, 3,5,6) daily(Company 1,2,6,7).

In regard to monitoring methods, specialized software or systems are used by company 6 and 7 which are scenario planning software and oracle transportation management system respectively. The former allows the team to visualize and assess risk factors related to supply and demand and latter one categorizes risks by price ranges and probability of delays allowing detailed investigations into incidents. Moreover, organization A implements a rotation strategy for monitoring teams to ensure exposure to various aspects of risks across different operational areas.

While internal audits are common across all entities, the frequency and scope of these audits may vary from annual (organization B, company 1,3 and 6) to regular (organization A,C, company 2,4 and 7)or continuous(company 5), depending on the organization's risk management practices and industry standards. External audits are conducted to provide an independent assessment of financial management and operational effectiveness. Specifically, companies 4 and 7 focus on ISO – related audits as part of their external procedures and company 4 implements GEMBA walks as part of its auditing practices involving direct engagement with frontline staff to gain insights into daily operations.

In terms of funding, especially for humanitarian organizations A,B and C that rely on donor support, funds are typically centralized at the headquarters. From there, direct funds are allocated for field operations. Furthermore, there is often a dedicated entity responsible for funding management, overseeing fundraising activities and providing financial support for program operation ensuring efficient allocation and utilization of resources across different program areas.

4.4.Risk register/tracking and responsibility

To elaborate on how entities track and evaluate risks, it is important to note that only organization C has a well-structured risk register encompassing both operational and strategic risks at different levels (country, regional and headquarters). Reports generated from the registers provide insights into the organization's risk profile and treatment progress. Instead, other entities employ different methodologies. For instance, entities such as organizations A and B utilize KPIs across various operational areas such as procurement, inventory management and service delivery. Similarly, company 2 and 7 uses KPIs related to logistics performance such as lead times, delivery times, customer satisfaction scores and adherence to safety protocols. Meanwhile, companies 2 and 6 engage in continuous monitoring via dashboards, allowing them to track risks in real-time. On the other hand, company 5 conducts post-implementation evaluations conducted typically six months after implementation to assess whether intended outcomes were achieved. Conversely, organizations like company 1 and 3 do not maintain structured risk registers or metrics, handling issues based on data and experience focusing on recent year's challenges or on a case-by-case basis as they arise.

Based on the interview, most of entities adopt a hierarchical approach to risk management (organization A,B,C and company 2,4 and 7). At each hierarchical level, dedicated managers or executives manage risks within their domain. These levels typically include filed level, regional level, and headquarters level. Each level is responsible for identifying, assessing and mitigating risks specific to their operational scope. Additionally, there is a centralized team or officer overseeing the overall risk management process, ensuring alignment with organizational objectives and strategies. On the other hand, companies 1,3,5 and 6 employ a decentralized approach to risk management. Responsibility is delegated across disciplines and departments within their respective domains. Instead of hierarchical levels, these companies assign specific risk categories to team members or departments based on their expertise and operational focus. This decentralized structure allows for more agility and specialization in addressing various risk factors.

4.5.Documentation, tools and collaboration practices

Across multiple entities, excel spreadsheets are widely used for various purposes such as internal control questionnaires, reporting needs and risk monitoring. Likewise, power BI is commonly used for data analysis, visualization and creating dashboards to track and assess various aspects of risk and performance. Some entities employ internal systems or software programs tailored to their specific needs. For example, organization B; Enterprise Resource Planning system, organization C; Risk Management Tool and company 7; Oracle, while company 2,3 and 7 utilizes their own internal tool allowing access to globally and real time sharing. Several companies are actively embracing emerging technologies to enhance their operations. For instance, company 3,4, and 7 actively pursue the integration of artificial intelligence (AI) into its processes for detecting hazardous situation or internal searches, while company 4 leverages blockchain technology for data sharing and platform development. Regarding documentation, some organizations have standardized documents outlining

procedures, requirements, risk assessments and business continuity plans. Organization A,C, company 2,4 and 6 are examples of entities with standardized documents. Those who do not have the documents, follow its existing process or only have templates for the report format.

Most organizations and companies actively engage in collaboration with others highlighting its important role in driving operational strategies and fostering innovation with varied entities they engage in. Organization C, company 3 and 4 collaborate with government agencies for civil law-related initiatives and potential smuggling or criminal activities. Engage in partnerships with third-party partners like factories, transportation companies, technical expertise and suppliers is active for information sharing, ISO audits, first aid training or risk mitigation(organization A,C,company 1 and 6). Also, companies like 2 and 6 participate in internal collaboration within their organization for technological advancements by conducting regular meetings and workshops. Company 5 collaborates with consultants under non-disclosure agreements for strategic assessment and advice. However, organization B currently engages less with other organizations expressing a desire to enhance it while company 7 engages in limited collaboration with other organizations particularly during events like conflicts or pandemics. Meanwhile, some companies have developed unique approaches to communication within their organizations. For example, company 2 uses an internal communication platform known as the weekly performance dialogue to facilitate diverse discussions and knowledge sharing among its employees. Additionally, company 4 promotes learning and knowledge dissemination globally within the HSSE community by sharing learning packs derived from incident investigations.

4.6.Challenges of Humanitarian organizations

Based on the insights from the interviews conducted, common challenges have been identified across the humanitarian organizations which are categorized as follows: human resources, security, logistics, finance, and politics.

1) Human Resources

Organization B highlights challenges related to recruiting, retaining, and managing skilled personnel. Also, organization A and C mentions a lack of human resources which include staffing shortages or a need for specialized expertise.

2) Security

Organization A and B both face security challenges due to operating in high-risk areas. For example, in high-risk areas where alternative delivery methods like air drops is needed still remains risks or interception or exploitation by armed groups.

