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## Maritime transportation disaster management and humanitarian: Iskenderun region

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### Research Article

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Throughout history, natural and man-made disasters have caused severe humanitarian crises, both worldwide and in Türkiye. These disasters have necessitated extensive humanitarian aid as well as efficient and rapid logistics management. This article analyzes the role of maritime transportation in disaster management and humanitarian aid processes in Iskenderun Region, with a focus on the 6 February 2023 earthquakes in Türkiye. Utilizing literature through reviews, surveys, and data analyses, the study examines the effectiveness of maritime transportation in disaster response activities. The results of the survey conducted with 160 participants indicate that maritime transport plays a critical role in disaster management processes. While the majority of participants expressed that maritime transport provides a rapid and effective response to disasters, some participants highlighted the need for infrastructure improvements to enhance the efficiency of these processes. These findings suggest that the current maritime transport infrastructure requires strengthening to improve its effectiveness in disaster management. Most of the participants highlighted the rapid and effective responses enabled by maritime transportation and humanitarian aid processes, but some emphasized the need to strengthen its infrastructure.

## INTRODUCTION

Disasters negatively impact the human lives and necessitate extensive humanitarian aid. A disaster is an unpredictable event that disrupts the course of life, often resulting in loss of life and property. Many disasters have occurred since the dawn of humanity. The term 'disaster' is derived from Arabic, meaning destruction, calamity, or catastrophe (Çeber, 2005). In brief, a disaster is a cumulative event caused by human-made or natural factors, resulting in long-term impacts on living beings and significant loss of life and property (Coppola, 2011).

Disasters can be categorized into natural and technological disasters. Natural disasters include earthquakes, landslides, volcanic eruptions, floods, tsunamis, droughts, environmental epidemics,

desertification, deforestation, and pandemics. Technological disasters encompass nuclear, chemical, industrial, and maritime transportation accidents, as well as terrorist acts. These technological disasters can be triggered during the natural flow of life or as a result of natural disasters (Akyel, 2007).

Humanitarian aid is defined as all assistance including money, gifts, and services, provided to those in need. As opposed to development aid, humanitarian aid is intended to be temporary and is not aimed at long-term or permanent solutions. It includes daily essentials to sustain life temporarily. Long-term aid, also known as development aid, is typically implemented for a limited period before changes are made. The recipients of aid include the vulnerable groups such as elderly, disabled, displaced, refugees, and all victims of natural disasters, wars, and famines.

Research on the challenges of humanitarian logistics (HL) in disaster relief reveals significant obstacles to logistical organization, including poor communication. Kovács and Spens (2009) highlight that these challenges vary depending on the type, severity, location, and timing of the disaster. One of the main challenges is ensuring coordination of logistical activities at both intra-organizational and inter-organizational levels. Poor communication and teamwork can severely disrupt logistics operations, both within and between humanitarian organizations. Lack of standard procedures and training for logisticians reduces the efficiency of aid efforts (Kovács and Spens, 2009; Moshtari and Gonçalves, 2012).

Humanitarian organizations often struggle with disrupted supply chains caused by access restrictions, limited capacity, and security issues. Unpredictable road conditions, travel bans, and border closures make maritime transportation even more challenging. The distribution process becomes increasingly complicated as numerous local and international organizations, each with their own procedures and priorities, get involved (Balcik et al., 2008; Nikbakhsh and Farahani, 2017).

External factors, like the influence of social media, also affect humanitarian logistics. While social media can expedite information sharing, it can also spread misinformation and distract logistics teams. The presence of many new and emerging organizations, as seen after the 2010 Haiti earthquake, adds another layer of complexity to the process (Van Wassenhove and Besiou, 2013; Kunz and Reiner, 2016).

Throughout history, both globally and in Türkiye, natural and technological disasters have occurred frequently, requiring extensive humanitarian aid and effective logistics management. Maritime transportation plays a vital role in disaster management by enabling the rapid and cost-effective maritime transportation of large volumes of materials. According to UNCTAD, over 80% of the volume of international trade in goods is carried by sea, and the percentage is even higher for most developing countries (UNCTAD, 2021).

Modern disaster management involves Prevention of natural disasters and accidents, preparation activities for these situations, and post-disaster response and recovery activities. Initially, hazards are understood, and countermeasures are taken. Plans and training are prepared for potential disaster scenarios, and public awareness is raised. Rapid response during a disaster is crucial, such as search and rescue activities and delivery of essential materials such as food, water, medicine, and shelter. Post-disaster efforts, on the other hand, focus on repair of

damaged areas and restoration of normalcy. Governments, aid organizations, and communities should work together, using technology effectively to minimize disaster impacts and build a safer and more resilient society (Kadıoğlu and Özdamar, 2008).

The relationship between modern disaster management and humanitarian logistics (HL) is critical for minimizing disaster impacts and ensuring effective aid. Modern disaster management comprises four main phases: mitigation, preparation, response, and reconstruction. These phases encompass the core processes of humanitarian logistics and determines how logistical activities can be optimized at each stage.

1. Mitigation: This phase involves taking steps to prevent or lessen the negative impacts of disasters. It starts with hazard analyses to identify risks, followed by implementing necessary structural and non-structural measures. From the perspective of humanitarian logistics, this means strategically positioning logistics facilities and pre-stocking essential supplies (Warfield, 2008).

2. Preparation: This phase focuses on activities to get ready before a disaster strikes. It includes organization of logistics networks, preparation of emergency plans, and rehearsals. It's also crucial to identify collaboration partners and align information and communication technologies during this phase (Kunz et al., 2014).

3. Response: This phase involves quick and effective action during a disaster. It includes distributing emergency supplies, evacuating the survivors, and providing essential services. From a logistics perspective, rapid mobilization and coordination of resources are crucial in this stage (Altay et al., 2013).

4. Reconstruction: This phase focuses on long-term solutions after a disaster. It involves reconstruction of damaged structure and infrastructure and restoration of normalcy. Logistics processes play a key role in rehabilitation and solidarity efforts during this phase (Warfield, 2008).

