*Journal of Risk Analysis and Crisis Response, 2024, 14(2), 178-204*
*https://jracr.com/*
*ISSN Print: 2210-8491*
*ISSN Online: 2210-8505*

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# Analyzing the Challenges of Cross-Border Disaster Response and Management: A European Perspective

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Received: February 9, 2024; Received in revised form: May 3, 2024; Accepted: May 12, 2024; Available online: June 30, 2024

**Abstract:** This study investigates the challenges of cross-border disaster response and management in Europe, with a focus on legal and administrative barriers, cultural and linguistic differences, and existing frameworks and protocols. It seeks to understand their impact on the effectiveness of disaster management and identify areas for improvement. A quantitative approach was employed using a descriptive research design. A sample of 233 disaster management experts in Greece, representative of Europe, participated in the study. Data were collected through a well-designed questionnaire and analyzed using multiple regression analysis. The study found that in Europe, administrative and legislative obstacles seriously obstruct efficient cross-border catastrophe response and management. Although cultural and language differences have a statistically significant detrimental effect, hey equally have less of an effect overall. The current structures and procedures for cross-border disaster coordination positively impact the efficiency of catastrophe management. The study emphasizes how crucial it is to remove administrative and legal obstacles to improve cross-border catastrophe response throughout Europe. It implies that more efficient resource sharing systems, unified legal frameworks, and streamlined administrative processes are required. Furthermore, the impact of linguistic and cultural disparities can be lessened by fostering cultural awareness and multilingualism. To increase the efficacy of disaster management, the study recommends strengthening and standardize current frameworks and procedures. From a European perspective, this study offers insightful information about the difficulties involved in responding to cross-border disasters. It offers practitioners and policymakers evidence-based suggestions to improve coordination and response effectiveness, which will ultimately improve disaster management in Europe and beyond.

**Keywords:** Cross-border Disaster Response and Management; Administrative Barriers; Cultural Differences; Linguistic Differences; Coordination Frameworks; Disaster Response Efficiency; Europe

## 1. Introduction

Cross-border disaster response and management in Europe presents a multifaceted challenge that demands comprehensive understanding and strategic solutions [1]. Europe faces difficulties in managing disasters that cross national lines because of its diversified geopolitical terrain, common borders, and historical legacies. These difficulties stem from the region's long history of both cooperation and war, and they are made worse by the variety of the environment and different

government systems [2]. Europe has seen a variety of catastrophes in recent years, including complex humanitarian situations like the refugee crisis and natural disasters like wildfires, floods, and earthquakes [1,3,4]. There has never been a greater need for efficient cross-border coordination and response to disasters. Significant obstacles still exist, notwithstanding the European Union's attempts to promote collaboration among its member states. Greece is one of the many countries that make up Europe's geopolitical patchwork, each with its own policies, practices, and goals [5,6]. This variation is also evident in the way that different countries handle disasters, with each country using its own set of laws and administrative procedures. The problem emerges when catastrophes, which frequently have widespread effects, call for cooperative efforts beyond national boundaries [6,7]. It is a difficult undertaking to bring various legal and administrative systems into harmony in order to provide quick and effective catastrophe response. Although Europe's linguistic and cultural variety is one of its advantages, it may also provide serious challenges during difficult times [2,8,9]. For example, effective communication amongst responders from various nations might be hampered by language issues [10]. Cultural quirks can have an impact on how decisions are made as well as how catastrophe response is planned and carried out. Successful cross-border cooperation requires an understanding of and ability to navigate these variances [11].

The cross-border disaster response environment is further complicated by differences in resources and readiness levels between European states [7]. Certain nations may have vast resources, well developed infrastructure, and well-trained reaction teams, while others could have trouble meeting their needs. The European Union has put in place guidelines and procedures to promote coordination of disaster relief efforts across national borders. On the other hand, there is debate over these processes' practical efficacy. To determine areas that require improvement, it is important to assess the advantages and disadvantages of current frameworks [10,12,13]. The majority of the material that has been written about disaster management in Europe to yet has been on national-level plans and actions [14]. Although these studies offer insightful information on the strategies used by various nations, they frequently ignore the special possibilities and problems that cross-border catastrophes in the European setting bring [7,15,16]. Research that thoroughly discusses the challenges and difficulties unique to cross-border disaster response and management in Europe is conspicuously lacking. The impact of linguistic and cultural differences on the efficacy of responses, the legal and administrative obstacles that impede effective coordination, and the evaluation of the current frameworks and protocols for cross-border disaster coordination have all received insufficient attention [8,17,18]. This study intends to close this research gap by carefully examining these important variables. It aims to provide a comprehensive knowledge of the difficulties Europe has in responding to cross-border disasters and, above all, to suggest workable solutions for improving coordination and response effectiveness.