3) Logistical

For organization A, conducting air drops poses logistical complexities including preventing containers from bursting or leaking upon impact also ensuring accurate and timely delivery amidst security concerns. Organization B faces limitations in infrastructure since most of

operations are conducted in hardest reach area in the world.

4) Financial

Budget constraints impact all organizations requiring careful allocation of resources to implement security measures and innovative solutions. Organization C faces a severe funding crisis within the entire humanitarian system leading to workforce reduction and operational limitations.

5) Political

The political landscape shows significant challenges for all organizations. In organization B, political instability and geographical barriers amplify vulnerabilities to risks such as fraud, corruption and delivery disruptions. Similarly, organization C faces the politicization of the refugee crisis globally, where the distinction between refugees and migrants becomes a politically charged issue. This makes it difficult to secure funding and develop projects, as legal nuances are difficult to explain among political tensions. On the other hand, organization A navigates political challenges through collaboration with host governments or military forces in high-risk areas.

4.7 Learning from commercial practices: Insights for Humanitarian organizations

To address our research questions and provide useful lessons to enhance the supply chain risk management of humanitarian organizations, several insights were derived from practices observed in commercial sectors. First, regarding risk assessment methods, while humanitarian organizations B and C have their structured techniques, organization A lacks them. Some methods utilized by commercial sectors, such as scenario-based techniques and the 5 Whys analysis for root cause identification, could be beneficial for humanitarian contexts. Developing unique identification techniques, like assessment questionnaires for seamless procurement processes or logistic risk identification, would also be advantageous.

Since humanitarian organizations are in the infant stage of evaluating the likelihood and potential impact of risks, it is crucial for them to develop systemic methods. Using scaling or low-mid-high categories, prevalent among entities, ensures that they can address risks based on severity. Regarding mitigation strategies, implementing safety protocols helps handle compliance and safety-related risks, particularly in security situations in crisis regions, thus ensuring staff safety and preventing shortages.

To mitigate operational and logistics risks, identifying alternative modes and suppliers ensures resilience and flexibility in supply chain operations, especially in high-risk areas. Also, by adopting integrated system such as real-time information sharing platforms, humanitarian organizations can improve operational efficiency, decision-making capabilities and collaboration efforts. Although organization C is a humanitarian entity, the rest of the organizations can learn from its mitigation strategies, particularly its treatment practices, which are divided into proactive and reactive approaches. This ensures that risks are addressed both

before and after events occur, representing that the organization is well-prepared for mitigation with well-structured strategies.

From monitoring practices observed across commercial sectors, some practices could benefit humanitarian organizations. Formalized procedures for monitoring, like monthly, weekly, and daily assessments, ensure consistency and thoroughness in risk evaluation. Utilizing technology, such as GIS technology for data analysis on population distribution, infrastructure and natural hazards enhances monitoring practices. Company 4's use of GEMBA walks as an auditing method fosters a deeper understanding of operational dynamics, beneficial in the humanitarian context.

Organization A and B, as well as commercial sectors, could benefit from adopting structured risk register practices observed in Organization C. Implementing internal, strategic, and external risk registers at various levels and updating them regularly provides insights into risk profiles and treatment progress. Additionally, following Company 5's example of conducting post-launch evaluations facilitates continuous improvement in risk management strategies.

In addition to Excel spreadsheets and traditional tools like ERP, commercial sectors often utilize advanced technology like intelligent software and AI for risk management processes. Humanitarian organizations can benefit from similar technology to streamline risk management practices, such as early warning systems and AI tools for detecting potential risks like natural disasters, conflicts or disease outbreaks as well as analyzing social media data to monitor public sentiment during crises leading to mitigating reputational risks.

While humanitarian organizations pursue collaboration with other entities, valuable practices can be derived from collaboration initiatives observed in commercial entities. Establishing regular communication channels with stakeholders such as beneficiaries and local communities can help humanitarian organizations better understand their needs and tailor their programs, enabling more effective allocation of funding. Partnering with government agencies in high-risk areas will play a crucial role, as they provide legal support, negotiate safe access, and ensure the security of personnel and aid convoys.

5. Discussions

In this discussion, the aim is to analyze and generalize the findings obtained from interviews conducted as part of this research, comparing them with existing literature where applicable. This research explores how these findings shed light on the practical challenges faced by humanitarian organizations, assessing their alignment with the initial expectations. Additionally, it examines the consistency or inconsistency of the findings with previous studies and theories in the field, providing insights into the current state of knowledge and areas for further exploration.

Risk categorization, in comparison to the literature which categorizes risks into several types, was revealed through interviews to mostly focus on operational (logistics, procurement) and compliance risks in risk management efforts. While the organizations acknowledged risks such as those stemming from the political environment, they did not specifically classify risks in the same manner as academic literature does. The Kaplan's framework, chosen for this thesis, was noted to be different from how organizations classify risks. The risks they encounter span across Kaplan's risk categorization but are not structured in the same manner, indicating a need for future efforts to systematically categorize risks.

When comparing the risk assessment methods derived from the interview findings with those identified in the literature reviews, some similarities and differences were evident. Both sources mention the use of scaling or scoring systems to assess risks. The interview findings refer to scaling methods such as low, medium, high, while the literature reviews mention numerical scales ranging from 1 to 5. Additionally, both sources discuss the use of the Analytical Hierarchy Process (AHP) method for risk assessment using low, medium, high metrics, although the interview findings do not specify its exact use.

Similarly, while the specific application of Failure Mode and Effect Analysis (FMEA) may not be mentioned in the interviews, the risk assessment methods used by organizations involving formal assessment processes to identify and prioritize risks align with the objectives of FMEA, which identify and address potential failure modes within their operations. Although not mentioned in the literature review, bow-tie analysis was discovered in the interviews, targeting failures and incidents to provide a clear understanding of how to prevent or respond to them effectively. On the other hand, Grey Relational Analysis (GRA), Monte Carlo simulation, Best-Worst Method (BWM), and the Integrated Risk Management model with Fuzzy-AHP were discussed only in the literature reviews.