Humanitarian logistics is vital in every phase of disaster management. For example, during the pre-disaster preparation phase, proper storage and supply chain management actions are essential. During the disaster response phase, quick interventions and the distribution of materials are critical. In the reconstruction phase, long-term logistics planning and sustainability are of utmost importance. Humanitarian logistics requires the coordination of various institutions and organizations, including governments, NGOs, and the private sector. Each entity contributes differently in their respective capacities and mandates. For instance, military units are capable of

rapid intervention, while NGOs play a crucial role in identifying and meeting needs by working closely with local communities (Kovács and Spens, 2007). Using maritime transportation during disasters allows for faster and more effective interventions. Historical examples, such as the use of Ottoman ships to deliver aid during the seven-year famine in Ireland in 1847, demonstrate the long-standing importance of maritime transportation in disaster response.

Identifying, preventing, and managing hazards and emergencies at seaports is also crucial. Skiba (2023) emphasizes the need for well-prepared laws and regulations to ensure maximum safety in maritime transportation. Because seaports play a critical role in security and crisis management and the port administrations must always be ready for a swift and effective response during crises (Skiba, 2023) and they cannot carry out these functions without suitable laws and regulations.

Dui et al. (2021) propose a new method to optimize resilience management in maritime transportation systems (MTS). The new method defined by Wan et al. (2018) is a strategic approach aimed at optimizing resilience management in maritime transportation systems (MTS). This method enables MTS to be prepared against risks, respond swiftly and effectively to operational disruptions, and strengthen its capacity to return to normal operations.

Incorporating components such as systematic risk assessment, flexible design, real-time monitoring, and stakeholder collaboration, this approach seeks to optimize the resilience capacity against potential disruptions while enhancing operational efficiency by considering the complex and dynamic nature of MTS. Their study shows that ports and maritime routes can easily be disrupted by political and natural events that cause significant socio-economic impacts. They developed a model based on post-disruption analyses to optimize the resilience of ports and routes, aiming to prioritize their restoration to enhance disaster management resilience. Dui et al stress the need for substantial measures to increase the resilience of maritime transportation systems, which would accelerate post-disaster recovery (Dui et al., 2021).

Effective communication during a disaster facilitates rapid intervention. Islam et al. (2020) utilize an Automatic Identification System (AIS) data for disaster management at ports which continuously transmits critical information such as the position, identity, speed, and route of ships. Their study aims to estimate the quantity of essential goods carried by ships using AIS data and artificial intelligence networks. This helps disaster managers more accurately assess post-disaster needs and make informed aid decisions. Islam et al highlight that AIS data improves post-disaster logistics

processes and enables more effective aid distribution and can also enhance pre-disaster preparations (Islam et al., 2020). Proper maritime logistics planning during disasters is essential as chaos and lack of planning negatively impact disaster logistics.

Wang and Tanaka (2016) developed a planning model to optimize maritime logistics during emergencies or disasters. The model aims to optimize maritime logistics by assigning ships to relevant maritime transportation routes. Applied in a Tonankai earthquake scenario, the model estimates the required resources during a disaster. Their study demonstrates how to manage maritime logistics in emergencies by determining the necessary ships and materials under different scenarios. Wang and Tanaka emphasize that this model can be adapted to other disaster scenarios, ensuring efficient resource use in disaster management. Their study underscores the critical role of maritime logistics in disaster scenarios and the importance of proper planning for faster post-disaster recovery (Wang and Tanaka, 2016).

Ozkapici et al. (2016) examined the intermodal aid distribution model involving maritime and road transportation in Istanbul. Given Istanbul's vulnerability to earthquakes, the model aims to utilize the flexibility and accessibility of maritime transportation for effective and reliable humanitarian logistics operations. The model focuses on transporting aid materials between the European and Anatolian sides of Istanbul using maritime routes, ensuring faster and more reliable delivery of aid materials to areas in need. Their study demonstrates how to optimize post-disaster aid operations using the flexibility and efficiency of maritime transportation (Ozkapici et al., 2016).

In conclusion, effective maritime logistics planning during disasters significantly contributes to humanitarian aid operations. The literature highlights that maritime transport plays a crucial role, particularly in providing logistical support, increasing capacity, and facilitating accessibility (Kovács and Spens, 2007; Rodrigue, 2014). In this context, the preparedness level of the Port of Iskenderun in disaster management and humanitarian aid processes is generally considered "moderate." However, studies on the resilience of ports and logistical challenges emphasize the need for further implementation of emergency plans, training programs, and awareness-raising initiatives (Lam and Su, 2015).

The assessments specific to the Iskenderun Port reveal that the effectiveness of emergency plans and training programs is "moderate" and that these processes need improvement. Over the years, investments and projects aimed at enhancing the resilience of ports against disasters

have proven insufficient. Therefore, it is evident that maritime transport strategies should be reviewed, and greater logistical support, capacity, and accessibility, particularly in disaster management processes, must be ensured (Van Wassenhove, 2006). Ultimately, reviewing current strategies and investing in projects that boost logistical capacity will enable ports to be used more effectively during humanitarian aid operations in times of disaster (Jahre and Heigh, 2008).

The purpose of this study is to highlight the critical role that maritime transport plays in humanitarian aid operations within disaster management. Disasters are unexpected events that deeply affect human life and threaten the fundamental structures of societies. In such situations, the swift and effective delivery of aid is one of the most vital components of saving lives and facilitating societal recovery. Maritime transport offers a strategic logistical solution in post-disaster recovery due to its capacity to deliver large quantities of aid materials quickly, economically, and across vast geographical areas. However, there is a significant gap in the literature regarding the integration of maritime transport into disaster logistics. This study aims to fill that gap by contributing to the more efficient delivery of humanitarian aid, thereby improving the living conditions of disaster victims more rapidly. From an academic perspective, this research not only emphasizes the strategic importance of maritime transport in disaster management processes but also lays the groundwork for the development of more effective, sustainable, and resilient logistical solutions. In doing so, it will help ensure that societies are more resilient and prepared for future disasters.

## MATERIALS AND METHODS

This study evaluates the effectiveness of maritime transportation in disaster management and humanitarian aid processes in the Iskenderun Region through literature reviews, surveys, and data analyses. After preparing the questions and obtaining Ethics Committee approval, the survey was distributed to relevant individuals via Google Forms, and responses were recorded electronically with their consent. Initially, demographic information such as age, gender, education level, and occupation were collected. The survey responses were gathered and compiled into a table format.