### *1.1. Purpose of the Study*

This study examines the barriers to effective cross-border disaster response in Europe, identifying areas for improvement and suggesting strategies for enhanced coordination.

### *1.2. Objectives of the Study*

1. To identify the different key legal and administrative barriers to cross-border disaster management in Europe.

2. To assess the impact of cultural and linguistic differences on disaster management effectiveness.
3. To evaluate the existing frameworks and protocols for cross-border disaster coordination.
4. To propose different actionable strategies for enhancing cross-border disaster response efficiency.

### *1.3. Research Questions*

1. What are the main legal and administrative challenges in cross-border disaster management in Europe?
2. How do cultural and linguistic differences affect disaster management effectiveness?
3. What are the strengths and weaknesses of current cross-border disaster response frameworks?
4. What strategies can be implemented to improve cross-border disaster response efficiency?

## 2. Literature Review

### *2.1. Legal and Administrative Barriers*

The exploration of legal and administrative barriers in cross-border disaster response within Europe is critical, as these obstacles often hinder swift and effective disaster management efforts [11]. A fundamental concern in transnational disaster response is the intricacy of the legal structures that oversee emergency operations in several European countries. Diverse national laws and regulations pertaining to disaster management can provide substantial operational challenges, as observed by Vries et al. [1]. There might be delays and misunderstanding when emergency response protocols that are legal or regulated in one nation are not in another. This is further explored in the study by Appleby-Arnold et al. [2], which looks at the legal differences between EU members and emphasizes the need for more harmonized legal frameworks to promote easier cross-border collaboration.

Cross-border catastrophe response can also be significantly hampered by national pride and sovereignty. Shukla et al. [19] explain how political ramifications or worries about national sovereignty may make a country hesitant to offer or receive aid. In the European environment, where national identity and independence are strongly cherished, this is especially pertinent. Reluctance to accept help from outside sources or to give up control can cause actions to be delayed, as Bollen & Kalkman's [10] analysis of the political aspects of cross-border disaster management demonstrates. Administrative obstacles are a major factor in the complexity of cross-border disaster response, in addition to legal concerns. Sun and Doh's [18] study explores the bureaucratic obstacles that European nations must overcome to coordinate their catastrophe response activities. These can cause major delays in the response process and include things like inconsistent administrative procedures, requirements for paperwork, and regulations about resource allocation. In a similar vein, Rexroth et al. [5] draw attention to the challenges associated with navigating several administrative systems and stress the necessity of more efficient processes to improve collaboration efficiency. The interoperability of catastrophe management systems between many European nations is another important difficulty. Ogie et al. [6] have pointed out that interoperable systems and processes are essential for a smooth and successful cross-border disaster response. The diversity of emergency management systems across Europe, as noted in the study of Keith et al. [20], frequently results in

compatibility problems, which impede effective coordination and information sharing during catastrophes.

The European Union (EU) has played a pivotal role in efforts to standardize administrative and legislative procedures related to disaster management. The EU's role in promoting cross-border collaboration is examined by Berchtold et al. [11], with a focus on the EU Civil Protection Mechanism. The purpose of this system is to enable a coordinated reaction to calamities both inside and outside of the EU. Kurdi [21] points out that these legislative and administrative disparities across member states frequently restrict the efficacy of such procedures. Another important topic to be concerned about is the legal ramifications of giving cross-border assistance. Studies conducted by Berchtold et al. [11] highlight the intricacies associated with legal responsibility and liability when nations participate in international disaster relief efforts. To guarantee that responders are safeguarded and that responsibilities are evident, for example, concerns regarding jurisdiction, responders' legal obligations, and payment procedures must be addressed.

The operational barriers to the disaster management introduced by various national laws and regulations are highlighted by Vries et al. [22]. This variety may bring huge obstacles to emergency operations, because the legal and administrative procedures that work in one country, probably won't be recognized in another. This finding is significant because it reveals that the main objective is to establish a coherent legal framework which could facilitate cross-border operations that are more efficient due to the minimized legal ambiguities and streamlined administrative process. Appleby-Arnold et al. [2] go into the details of legal systems in EU member states, suggesting more unified legal frameworks for easier cross-border cooperation. With this, the objective is clearly provided to reflect on how the legal inequality can slow down the provision of cross-border emergency services, thus underlining the significance of having a comprehensive legal framework that facilitates, rather than hinders, the cross-border aid. The attitude of the nations of asking or accepting the help of others on the issues of sovereignty, as outlined by Shukla et al. [19], also contributes to the problem. This ambiguity can cause long delays, which emphasizes the relevance of striking the balance between national sovereignty and the vital need for international cooperation in the field of disaster response.