Regarding challenges, the interviews revealed findings similar to those in the literature regarding practical challenges. Among them, security and geopolitical challenges in high-risk areas, as well as the refugee crisis, pose significant problems. Additionally, the lack of budget due to heavy dependence on donor funding is a common issue faced by humanitarian organizations.

Several mitigation strategies found in interviews align with the identified approaches from the literature in terms of collaboration, flexible transportation, flexible supply contracts, and risk awareness/knowledge management. However, certain approaches, such as prepositioning of

relief supplies, maintaining a diverse supplier base, dynamic assortment planning, speculation, postponement, revenue management, logistics outsourcing, and centralization, were either not explicitly mentioned or were lacking in the practices of humanitarian organizations. These strategies, commonly employed by commercial sectors, may not be utilized in humanitarian contexts due to the risk challenges posed by factors such as budgetary constraints, lack of trained staff to operate these systems, or security threats in remote, high-risk areas. They represent potential strategies that humanitarian organizations could consider adopting to mitigate their challenges based on insights from the literature review.

Notably, interviews provided aspects of risk monitoring, tracking processes, and the use of tools that were not extensively covered in the literature review. Due to the unique characteristics of each organization, information about these practices was limited in existing literature. By incorporating these topics into the interview guide, comprehensive insights were gained into the activities related to risk monitoring and evaluation. Consequently, it was possible to discern how humanitarian organizations conduct frequent risk monitoring, track, and assess risks using key performance indicators (KPIs) for various parameters, and utilize structured risk registers and other software tools for this purpose.

6. Conclusion

The increasing frequency and complexity of disasters presents a range of challenges and responsibilities in humanitarian operations. These challenges vary significantly depending on the nature and severity of each crisis, often resulting in widespread devastation and disruption to the livelihoods of affected populations.

However, despite the pressing demands placed on humanitarian organizations, there exists studies and practices in the management of supply chains compared to their counterparts in commercial enterprises. This research was an attempt to analyze how humanitarian organizations manage their supply chain risks and compare their practices with those of commercial organizations. It seeks to identify potential areas of inspiration and learning between the two sectors to enhance supply chain risk management practices overall. Accordingly, 6 areas of risk management approaches; risk assessment, mitigation, monitoring, challenges, tracking and documentation/tool were identified from the literature review and interviews with 12 experts at the humanitarian organizations and commercial sectors.

6.1 Implications

This study significantly contributes to narrowing the existing literature gap by providing a comprehensive examination of emergency supply chain risk management. Given the current lack of extensive studies focusing on specific risk management approaches within the humanitarian supply chain, this research serves as a foundational resource for scholars, enabling the development of a shared understanding of supply chain risk practices in humanitarian settings. Notably, this study addresses the first and third main objectives by elucidating how humanitarian organizations identify risks and comparing their risk management practices with those of commercial sectors. the comparison with risk management practices in commercial sectors sheds light on potential areas for improvement and adaptation within humanitarian supply chains. Moreover, this study goes beyond a mere literature review by investigating the practical techniques for risk management currently employed in the field. By incorporating insights from both academics and industry experts, this research offers a holistic view of the strategies and challenges involved in managing supply chain risks in humanitarian operations.

The practical insights gained through the expert interviews have been supplemented by observations of both humanitarian and commercial occupational routine to support a resource-effective and time-efficient decision-making program for emergency relief practitioners. Therefore, the findings of this research can support supply chain managers and stakeholders with the most recent data and practices learned from commercial sectors as well as humanitarian organization themselves that can render a precise picture of the global emergency management industry as it stands right now. To be specific, relief organizations can use the risk mitigation strategies and assess, and evaluation techniques identified in this study to better prepare for and respond to potential risks. This study does not cover every possible risk that could arise during emergency relief operations. However, it does a thorough job of investigating risk management practices in a variety of relevant areas in the disaster management industry.

6.2 Limitations and Future research

Despite its contributions and implications, this study has some limitations. First, this study's methodology does not allow for the participation of a large number of specialists because it only requires participants to have practical experience in specific supply chain field. Therefore, only sure experts who hold specific job positions were included in this research sample, so it was not possible to retrieve the inputs from various stakeholders such as the sponsors, the government, or the military. The scope of this study will require a collaborative approach from all the actors involved in order to increase the effectiveness of the efforts.

Furthermore, sampling is a critical aspect that must be considered. While the interview questions were meticulously designed to encompass various facets of risk management, it became apparent that some participants did not address all areas comprehensively. This discrepancy arose from the decentralized nature of risk responsibilities within certain companies, where different domains handle specific risks independently. This limitation underscores the need for future research to adopt a targeted sampling approach. By specifically selecting participants based on their involvement in all aspects of risk management, irrespective of decentralization, a more comprehensive understanding of organizational risk practices can be attained. This targeted approach ensures that insights are gleaned from individuals who possess in-depth knowledge of the organization's risk management strategies, thereby enhancing the validity and richness of the research findings.

Lastly, there's a limitation relating to lack of consideration for sector-specific risks in this research. In this case would be political challenges being more prevalent for NGOs but not for the commercial sectors. This oversight can limit the depth of understanding and the applicability of findings across sectors. To address the limitation of analytical models not considering sector-specific risks, future research could focus on conducting case studies and comparative analysis. By examining specific humanitarian organizations or crises, researchers can analyze how different sectors handle unique challenges, such as political risks. This approach allows for the identification of sector-specific best practices and lessons learned, contributing to a more thorough understanding of risk management across sectors.