The data was collected through the Google Forms platform, which automatically recorded and stored responses to the survey questions. The data was analyzed using Python. The survey conducted in the Iskenderun region on maritime transportation's role in disaster management and humanitarian aid processes was designed to include various demographic groups and types of

institutions. The survey collected data from individuals working in different institutions, including humanitarian aid organizations, port operators, and students. Including participants from various genders and age groups ensured that the sample represented the stakeholders in the region. Data was collected through an online survey, allowing participants to respond over an extended period. This method provided scientifically and statistically valid results in evaluating the impact of maritime transportation on humanitarian aid processes during disasters. The collected data was analyzed using the Python programming language. First, the survey data was transformed into a table format using the Pandas library, and frequency and percentage analyses were conducted. This allowed for the calculation of the distribution and percentage of responses to each question. Next, a chi-square test was applied to examine the relationships between variables; this test was particularly used to evaluate the relationship between the impact of maritime transportation on disaster management and the institutions where participants work. If the p-value was less than 0.05, it was concluded that there is a significant relationship between the two variables. The analysis results were visualized using Matplotlib and Seaborn libraries, making the findings easier to interpret. In this way, the data was summarized using basic statistical methods, while also allowing for a deeper examination of more complex relationships.

In this study, we engaged 160 participants involved in maritime transportation and disaster management. We distributed surveys to 300 individuals and achieved a 53.33 % response rate, which is acceptable for representativeness in social sciences. The participants were professionals from sectors like maritime transport, humanitarian aid organizations, and port operations. Our selection criteria included maritime industry employees, staff from humanitarian aid groups, logistics experts, public sector workers, and representatives of non-governmental organizations (NGOs). By focusing on participants with experience in disaster management and maritime processes, we aimed to gather meaningful data. Consequently, reaching a broad group of professionals and drawing on their expertise provided us with reliable and comprehensive insights into the role of maritime transportation in disaster management.

Shipowners, port authority employees, freight forwarders, maritime logistics workers, academics in marine science, professionals working in the logistics sector of the private industry, and personnel from the General Directorate of Coastal Safety (KEGM) are among the other professions that participated in the survey. The students who participated in the survey are maritime faculty students, and



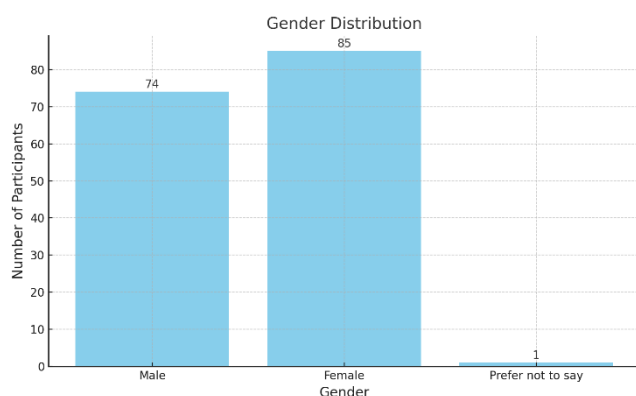
the survey was distributed to them.

## RESULTS AND DISCUSSION

Demographic data and responses from the survey were recorded in numerical format with confidentiality maintained throughout the data collection process. During the evaluation of the research data, frequency and percentage analyses were applied to each question. Chi-square tests were conducted for categorical variables to assess the significance of the data ( $p < 0.05$ ). Additionally, demographic analysis was applied to questions related to age, education, and occupation.

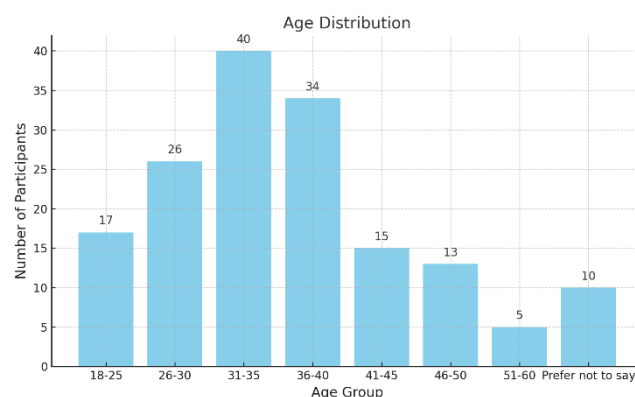
The average age of the participants is 34.9, with an age range between 18 and 57. In terms of gender distribution, it was observed that 80 participants were female, 75 were male, and 1 preferred not to disclose their gender. Regarding the distribution based on the type of institution the participants work for, the highest participation came from employees of port operations, with 44 participants. Additionally, 33 students and 24 employees of humanitarian organizations also participated in the survey.

When examining the participants views on the impact of maritime transportation in humanitarian aid processes during disasters, 52 individuals evaluated maritime transportation as having a 'very high impact,' while 47 considered it to have a 'moderate' impact. Fewer participants believed that maritime transportation was less effective. These findings reveal that the majority of participants perceive maritime transportation as playing a significant role in humanitarian aid processes.



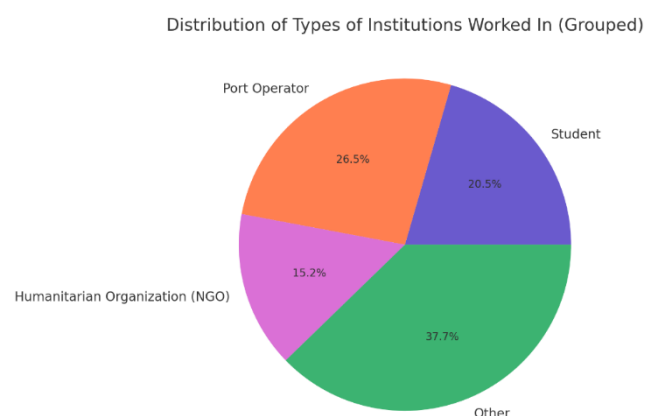
**Figure 1.** Gender distribution of survey participants

According to Figure 1, the number of male participants is approximately 74. The number of female participants is slightly higher, around 85. The number of participants who chose the "Prefer not to say" option is almost negligible. This distribution indicates a relatively balanced gender profile among participants, with a slight majority of female participants, presenting a positive picture regarding gender balance.