### *2.2. Cultural and Linguistic Challenges in Cross-Border Disaster Response*

Zillmer et al. [23] have shown that cultural norms and values influence how communities understand hazards and react to warnings. For example, a greater degree of community solidarity and collaborative activity in the wake of disasters may exist in various cultures, which can greatly contribute to the success of relief operations. On the other hand, certain cultures could prioritize individuality more than others, which could result in different approaches to crisis management tactics. Carter et al. [7] found that cultural variables might affect how response activities are prioritized, how decisions are made, and whether mitigation measures are adopted. This is especially true for multi-national coordination initiatives, where various goals and strategies may cause disagreements or hold up progress [24].

Cultural disparities may have a significant impact on how danger is perceived, how reaction activities are prioritized, and how different national teams engage with one another. Appleby-Arnold et al. [2] have observed that cultural norms and values significantly influence the development of disaster response tactics. For example, nations that place a high importance on community solidarity

would prioritize local response initiatives, whilst other nations might concentrate on top-down, centralized strategies. Adrot & Aguerre [25] emphasize the need of comprehending indigenous cultures and practices in disaster response. Failure to do so may impede efficient aid delivery and perhaps lead to discord among impacted people.

In Europe, where many languages are spoken, this is especially true. Language barriers can seriously hinder the ability of different foreign teams to coordinate effectively, which is why communication is so important. The research by Appleby-Arnold et al. [2] emphasizes how crucial it is to communicate precisely and clearly in the immediate wake of a tragedy, since this can sometimes be impeded by language difference. Coordination, information sharing, and the effective execution of relief efforts all depend on effective communication. Language barriers can cause miscommunication, which can result in delays, misunderstandings, and poor reaction times. Mohammad & Mohammad's [8] highlights how crucial it is for disaster response efforts to get across language obstacles. They point out that the absence of a uniform linguistic framework in Europe, with its large number of languages, might make it difficult for various national teams to coordinate and share important information.

Cultural and linguistic diversity, although one of EU's strengths, has its own specific difficulties in disaster management as well. The study by Carter et al. [7] shows that cultural orientations and values significantly influence the choice of activities as well as prioritization and adoption of disaster management approaches. This Cultural Variance necessitates the development of a customized approach to disaster response which incorporates diverse Cultural Perspectives, thereby ensuring that disaster response strategies are efficacy and sensitive to Cultural Considerations. The language barriers also increase the difficulties in the international disaster response team members to communicate effectively. Barriers must be overcome, and it cannot be stressed that effective communication is vital for coordination, information sharing, and relief operations implementation. According to the investigations made by Rexroth et al. [5] and Serraglio et al. [17], the chances of misunderstandings and delays in action are greatly increased due to the language differences. These findings emphasize the fact that language proficiency and cultural awareness should be incorporated into disaster response training and the programs for greater efficiency.

### *2.3. Frameworks and Protocols for Cross-Border Disaster Response*

A complex interaction of international, regional, and national procedures is shown by an assessment of frameworks and protocols for cross-border disaster response in Europe [10], [26]. The European Union Civil Protection Mechanism (EUCPM) is a crucial component of cross-border disaster response [3]. The EUCPM, which was created to promote cooperation in disaster response, is essential to the coordination of activities across EU member states. European Union [27] highlights the EUCPM's participation in previous European catastrophes and discusses how effective it is at mobilizing resources and knowledge across borders. Nonetheless, Yap et al. [28] highlight difficulties with the EUCPM's decision-making procedures and resource integration, pointing to the necessity for more simplified operations.

Bilateral and multilateral agreements between European nations are important in facilitating cross-border disaster response, in addition to EU-wide institutions. Research by Kiberu [29] shows how these accords, which are frequently founded on close proximity and shared history, can hasten the distribution of resources and assistance. The World Health Organization [30] points out that the efficacy and extent of these agreements differ significantly, with certain regions demonstrating more

collaboration than others. In cross-border disaster management, standardizing response procedures and training is also essential. According to Adrot & Aguerre [25], establishing standard operating procedures is crucial for ensuring effective teamwork during emergencies. Additionally, Zillmer et al.'s [23] research emphasizes the value of cooperative training exercises in acquainting responders with these standardized protocols and boosting interoperability across various national teams.