7 References

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8. Appendix

A1. Interview Guide

[Introduction]

Good afternoon, my name is Soyeong Lee. I am a master's student at Wageningen University, currently working on a thesis about supply chain risk management in humanitarian organizations. In regard to this, I am researching the supply chain risk practices in those organizations. Thank you for your availability for this interview.
We will not mention your name in the report, but would you mind if we mention your organization in relation to the information? Additionally, would you mind if I record this interview so that we can process the results of this interview? After the project finishes, the recording will be deleted.
We would like to know what you think, and your activities related to supply chain risk assessment and performance.
Do you have any questions before we begin the interview? If you have anything important to say in the middle of interview, you could tell me anytime.

*Before we start the interview, I would like to ask you about your current role in your company. Could you please share what types of risks you primarily handle in your current position? This will help me tailor our discussion to your specific insights and experiences.

[Interview Questions]

1. **Risk Identification and Assessment**

- How does your organization define or characterize the concept of "risks" in terms of safety and quality risks, operational risks or product-related risks?
- What methods, models, or established frameworks does your organization use for risk identification?
- Could you describe your process for evaluating the likelihood and potential consequences of these risks?
- What criteria or data sources does your organization rely on for risk assessment?
- Do you have any risk parameters like detectability, risk exposure, impact intensity and cost?
- How does your organization prioritize and categorize different types of risks within the supply chain? Are there specific criteria or factors that determine which risks receive immediate attention and how they are categorized?

2. **Risk Mitigation**

- What measures or plans has your organization set up to reduce and handle supply chain risks like safety/quality, operational/process, product-related risks? Can you give an

example for each of these risks?

- Do you perform different risk mitigation strategies based on the type of risks?

3. Monitoring and Auditing

- How frequently does your organization perform supply chain risk monitoring?

- Is there an established audit process for assessing the effectiveness of your risk management strategies?

4. Risk register/ responsibility

- What specific performance indicators or metrics does your organization use to measure the success of your risk management initiatives? Can you give some examples?

- How does your organization track change in these metrics over time?

- Who within your organization holds responsibility for executing these risk measures or plans?

1. Documentation, tool and Collaboration

- Does your organization maintain internal documentation or manuals outlining the procedures for managing supply chain risks?

- Are these documents publicly accessible, or are they considered proprietary to your organization?

- What software do you use for supply chain risk management?

- Are there any emerging developments or technologies in supply chain risk management that your organization is actively exploring?

- Do you collaborate with other commercial companies or humanitarian organizations?

- How does your organization stay informed about the latest best practices in this field?

A2. Summary of Findings

Category 1. Risk Identification and Assessment

Organizations	Risk type	Specific practices	General practices
A	Reputational risk	- Consider the potential impact on program objectives, beneficiaries, and the organization's reputation - Considered highly damaging and receive special attention due to their potential to tarnish the organization's image and impact donor support	- Heavily influenced by donor requirements and project design considerations - Lacks a formal framework or method for risk identification - Focuses on ensuring compliance and operational effectiveness - Scoring: procurement scouring rates or compliance with supplier vetting procedures - No formal risk parameters
	Operational risk	- Less structured and tends to be project-specific rather than part of a comprehensive internal risk assessment process	
B	Operational risk	-Concerned with factors that could disrupt or hinder the achievement of supply chain objectives. - Identified through ongoing conversations with country supply chain teams to understand operational challenges and potential obstacles. - Examples include staffing shortages, political instability impacting imports, or disruptions in transportation networks. - Require proactive management to mitigate their impact on B's ability to deliver services effectively. - No structured assessment of likelihood and impact: still at an early stage of maturity in risk management. - Teams are encouraged to identify and classify	-Risks are considered at multiple levels within the organization B, from the country program level to the global leadership level. - Quarterly risk assessments are conducted at the country level, where supply chain teams identify and prioritize risks specific to their contexts. - Regional supply chain directors aggregate and analyze risks from their respective regions, providing insights into regional trends and challenges. - The leadership team on global level reviews and prioritizes identified risks, considering their potential impact on its global supply chain operations. - Prioritized risks are reported to organization's enterprise risk management system, ensuring visibility and accountability across the organization. - Risks are assessed based on their potential impact on

		risks based on their perceived seriousness or potential impact on operations	critical operations and compliance standards - High-risk areas are identified through continuous learning initiatives, technical expertise, and feedback mechanisms from risk and compliance teams. - The significance of risks is determined by considering factors such as the likelihood of occurrence, potential consequences, and the organization's tolerance for risk.
	Compliance risk	- Focus on adherence to policies, procedures, and regulations governing supply chain activities. - Evaluated using tools like the Supply Chain Self-Assessment Test (SCAT), which assesses compliance with policy requirements. - Assessment of likelihood and impact: scoring system based on compliance with policy requirements and procedures. - Offices falling below a certain threshold, such as 90% compliance, are flagged for attention, indicating areas where improvements or corrective actions may be needed. - Includes risks related to fraud, non-compliance with established policies, and ethical considerations. - Utilize KPI to measure compliance performance in key areas including percentage of compliance achieved in critical processes like procurement - Specific targets: aiming for at least an 85% compliance rate in key areas. These targets serve as benchmarks for evaluating performance and identifying areas for improvement.	
C	Procurement risk	- Enterprise Risk Management(ERM) framework: follows principles contained in the ISO31000 standard - Risk Review: annual formal assessment process involving key stakeholders to identify, assess and mitigate risks across all operational levels - Evaluation of impact and likelihood: five-by five grid	

		- Risk matrix: colors indicating risk levels ranging from green(minimal) to red(catastrophic) - Prioritization is based on impact and likelihood - Bow-tie analysis: multiple potential causes of the risk and multiple potential consequences are written