**Figure 2.** Age distribution of survey participants

Figure 2 shows the distribution of participants by age groups. The highest number of participants is in the 31-35 age group, with 40 participants. This is followed by the 36-40 age group with 34 participants, the 26-30 age group with 26 participants, and the 18-25 age group with 17 participants. The 41-45 age group has 15 participants, the 46-50 age group has 13 participants, and the 51-60 age group has 5 participants. Additionally, 10 participants preferred not to specify their age. This distribution indicates that the majority of participants are in their 30s, with a wide range of age groups represented.



**Figure 3.** Distribution of the types of institutions worked

Most participants work in humanitarian aid organizations and port operations. The majority are employed by humanitarian aid organizations, with port operations being the second largest group. Students and the "Other" category are represented in lower proportions (Figure 3).

### Percentage Analysis of Questions and Answers

1. How effective do you find maritime transportation in humanitarian aid processes during disasters? (Please select only one option)

**Table 1.** Frequency and percentage analysis of the survey question 1

| Response              | Frequency | Percentage (%) |
|-----------------------|-----------|----------------|
| Not Effective         | 3         | 5%             |
| Slightly Effective    | 7         | 12%            |
| Moderate              | 12        | 20%            |
| Highly Effective      | 18        | 30%            |
| Very Highly Effective | 20        | 33%            |

The majority of participants (63%) find maritime transportation to be highly or very highly effective in humanitarian aid processes. maritime transportation is considered significant in disaster management and humanitarian aid processes by most participants (Table 1).

2. Which areas of maritime transportation do you think contribute to humanitarian aid during a disaster? (You can select more than one)

**Table 2.** Frequency and percentage analysis of the survey question 2

| Area               | Frequency | Percentage (%) |
|--------------------|-----------|----------------|
| Speed              | 30        | 50%            |
| Accessibility      | 20        | 33%            |
| Capacity           | 25        | 42%            |
| Logistical Support | 35        | 58%            |
| Other              | 5         | 8%             |

Most participants (50%) rate the preparedness of maritime transportation as good or very good. Logistics support and speed are the most significant contributing factors in maritime transportation during disasters. Improving these areas can enhance the effectiveness of maritime transportation (Table 2).

3. How prepared are the İskenderun Port for disaster management and humanitarian aid processes? (Please select only one option)

**Table 3.** Frequency and percentage analysis of the survey question 3

| Response  | Frequency | Percentage (%) |
|-----------|-----------|----------------|
| Very Poor | 5         | 8%             |
| Poor      | 10        | 17%            |
| Moderate  | 15        | 25%            |
| Good      | 20        | 33%            |
| Very Good | 10        | 17%            |

Most participants (50%) rate the preparedness of maritime transportation as good or very good. There is general satisfaction with the preparedness of maritime transportation for disaster management and humanitarian aid processes, but there are areas for improvement (Table 3).

4. What do you think about the emergency plans and training programs of ports? (Please select only one option)

**Table 4.** Frequency and percentage analysis of the survey question 4

| Response        | Frequency | Percentage (%) |
|-----------------|-----------|----------------|
| Very Inadequate | 8         | 13%            |
| Inadequate      | 12        | 20%            |
| Moderate        | 20        | 33%            |
| Adequate        | 15        | 25%            |
| Very Adequate   | 5         | 8%             |

33% of participants find these preparations to be moderate, while 25% find them sufficient. There are mixed opinions about the emergency plans and training programs of ports. There is a need to improve existing programs (Table 4).

5. Which institutions and organizations should collaborate to coordinate maritime transportation in humanitarian aid activities during a disaster? (You can select more than one)

**Table 5.** Frequency and percentage analysis of the survey question 5

| Institution/Organization        | Frequency | Percentage (%) |
|---------------------------------|-----------|----------------|
| Local Governments               | 30        | 50%            |
| NGOs                            | 25        | 42%            |
| Port Operations                 | 35        | 58%            |
| Emergency Management Agencies   | 40        | 67%            |
| International Aid Organizations | 20        | 33%            |
| Other                           | 5         | 8%             |

The most critical institutions for collaboration are emergency management agencies (67%) and port operations (58%). Participants also recognize the significant role of local governments (50%) and non-governmental organizations (42%). Emergency management agencies and port operations play key roles in coordinating maritime transportation. The participation of local governments and NGOs is also crucial (Table 5).

6. Which factor most influences the contribution of maritime transportation to humanitarian aid during a disaster? (Please select only one option)

**Table 6.** Frequency and percentage analysis of the survey question 6

| Factor             | Frequency | Percentage (%) |
|--------------------|-----------|----------------|
| Speed              | 25        | 42%            |
| Accessibility      | 15        | 25%            |
| Logistical Support | 20        | 33%            |

Speed (42%) is seen as the most influential factor. To enhance the effectiveness of maritime transportation, more emphasis should be placed on speed, logistics support, and accessibility (Table 6).

7. What improvements do you think should be made to increase the resilience of port infrastructure in İskenderun against disasters?

**Table 7.** Frequency and percentage analysis of the survey question 7

| Improvement                  | Frequency | Percentage (%) |
|------------------------------|-----------|----------------|
| Infrastructure Strengthening | 30        | 50%            |
| Training and Drills          | 20        | 33%            |
| Technological Investments    | 10        | 17%            |

Infrastructure strengthening is seen as the highest priority improvement. Strengthening infrastructure is considered the top priority for disaster resilience. Training and technological advancements are also important areas to focus on (Table 7).

8. What training should be provided to enhance the performance of maritime transportation in disaster management and humanitarian aid processes? (You can select more than one)

**Table 8.** Frequency and percentage analysis of the survey question 8

| Training                                | Frequency | Percentage (%) |
|---|-----------|----------------|
| Emergency Response Training             | 25        | 42%            |
| Logistic Planning Training              | 20        | 33%            |
| Communication and Coordination Training | 15        | 25%            |

Emergency response training (42%) is the most recommended. Emphasizing emergency response training is essential to improving the performance of maritime transportation in disaster management. Logistics and communication training also play supportive roles (Table 8).