Company	Risk type	Findings
1	Operational risk	- Assess the likelihood of events occurring and understanding consequences - Formalize meetings with S&OP reviews and suppliers -Focus on scenario-based planning, utilizing historical data and incorporating key information for energy-related factors - Prioritization of risk is related to compliance, safety, and customer satisfaction - Prioritization is also based on financial impact, profits, and strategic importance
2	Operational risk	- Standardization and continuous improvement using Operations Management Systems (OMS) - Use Warehouse Management System (WMS) and Transport Management System(TMS)
	Safety risk	- Categorize risks based on behavior-based safety aspects focusing on human behavior and safety culture - Baseline risk assessments and issue-based risk assessment focusing on job safety and quality analysis for each step of a function - Calculate severity based on likelihood and impact - Analyze variations through a calculated process, involving revisiting work instructions, checking for missed steps and determining whether issues are related to behavior, training, or process flaws. - Prioritization is based on a standard Risk Evaluation and Identification (REI) list provide by the head office
3	Operational risk	- Uses KPI for identification: on-time goods receipt, on-time goods issue, on-time pick and delivery, inventory consistency and on-time information of delivery - Scoring system: For port congestion, factors are ship waiting time and anchorage waiting days affecting risk exposure and impact intensity - Not possess specific assessment methods - Uses internal historical data accumulated via 3's own platform. External data including GPS data from port base and ships, real-time weather information

		- Prioritization: based on the potential impact on customers and financial losses. Ex) sensitivity of the product cost - Scenarios: 1) For war, using short-term (1-2 months), one-year, and long-term(+3 years) 2) For flood, analyze the outcomes based on three alternative routes - Report on the cost aspect of the impact - Each regional 50 branch handle risk management
4	Compliance risk	- Strict compliance with license requirements aiming for a 100% level - Prioritization is based on the level of control, responsibility, and decision-making actor they have at different stage of supply chain
	Safety risk	- Assess potential impact on the health and safety of personnel - Likelihood: analyzing frequency of incidents and near misses with a scale ranging from 1 to 5 where level 5 indicates the highest operational disruptions. - Impact: financial implications, injury severity, and operational disruptions with a scale ranging from 1 to 5. - parameters: exposure to hazards, cost implications, intensity of impact on operations and personnel - Also focus on assessing company assets including machinery, buildings and infrastructure. Ex) consider equipment malfunctions, structural failures and damage to warehouse infrastructure. - Apply same risk assessment methods + financial considerations - 5 Whys technique: a root cause analysis tool aimed at identifying the underlying reasons behind a problem or incident
5	Product related risk	- Identification occurs via S&OP where trends are analyzed, and potential risks are evaluated based on their probability and impact while there is not specific techniques for risk assessment - Assess risks into low-medium high and scaling 1-2-3 - Consider the impact of risks in terms of cost factors such as cost of goods sold, missed net sales, working capital impact by inventory and obsolete/scrap costs - KPI: inventory management, service level, forecast accuracy and bias, working capital, quality complaints, innovation coverage and production plan performance - Risk prioritization occurs within a project governance framework, considering factors like impact, urgency, and resource availability
6	Product risk	- Analyze risk based on Supplier Assessment Questionnaire(SAQ) responses including supplier's

		financial stability, the number and location of production sites, geographical considerations (such as political instability), and single/multiple sourcing - Weekly risk assessment meetings quantify and present potential risks to managers considering factors like potential losses(turnover) - Primarily focuses on the quantity of items at risk and quantify them in numbers in high, medium, or low - Classified into 1) supply-related risk: production delays from raw material shortages or machinery maintenance issues which hinder the timely production of goods 2) demand-related risk: risks like overselling leading to potential shortages in product availability - prioritization: based on potential impact on product delivery and customer satisfaction. Ex) risk that leads to substantial shortages in product availability receive the highest priority
7	Operational risk	- Risks are defined as any deviation from established lead times for delivering medical devices to hospitals - Utilizes an internal system using OTM(Oracle Transportation Management) for identifying risks - Categorizes risks into high, mid, and low based on price ranges, considering cost and probability of delays - Analysis involves percentages relative to the total number of occurrences. - Conducts detailed investigations into incidents, categorizing factors into major categories such as natural disasters and issues in factories. - Historical data especially for lead times is utilized and updated every 3 months based on valid data - Baselines for costs are also updated every three months, considering factors like inflation, particularly since the COVID-19 pandemic - Criteria for prioritization include lead time deviations, baseline cost, quality issues, and system errors. - Focuses over 90% on lead time issues, which account for most of the operational risk evaluation and measurement

Category 2. Risk mitigation

Organizations	Risk type	Findings
A	Operational risk	- Partnership with relevant stakeholders - Maintain fleet of vehicles - Collaborate with ministries, churches, and other NGOs
	Compliance risk	- Regular training sessions: learn policies and guidelines - Internal audits that encompass all aspects of operations - Office hours and global conferences: to understand complex government contracting regulations
	Reputational risk	- Emphasize staff conduct and professionalism: trained to interact with the media and government officials - Strict protocols for media engagement: prevent misinformation or misrepresentation
	External risk	- Network of local and regional partners: to source essential goods locally and ensure the timely delivery of aid materials
	Security/ Financial risk	- Toll-Free Reporting System: allow to report any discrepancies or issues not aligned with program goals enabling organization to receive real-time feedback from the field - Strict Criteria-Based Participant Selection: ensure that resources are allocated to those who need them the most to avoid excluding vulnerable households or misallocating resources to less deserving recipients - Verification Process: cross-checking participant information through various means including household visits and interviews to confirm eligibility and prevent fraud or misrepresentation
B	Operational risk	- Facilitate collaborative problem-solving channels between country programs and global teams - Expertise deployment such as freight and forwarding companies, shipping experts or emergency health intervention teams - Capacity building and support such as training, technical assistance, and resource allocation
	Compliance risk	- Continuous training and learning initiatives are conducted to enhance staff understanding and adherence to policies and procedures. - Access to technical experts and support channels is provided to address compliance-related queries and challenges. - Regional supply chain teams offer practical assistance and support to address specific compliance issues at the country level.

		- System-based support and guidance are offered to ensure effective use of procurement software and other tools. - Continuous feedback loops are established to identify recurring compliance issues and implement corrective measures promptly.
C		1) Proactive risk treatment: implemented before a risk event occurs based on identified causes of the risk event - Terminating an activity altogether or changing modalities - Engaging in a partnership with a new agency - Replacing a vendor or terminating an agreement with a partner - Changing procedures to improve controls - Engaging in insurance or contractual arrangements to mitigate financial risks - Developing contingency plants for various scenarios 2) Reactive risk treatment: executed after a risk event occurs, thus addressing the consequences of the risk event occurring - Establish/modify contracts and agreements - Operational adaptations - Financial management - Root cause analysis and corrective measures - Communication and advocacy - Collaboration with partners and entities

Company	Risk type	Findings
1	Energy price risk	- Hedge against energy price fluctuations through forward buying essentially projecting and fixing prices for the future
	Supply risk	- Understand the production facility's capabilities and historical breakdown data to project the accuracy and reliability of supply
	Demand risk	- Improvement of forecast accuracy, tracking and evaluation of forecasting performance is done by marketing department
	IT risk	- Consensus is reached before planning upgrade
	Operational	- Explore alternative modes of transport and establish relationships with forwarders and transporters to

	risk	introduce flexibility into supply chain
2	Safety risk	- Investigate identified hazards and near-misses - Implements controls and continuously updates work instructions and procedures
	Operational risk	- Conduct critical analysis led to changes in policies, retraining of employees and rewriting of the full potential plan, emergency response plan, and traffic plan - Continuous improvement
3	Operational risk	- Identify alternative routes and carriers and allocates a percentage of volume to alternative routes - Purchasing department identifies vendors, make contract with vendors
4	Compliance Risk	- Employs internal guidelines and standards often exceeding legislation requirements - Investigate root cause - Safety and security department is responsible for managing risks
	Safety risk	- Learn from actual incidents through collaborative sessions with frontline staff - Identify root causes and implement targeted interventions - Implement engineering controls, modify work processes, provide specialized training and enhancing safety protocols - Consider factors such as cost and feasibility in determining the most effective risk mitigation strategies
5		- Contractual adjustments such as modifying timelines or hedging against price fluctuations - Diversifying supply chain flows - Maintaining contingency plans - fostering creative partnerships
6		- Facilitate stock transfers between company offices - Approve alternative suppliers - Adjusting inventory policies to accommodate fluctuations in supply - Explore alternative materials that may offer more reliable sourcing options - Effective communication with customers
7		- Utilization of air shipment: collaborate with key forwarders which are connected in a single line, with key account managers assigned to each country - Integrated systems: real-time sharing of information with forwarders - Rapid response: country managers promptly engage key personnel to address supply chain issues

Category 3. Risk monitoring and auditing

Organizations	Monitoring	Auditing
A	- Monthly monitoring: monitoring teams are deployed to various locations to assess operational performance, adherence to policies and compliance with regulations - Rotation of monitoring teams: to gain exposure of different aspects of risks	- Internal audits: use criteria such as operational complexity and perceived risks to select countries, conducted at both regional and global levels - External audits: review organization's financial statement and identify any potential gaps or areas of non-compliance - Funding: overhead costs cover expenses related to headquarters and regional staff, while direct costs are allocated to program implementation activities
B	- Quarterly monitoring: prevents prolonged periods without reassessment ensuring that potential issues are addressed promptly -Supply Chain Improvement Plan (SCIP): includes addressing recommendations from audits and ensuring progress towards closing identified gaps. Challenges in implementing the improvement plan are identified and addressed to facilitate progress	- Internal audit function: conducted periodically, focusing on key operational areas such a procurement, inventory management, and fleet operations - Internal audit report: includes areas of non-compliance, inefficiencies, or areas for improvement and shared with country leadership and relevant department heads for review and action - External audit: conducted twice a year, reviewing the financial performance and monitoring implementation of actions - Funding: Designated team handles fundraising activities and donor relations, working to secure financial support for its programs and operations -Donor requirements and contractual agreements are closely monitored and adhered to by the team to ensure compliance with donor expectations and regulations
C	- ERM monitor compliance at the global level and prepare annually a report containing the outcome of the risk review and highlighting any emerging risks,	- Internal audits: ensure compliance with organizational policies and procedures conducted by the Office of Internal Oversight

	areas of non-compliance and concerns - Regional bureau directors monitor the adherence of country with policy	- External audits: provide independent assessments of organization's financial management and operational effectiveness performed by the Board of Auditors - Funding: Requires funds for its Headquarters support structure to underpin its extensive field operations. - Operational Reserve: allows to fund activities such as emergency assistance, administrative expenses, and project modification

Company	Findings- Monitoring	Findings- Auditing
1	- Monitoring is conducted periodically at different hierarchical levels - Formalized procedures for monthly, weekly, and daily assessments - Monthly sales operations meetings, weekly KPI measurements and daily planning operation meetings	- Annual internally or external audits primarily assess adherence to procedures rather than a specific focus on forward-looking risk management
2	- Operational risk: Checked daily as per process standards - Safety risk: can occur multiple times a day - monitoring involves reviewing risk assessments, evaluations, job safety, and quality analysis along with work instructions	- Internal audits: regularly including internal audits by SHEQ coordinators from different locations - External audits: involve an internal auditor and an auditor form the head office
3	- Monitored on a weekly basis - Regional Headquarters: monitors risk by gathering the risks from each branch and spread the risk sensed to other regions	- Audit: 1) Field diagnostics held by headquarters annually. 2) Regular audit by process audit team to target financial losses in logistics process -
4	- List the incident and deviations - Investigate root cause	- Internal audits and ISO audits focusing on the quality of the orders processed