9. Which communication tools should be preferred in humanitarian aid operations using maritime transportation? (You can select more than one)

**Table 9.** Frequency and percentage analysis of the survey question 9

| Communication Tool     | Frequency | Percentage (%) |
|------------------------|-----------|----------------|
| Satellite Phone        | 20        | 33%            |
| VHF Radio              | 25        | 42%            |
| Internet-Based Systems | 15        | 25%            |

VHF radio (42%) is identified as the most preferred communication tool. (Very High Frequency) is the name of radio waves between 30-300MHz. The system, which goes by different names such as Marine Radio (VHF Marine Radio), Radio Telephone, is a radio system that operates in the VHF frequency band and is used for marine vehicles to communicate with each other or with the land. This system uses frequencies between 156-174 MHz in the VHF frequency band. VHF radios are seen as the most effective communication tool in humanitarian aid operations. Satellite phones and internet-based systems are also critical communication tools (Table 9).

10. Which feature best expresses the importance of the sea bridge strategy in disaster relief operations? (You can select more than one)

**Table 10.** Frequency and percentage analysis of the survey question 10

| Feature            | Frequency | Percentage (%) |
|--------------------|-----------|----------------|
| Rapid Access       | 30        | 50%            |
| Wide Coverage      | 15        | 25%            |
| Flexible Logistics | 15        | 25%            |

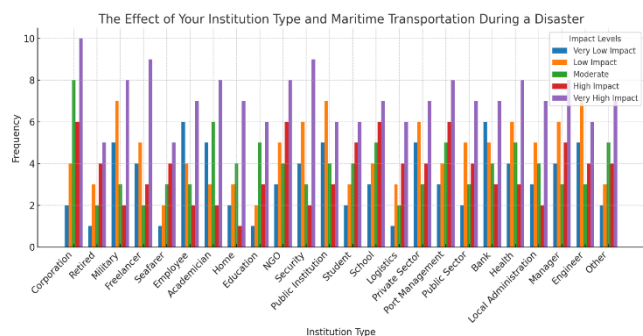
Quick access (50%) is considered the most crucial feature. Quick access is highlighted as the most important feature of the sea bridge strategy in disaster relief operations. Wide coverage and flexible logistics are also valuable aspects (Table 10). Impact of maritime transportation During Disasters;

- 1.The impact of the institution type you work for on the effectiveness of maritime transportation during a disaster. There is a significant relationship ( $p < 0.05$ ) (Table 11).
- 2.The preparedness of İskenderun Port for disaster management and humanitarian aid processes, based on the institution type you work for. There is a significant relationship ( $p < 0.05$ ) (Table 12).
- 3.The emergency plans and training programs of the ports, based on the institution type you work for. For each relationship: Chi-Square Statistic and p-Value. There is a significant relationship ( $p < 0.05$ ) (Table 13).

**Table 11.** Chi-Square analysis of the impact of Institution Type on the effectiveness of maritime transportation during a disaster

| Test Type            | Value     |
|----------------------|-----------|
| Chi-Square Statistic | 393.67    |
| p-Value              | 0.0000894 |

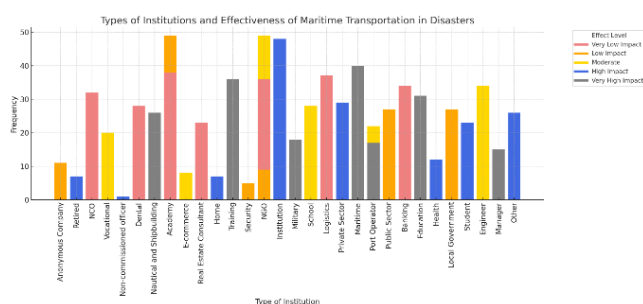




**Figure 4.** Type of Institution and the impact of maritime transportation during disasters

Figure 4 shows the levels of impact of maritime transportation during disasters by type of institution. The impact of maritime transportation varies by institution type, which may be due to the different levels of knowledge and roles these institutions have in disaster management processes. Many institutions and individuals may not be aware of the effectiveness of maritime transportation in disaster scenarios. In the logistics sector and port operations, institutions increasingly emphasize the efficiency of maritime transportation. However, it is observed that public and private sector employees not directly involved in these operations do not fully recognize the role of maritime transportation in disaster scenarios. This indicates the need to raise more awareness about the critical role of maritime transportation.

Improvement Suggestion: "Training and awareness campaigns should be organized for public and private sector employees to explain the critical role of maritime transportation in disaster scenarios, with an academic and humanitarian approach."



**Figure 5.** The impact of maritime transportation during a disaster by institution type worked

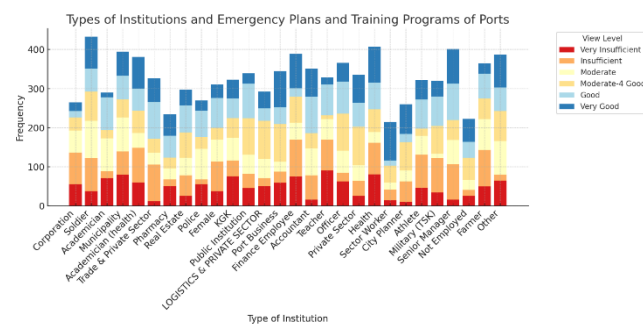
Figure 5 shows the preparedness levels of İskenderun Port for disaster management and humanitarian aid processes by type of institution. Different institutions have varying perceptions and experiences regarding port preparedness. Port operations and NGOs are the most informed and prepared in this regard.

Port employees and NGOs tend to assess the port's preparedness for disaster management more highly, while public and private sector employees appear to have a lower perception of preparedness. This suggests that institutions not directly involved in port operations may have less knowledge about disaster management processes.

Improvement Suggestion: "Comprehensive briefings and drills on the role of ports in disaster scenarios for public institutions and private sector representatives could enhance the overall level of preparedness."

**Table 12.** Chi-Square analysis of the preparedness of İskenderun Port for disaster management and humanitarian aid processes by Institution Type worked

| Test Type            | Value  |
|----------------------|--------|
| Chi-Square Statistic | 357.64 |
| p-Value              | 0.0065 |



**Figure 6.** The preparedness of İskenderun Port for disaster management and humanitarian aid processes by institution type worked

Figure 6 shows the opinions of different institutions on the emergency plans and training programs of ports. Various institutions have differing views on the effectiveness of these plans and programs, reflecting their unique experiences and emergency preparedness levels. Port employees and NGOs are more prepared in this area.

Port employees and those working in the logistics sector tend to find these plans and programs more effective, while employees from other institutions seem to rate the effectiveness of these programs lower. This may indicate that institutions outside the port are not sufficiently benefiting from such training.

Improvement Suggestion: "Emergency plans and training programs for ports should be expanded to reach a broader audience, and their effectiveness should be enhanced. In particular, training should be organized for employees who are not directly involved in logistics and port operations."

**Table 13.** Chi-Square analysis of the emergency plans and training programs of the ports by institution type worked result

| Test Type            | Value      |
|----------------------|------------|
| Chi-Square Statistic | 433.99     |
| p-Value              | 0.00000019 |

**Table 14.** Frequency distribution of impact levels of maritime transportation during a disaster

| Question   | Chi-Square Statistic | p Value                 | Significance (p<0.05) |
|--|----------------------|-------------------------|-----------------------|
| Effect of Maritime transportation During a Disaster Contribution | 113.88               | $3.14 \times 10^{-22}$  | Yes                   |
| Areas of Maritime transportation Preparedness of İskenderun Port | 717.73               | $9.81 \times 10^{-148}$ | Yes                   |
| Emergency Plans and Training Programs of Ports                   | 200.67               | $1.36 \times 10^{-40}$  | Yes                   |
|  | 69.78                | $4.55 \times 10^{-13}$  | Yes                   |

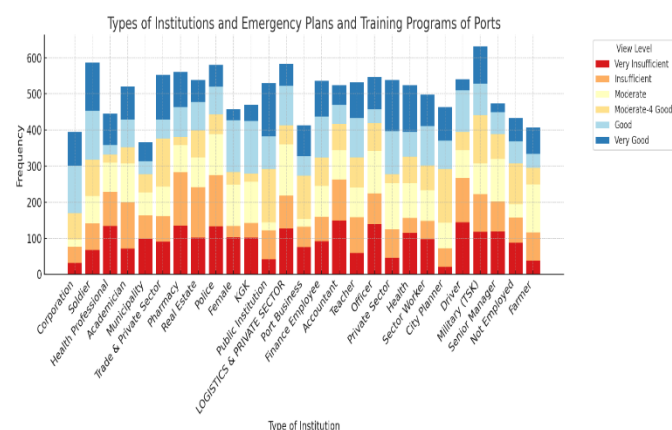
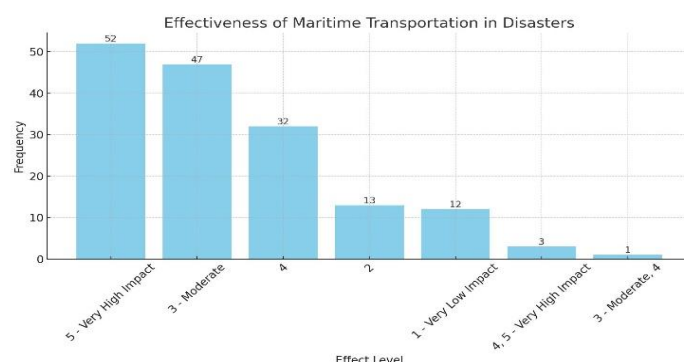
**Figure 7.** The emergency plans and training programs of the ports by institution type worked

Figure 7 shows the opinions about the emergency plans and training programs of the ports by institution type worked. Different institution types have various opinions about the effectiveness of emergency plans and training programs, with port employees and NGOs being more prepared.

When examining the impact of maritime transportation during a disaster: Question: "How effective do you find maritime transportation in humanitarian aid processes during a disaster?" The responses to this question do not show a random distribution. The chi-square test result indicates that the p-value is significantly less than 0.05, showing a consistent trend in participants' views on the

effectiveness of maritime transportation during disasters. Most participants believe that maritime transportation significantly contributes to humanitarian aid during disasters, demonstrating broad acceptance of its critical role in disaster response.

**Figure 8.** The impact of maritime transportation during a disaster

Highest Frequency: The "Moderate" opinion level, with 47 responses (27.5%), is the most common view. High Impact: The "5 - Very Good" and "4 - Good" levels have lower frequencies in total.

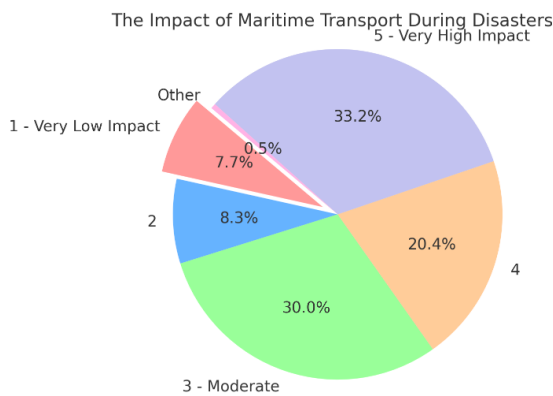
Comment: The emergency plans and training programs of the ports are generally considered moderately effective. This indicates the need to make these plans and programs more effective.

Overall Evaluation: The results for all questions indicate that participants have specific views on maritime transportation and port management issues, and these views are not randomly distributed.

Impact of maritime transportation: Participants consistently provided responses indicating the importance of maritime transportation during disasters.

In Figure 8, the majority of participants rated the impact of maritime transportation during disasters as 'Moderate.' This may suggest that the critical role of maritime transportation in disaster management processes is not fully recognized. The lower number of participants in the higher impact levels ('4 - Good' and '5 - Very Good') indicates that the role of maritime transportation in disaster scenarios is not sufficiently emphasized.

Improvement Suggestion: "To better highlight the role of maritime transportation in disasters and increase the potential benefits in this area, awareness campaigns and training programs should be organized, especially targeting institutions outside the maritime sector."