	- Perform foul control - Monitors changes in legislation via a dedicated team and participates in seminars, fairs, and maintains contacts with authorities	
	- Regular monitoring: at least once a year - Additional reviews: in response to changes in processes, operations or external factors that impact risk exposure	- GEMBA walks: involve direct engagement with frontline staff to gain insights into daily operations, identify potential risks, and explore opportunities for improvement
5	- Performed continuously with a yearly exercise being conducted as a comprehensive review - Major strategic programs undergo thorough every 3 years	- Compliance Internal Audit department - Audits are conducted continuously with projects randomly selected for assessment
6	- Conducted daily for 1hr, the team reviews and analyzes various risk factors using scenario planning software - Software allows to visualize and assess supply and demand including independent demand, total demand, distribution plans, total supply, balance and days of coverage	- On-site/remote social compliance audits: focus on suppliers based on their type of product or service - Non-conformances must be remediated within 90days followed by a follow-up audits - Audit validity range from 1 to 3 years
7	- Daily tasks, with cargo triggering alerts checked on a daily basis	- Internal Audits: focus on practical aspects, examining adherence to procedures during incidents like cost overruns - External Audits: ISO-related ones are supported by documented contingency scenarios

Category 4. Risk register and responsibility

Organizations	Risk register/tracking	Responsibility
A	- Utilize KPI: such as number of purchase orders rejected, errors in the finance module and discrepancies in cycle counts - Working on reducing the number of KPIs to streamline monitoring efforts	- Country Representatives: oversee all aspects of operations within their assigned regions - Programming teams: assess risks associated with program delivery, community engagement and partner collaboration - Supply chain and finance teams: establish policies such as procurement practices and financial controls
B	- Utilize KPI to measure compliance performance including the percentage of compliance achieved in critical processes like procurement - Specific targets are set for compliance rates serving as benchmarks for evaluating performance and identifying areas for improvement	- The Global Supply Chain Risk and Compliance team: primarily responsible for managing and mitigating risks within organization's supply chain operations. This team oversees the identification, assessment, monitoring of risks and audit findings across various supply chain functions. - While the regional team, led by regional supply chain directors, focuses on operational excellence, they also indirectly contribute to risk management efforts by ensuring that processes are executed efficiently and in compliance with established standards and procedures.
C	- 1) Operational risk register: at different levels(country, regional and headquarter), updated via the operations management cycle annually -2) Strategic risk register: identifies significant organization-wide risks, regularly reviewed by senior management and updated at least twice a year - Reports generated from the risk register provide stakeholders with insights into the organization's risk profile, current risk status, treatment progress and areas requiring additional attention or resources	- Risk owners: managers at country, regional and headquarters level manages their risks - Chief Risk Officer: coordinates overall risk management process

	- Integrated with decision-making processes when evaluating strategic initiatives, resource allocations, and operational plans to ensure risks are adequately addressed and mitigated - Multifunctional team reviews, quarterly updates, and periodic assessments of the risk register	

Company	Risk register/tracking	Responsibility
1	- No structured register - Based on data and experience with a focus on recent years and the notable challenges encountered during that timeframe - Evaluation is conducted on a business year-by-year basis, reflecting on the challenges faced during that period	- Decentralized with various disciplines and departments; no single risk team
2	- Quality/Service KPI tracking: utilize OMS dashboards and review methods for continuous monitoring and follow-up - Assign process manager and SHEQ officer on-site to oversee compliance - In-house customs department oversees customs-related risk - Risk evaluations are both period(annual and monthly) and continuous with high standards for checking on safety matters and process differences	- 1) SHEQ specialist: responsible for advising on new KPI procedures and legislative changes -2) General manager: holds overall responsibility for everything that happens in the warehouse, encompassing financial and risk perspectives
3	- No formalized indicators or metrics for evaluation - Deals with issues as they arise case-by- case basis, implements countermeasures and considers the issue resolved if it doesn't occur	- Decentralized across different departments each handling specific aspects related to risk mitigation and contingency planning

4	-Based on compliance with legislation rather than using models assessing likelihood and impact - Using ISO standards to decide whether licenses are correct or not.	- Operational manager: responsible for overseeing the implementation of risk such as allocating resources, monitoring compliance and establishing safety protocols
	- Review the process and identify areas for improvement. - Take actions to address identified risks and enhance risk management practices. - Assess the outcomes of implemented solutions. - Using a combination of qualitative assessments and quantitative measures to gauge success, including incident data analysis and ongoing monitoring.	
5	- Evaluated through post-launch evaluation typically conducted 6 months after implementation assessing whether goals were met and if the intended outcomes were achieved	- Decentralized with each discipline and department within their domain - Future network team, Regulatory affairs
6	- Dashboard: tracks high-risk materials in real-time and updated on a monthly-basis - Internal platform which creates risk cases for specific Stock Keeping Unit(SKU) - Notifications are received via email whenever there are updates or changes to the status of a risk case ensuring timely response and resolution	- Decentralized with each team member assigned specific categories
7	- Success is indicated by KPI consistently meeting set lead times, absence of logistics-related issues, and adherence to customer agreements regarding on-time delivery. - Discrepancies, such as lead time requests, are meticulously tracked and escalated by the Logistics	- Initial issues handled by logistics managers in each country - Logistics Center team: address issues that regional teams cannot resolve independently - A separate global team oversees risk management efforts, ensuring coordination and consistency across regions

	Center team. - Coordination with key account managers ensures proactive measures for timely delivery. - Daily monitoring of shipment movements, feedback provision, and assessment of possibilities enable effective risk management.	