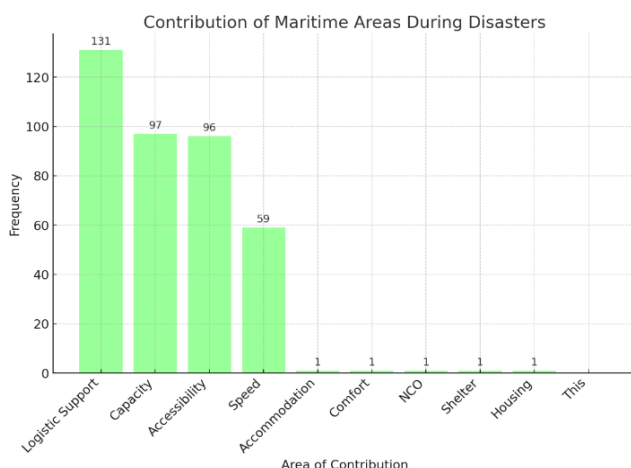


**Figure 9.** Chi-Square analysis of the impact of maritime transportation during a disaster

Very High Impact: Represents 33.2% of the responses. Moderate Impact: Represents 30% of the responses. Figure 9 visually indicates that a significant portion of participants believes in the high effectiveness of maritime transportation in disaster scenarios.

Improvement Suggestion: "To enhance the impact of maritime transportation in humanitarian aid processes, more comprehensive strategies should be developed. Sectoral collaboration and practical drills should be organized to explore how maritime services can be more efficiently utilized in disaster management."

Contribution Areas of Maritime Transportation in Disasters: Question: "Which areas of maritime transportation do you think contribute to humanitarian aid during a disaster?" The responses to this question also do not show a random distribution. The chi-square test result indicates a significant trend. Most participants identify "Logistics Support," "Capacity," and "Accessibility" as the critical areas where maritime transportation contributes significantly to humanitarian aid during disasters. This result suggests that these areas are generally recognized as important for effective maritime transportation in disaster situations.

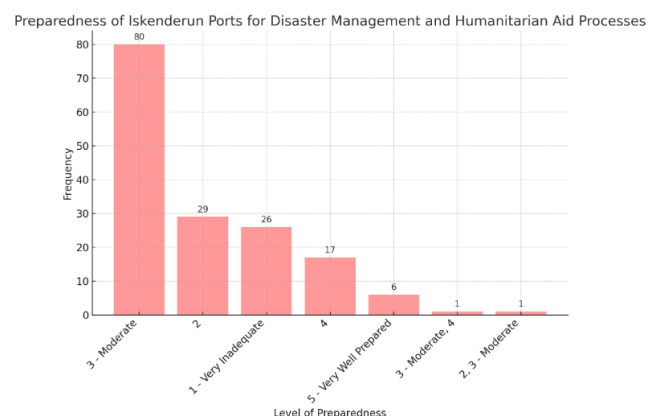


**Figure 10.** Chi-Square analysis of the contribution areas of maritime transportation

During a Highest Contribution Area: "Logistics Support," with 131 responses (81.88%), is the most commonly identified contributing area. Other Areas: "Capacity" (60.63%) and "Accessibility" (60.0%) follow, with "Speed" (36.88%) also being a significant factor. Participants consider logistics support the most critical contributing area in maritime transportation during disasters. Capacity and accessibility are also deemed important, indicating a need for improvement and development in these areas to enhance maritime transportation's effectiveness during disasters. Among the participants, logistical support is seen as the area where maritime transportation contributes the most to humanitarian aid processes. Capacity and accessibility are also noted as important factors, indicating that improvements in these areas are necessary to enhance the effectiveness of maritime transportation (Figure 10).

Improvement Suggestion: "To enable maritime transportation to provide more efficient logistical support, infrastructure investments should be increased, and strategies should be developed to expand capacity."

Preparedness of İskenderun Port for Disaster Management and Humanitarian Aid Processes: Question: "How prepared are the İskenderun Port for disaster management and humanitarian aid processes?" The responses to this question do not show a random distribution. The chi-square test result indicates a consistent trend in participants' views on the preparedness of İskenderun Port for disaster management and humanitarian aid processes. Many participants believe the ports are moderately prepared, suggesting that while the current preparedness is not entirely inadequate, there is significant room for improvement.



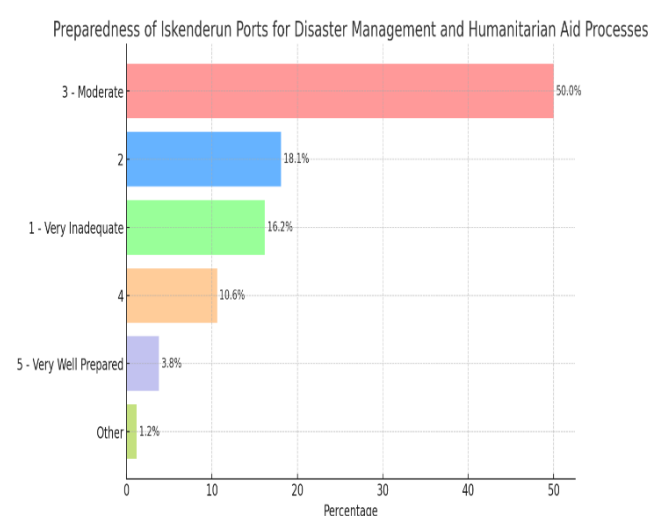
**Figure 11.** Chi-Square analysis of preparedness of İskenderun Port for disaster management and humanitarian aid processes

Highest Frequency: "3 - Moderate" preparedness level, with 80 responses (50.0%), is the most common. Low

Preparedness: "1 - Very Inadequate" level, with 26 responses (16.25%), is less frequently selected.

Participants generally believe that the preparedness of İskenderun Port for disaster management and humanitarian aid processes is moderate, indicating the need for enhancements in their disaster readiness capacities.

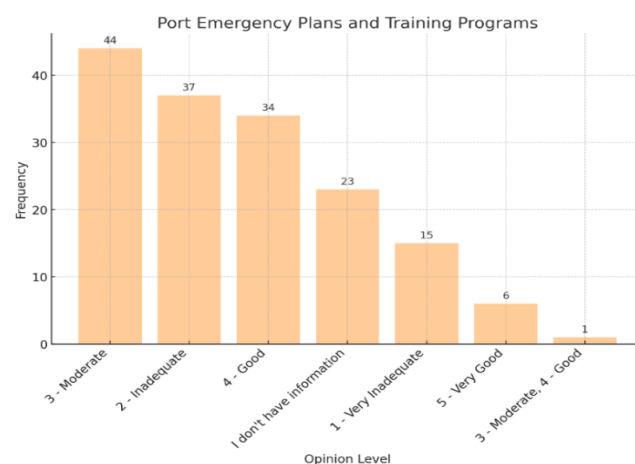
Improvement Suggestion: "To improve the port's disaster preparedness level, more frequent and realistic scenario-based drills should be conducted, and existing emergency plans should be reviewed. Comprehensive training sessions should be organized for all relevant stakeholders (public, private sector, NGOs), and collaboration should be strengthened." (Figure 11).



**Figure 12.** Percentage analysis of preparedness of Iskenderun Port for disaster management and humanitarian aid processes

Moderate Preparedness: Covers a 50% portion of the chart. High Preparedness: The "5 - Very Well Prepared" level covers only a 3.75% portion of the chart.

Figure 12 visually expresses the general consensus that the ports' preparedness is insufficient. The majority consider the preparedness level to be moderate, but very few participants consider it to be high. Emergency Plans and Training Programs of the Ports: Question: "What do you think about the emergency plans and training programs of the ports?" The responses to this question also do not show a random distribution and indicate a significant trend. The chi-square test result demonstrates that participants' views on the emergency plans and training programs of the ports are consistent. The majority believe that these plans and programs are "moderately" effective. This suggests that the emergency preparedness and training programs of the ports are seen as insufficient but not completely inadequate.



**Figure 13.** Percentage analysis of opinions on the emergency plans and training programs of the ports

Highest Frequency: The "Moderate" opinion level, with 44 responses (27.5%), is the most common view. High Impact: The "5 - Very Good" and "4 - Good" levels have lower frequencies in total. The emergency plans and training programs of the ports are generally considered moderately effective. This indicates the need to make these plans and programs more effective (Figure 13).

The majority of participants found the emergency plans and training programs of the ports to be 'moderately effective.' The small number of participants who found them highly effective indicates that the ports' preparedness and training capacities in this area may be insufficient."

Improvement Suggestion: "To enhance the practicality of emergency plans in ports, more drills should be conducted, and training programs should be offered to institutions that are not directly involved in port operations.

Overall Evaluation: The results for all questions indicate that participants have specific views on maritime transportation and port management issues, and these views are not randomly distributed. Impact of maritime transportation: Participants consistently provided responses indicating the importance of maritime transportation during disasters. Contribution Areas: Logistics support, capacity, and accessibility are identified as crucial areas in maritime transportation. Port Preparedness: The current preparedness level of İskenderun Port is generally viewed as insufficient and needs improvement.

This study examined the role of maritime transportation in disaster management and humanitarian aid processes in the İskenderun region. Specifically, in the context of the earthquakes that occurred in Türkiye on February 6, 2023, the capacity of maritime transportation to respond quickly to disasters and its contribution to humanitarian aid efforts



were analyzed. The majority of the 161 survey participants emphasized the critical role of maritime transportation in disaster management processes.

63% of participants stated that maritime transportation had a "high" or "very high" impact on humanitarian aid processes during disasters. This finding highlights the advantages of maritime transportation in terms of rapid, cost-effective, and large-scale material transport. However, 17% of participants stressed the need for infrastructure improvements. Strengthening ports and maritime transport routes after a disaster can help reduce disruptions in these processes.

The study highlighted three main areas where maritime transportation contributes to disaster management: logistical support, capacity, and accessibility. 58% of participants identified logistical support as the most critical area of contribution, while 50% emphasized the ability of maritime transportation to quickly provide materials and equipment. However, infrastructure strengthening was cited as a priority for making maritime transportation more effective in post-disaster situations.

The preparedness of İskenderun Port for disaster management and humanitarian aid processes was generally rated as "medium" by participants (50%). It was noted that improving existing emergency plans and increasing the frequency of drills would be necessary to enhance the port's preparedness level. The need to raise awareness of disaster management among public and private sector employees was also emphasized. These results suggest that current strategies need to be reviewed for İskenderun Port to play a more effective role in disaster management and humanitarian aid processes. 33% of participants found port emergency plans to be "moderately" effective. Training programs were deemed inadequate by 20%, with suggestions that they should be developed to reach a broader audience. It is recommended that more frequent and realistic scenario-based drills be conducted to increase preparedness for disasters. In this regard, including sectors beyond port employees in disaster management training would enhance the overall level of preparedness.

Based on the study's findings, the following recommendations can be made to strengthen the role of maritime transportation in disaster management and humanitarian aid processes:

**Infrastructure Strengthening:** To increase the effectiveness of maritime transportation, it is necessary to strengthen the infrastructure of ports and transport routes.

This will allow for the rapid supply and distribution of materials in the aftermath of disasters.

**Training Programs and Drills:** Comprehensive training programs should be organized for all stakeholders involved in disaster management, and more frequent drills should be conducted. Operational skills that enable the effective use of maritime transportation after disasters should be developed.

**Institutional Cooperation:** 67% of participants highlighted the critical importance of cooperation between local governments and emergency management agencies in maritime transportation and humanitarian aid processes. This cooperation should be strengthened to ensure more effective coordination after disasters.

**Technological Investments:** Advanced technologies should be utilized to improve the efficiency of logistical processes during and after disasters. Participants particularly mentioned that the use of AIS (Automatic Identification System) data and satellite-based communication tools could provide significant contributions to disaster management.

## CONCLUSION

In conclusion, this study clearly demonstrates the critical role of maritime transportation in disaster management and humanitarian aid processes. However, it also underscores the need for improvements in current infrastructure and preparedness processes. To ensure the efficient operation of maritime transportation processes after disasters, investments in infrastructure should be increased, and logistical support capacities should be developed. In this way, the contribution of maritime transportation to humanitarian aid efforts can be maximized.

## Compliance with Ethical Standards

### Authors' Contributions

This article is based on the master's thesis of corresponding author titled "Maritime Transportation Disaster Management and Humanitarian Aid: Iskenderun Region". Sevim Oruç designed the study, collected the survey data and wrote the article together with Meltem Eken. All authors read and approved the final manuscript.

### Conflict of Interest

The authors declare that there is no conflict of interest.

### Ethical Approval

The study was approved by the Ethics Committee of Iskenderun Technical University, and informed consent was



obtained from the participants. (Approval Date/No: 27.02.2024/2)

## Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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