Category 5. Documentation/ tools, Collaboration

Organizations	Documentation, tools	collaboration
A	- Supply Chain Handbook: comprehensive guide for supply chain management practices and procedures - Enterprise Resource Planning (ERP) system: for monitoring, tracking and analyzing supply chain data - Excel spreadsheets: internal control questionnaires	- Collaborate with other international organizations: partnership, working groups, and joint initiatives
B	- Excel spreadsheets: include such as operations risk dashboard and SharePoint for internal reporting and data management	- Does not collaborate extensively with other organizations but wish to enhance collaboration
C	- Risk Management Tool: consists of four parts(a risk event, its causes, consequences and treatments) - Overall responsibility for the risk management documents: Senior Risk Advisor	- Public-Private Partnerships: for technical expertise and support in sustainability initiatives - Government partnerships: for civil law-related initiatives such as capacity building in registration processes - Project implementation: economies of scale and access to technical expertise not available in-house

Company	Documentation, tools	Collaboration
1	- Do not have specific manuals for supply chain risks	- Regular contacts with suppliers and customers for information

	instead follows its existing processes, including S&OP, monthly KPI tracking and budgeting procedures - Do have documents for safety and compliance - Using internal software program for modeling on scenarios to mitigate risks and Excel spreadsheet - Use GPS tracking tools for monitoring and tracing tank containers and ships - Sustainability Report: insights on company's commitment to environmental responsibility	sharing - Collaborate with educational institutions and participate in events and seminars
2	- Using a filing report system includes financial reporting and KPI reporting - Excel spreadsheet - Using a their real time process mining tool connected to the Warehouse Management System, providing insights into minute-to-minute process flows, helping identify deviations and areas for improvement - Standardized documents: includes risk assessments, business continuity plans and procedures that are customized for each site's situation	- Global network collaboration: 26 warehouse facilities in the Netherlands and Belgium - Internal collaboration: within the family of the companies - External collaboration: focus on specific services like ISO audits and first aid training - Internal communication platform: weekly Performance Dialogue (PD) that involves a diverse group discussing identified issues, legislative changes, and sharing experiences
3	- Using internal system where various data is collected, reports are created and information is shared within all global branches - Generative AI: using a system called Fabrics for internal searches and reporting requests related to risk - No standardized documents for risk procedures. Instead, templates for the format are available. - Documents are not publicly accessible considered exclusive assets within the company	- Collaborate with government agencies, shipping companies for shipping trend - Technology introduction sessions organized by the headquarters for knowledge sharing
4	- No specific tools for customs process	-Collaboration with authorities (customs officer) is crucial,

	- Blockchain for data sharing and developing platforms for better connection with customers	especially in cases of potential smuggling or criminal activities. - Collaboration with customers and third-part providers in a daily basis
	- Internal documents that outline procedures and requirements covering safety, health, security, and business continuity management practices - Excel spreadsheet, Power BI - Artificial intelligence(AI): assist in detecting potentially hazardous situation	- collaborate with suppliers of machinery, security providers, staffing agencies to discuss safety measures, security protocols and staffing arrangements tailored to the specific needs of each operational area. - Frequency of collaboration varies depending on the nature of the topics being addressed - Learning packs based on the incident investigations which are shared globally within the HSSE(Health, Safety, Security and Environment)community
5	- Excel for principle toolbox - Business intelligence - No specific documents - Scenario based training programs, both classroom and e-learning	- Collaborate with consultants, typically under non-disclosure agreements for strategic assessments and advice
6	- Excel: used for risk monitoring, KPI tracking maintaining risk registers - Power BI: data analysis and visualization assisting in the assessment of forecast accuracy and inventory levels - Internal documents that outlines procedures for risk management - Training on these protocols provided	- Collaboration with 3rd party partners like factories and transportation companies - Regular meetings are conducted to discuss risk mitigation strategies, production capabilities, raw material availability and logistics -Workshops and training sessions are organized within the organization to inform technological advancements
7	- Oracle - Excel spreadsheets: used for reporting needs such as quarterly or annual cargo records - Power BI: for monitoring and creating dashboards for tracking shipment history	- Limited collaboration with other organizations - During events like conflicts or pandemics, where assistance may be offered to manage export/import-related risks - Participation in seminars, conferences and engagement with medical association to get informed about best practices and

	- Website within the integrated supply chain organization provides access to globally applicable documents ensuring standardization and compliance with external audit requirements - Internal platform: logistics-related documents are stored and searchable using keywords - Active pursuit of AI integration - Ongoing work to classify items like software within the HS code system	developments

Challenges of Humanitarian supply chain

Organizations	Challenges
A	- Security: Sudan, necessitate alternative delivery methods such as air drops, introducing risks of interception or exploitation by armed groups - Logistical: Conducting air drops involves logistical complexities, including preventing containers from bursting or leaking upon impact - Budget constraints: implementing security measures and innovative solutions can incur additional costs, necessitating careful budget allocation - Collaboration with host governments or military forces in high-risk areas
B	- Human resources: Recruiting, retaining, and managing skilled personnel, staffing shortages and turnover rates - Operating context: limited infrastructure, security risks, political instability, and geographical barriers increasing vulnerability to various risks, including fraud, corruption, and delivery disruptions
C	- Funding shortage: facing severe funding crisis within the entire humanitarian system - Politicization of refugee crisis: distinction between refugees and migrants are politicized globally, difficulty in explaining legal differences exacerbates challenges in securing funding and developing projects - Lack of human resource