Cross-border catastrophe response requires efficient information exchange and communication [18,31]. The technological and practical difficulties in creating a standard information-sharing platform between nations with different systems are covered by Jenni [13]. Bodas et al. (2022) go into further detail on the difficulties to communication caused by linguistic differences and emphasize the need of multilingualism in disaster response teams. In cross-border disaster response, non-governmental organizations (NGOs) are essential because they frequently cover the gaps left by state actions. While Berchtold et al. [11] investigate how NGOs use social media and other digital platforms to coordinate their efforts across borders, Hagenlocher et al. [4] highlight the adaptability and specialized knowledge of NGOs in responding to disasters.

The EUCPM stands out from the literature as a solid base for cross-border disaster response, with a clear goal of facilitating cooperation and coordination among member states. This mechanism, as assessed by European Union [26] and confirmed by this study's outcomes, prove to be the key element in gathering resources and knowledge across borders. But the integration of resources and the issues of the decision processes, as shown by Yap et al. [28], clearly indicate the areas for improvement to perform the mechanism well. Similarly, bilateral and multilateral agreements among countries which have been examined by Kiberu [29] and World Health Organization [14] play an equally important part in ensuring efficient cross border emergency response. These agreements, mostly, geographically and historically oriented, speed up assistance but are non-uniform as regards their effectiveness and implementation. This heterogeneity highlights the need for the harmonization of response protocols and training to increase the interoperability and readiness of European nations.

### *2.4. Impact of Technology on Cross-Border Disaster Response*

According to Rexroth et al. [5], social media sites like Twitter were essential for early warning and in-the-moment information exchange. These platforms have the power to get beyond the long-standing boundaries of authority and location, facilitating quicker and more effective cross-border communication. Additionally, Ogie et al. [6] explain the idea of "digital volunteers," emphasizing how people and organizations frequently work beyond national borders to utilize social media to support disaster response operations. The development of ICTs has greatly enhanced disaster management decision-making and situational awareness. UNDP [32] highlights how the capacity to monitor catastrophes, predict their effects, and coordinate cross-border responses has improved with the advent of real-time data collecting and analysis capabilities. The use of advanced communication technologies to facilitate cross-border collaboration in emergency situations is further demonstrated by the European Commission's Community Research and Development Information Service (CORDIS) project on 'Public Protection and Disaster Relief' (PPDR-TC) [32, 33].

Mapping disaster-affected areas and estimating damage across international borders have been made possible by the use of GIS and remote sensing technology. The crisis mapping study of Ogie et al. [6] demonstrates how these technologies offer vital geographical data that can be shared across nations, assisting in the organization and implementation of coordinated responses. Furthermore,

Marx et al. [34] explain how satellite imagery may be used to quickly assess the situation following a disaster, regardless of national boundaries. While there are numerous advantages to technology, there are also new difficulties when it comes to responding to cross-border disasters. According to IFRC [35], problems including the digital divide, data overload, and disinformation can affect how effective technology tools are. Furthermore, in order to guarantee smooth communication and data sharing, the Danish Refugee Council's report from 2023 emphasizes the necessity of standardization and interoperability of technical systems across national boundaries [36]. Initiatives from Europe have been crucial in expanding the use of technology in disaster relief. According to Bodas et al. [15], for example, the European Emergency Number Association (EENA) has played a significant role in encouraging the use of cutting-edge emergency call systems. In a similar vein, the EU-funded DRIVER+ project emphasizes the use of cutting-edge technologies to enhance crisis management, stressing the role that technology plays in fostering international cooperation [37].

### *2.5. Integration of the EU Recent Policies on Border Control and Management*

The EU border control and management policies play an important role for cross-border disaster management and support. The deployment of the Schengen Information System (SIS) and the setting up of the European Border and Coast Guard Agency (Frontex) have the goal to secure the EU external borders and enable people to move within the Schengen Area [11], [38], [39]. This policy, which is led by the security and migration concepts, may facilitate the process of cross-border operations or, on the contrary, overcomplicate affairs. Furthermore, the operational capabilities of Frontex, such as managing the influx of displaced populations and providing logistics support, can be applied during crisis situations, specifically in disaster response [40]. Furthermore, the EU's Integrated Political Crisis Response (IPCR) mechanism offers an avenue for aligning a joint European action to major emergencies, including disasters which exceed national borders [41]. The engagement of this mechanism in recent crises shows the EU's determination to a united crisis management paradigm, therefore, there is a need to plug the policies into existing systems of disaster responses.

The Schengen Agreement with its focus on the free movement of teams and equipment across member states has made it easier for disaster response personnel to cross borders. On the one hand, however, the mobility facilitated by security imposed can cripple disaster response efforts if the coordination mechanisms are not robust enough. The equilibrium of security and free movement is an essential part of disaster situations where the time is a factor [4], [42]. Frontex is the EU's main border management agency. Its activities, mainly operated on border security, can have implications for disaster response especially in managing refugee population and offering logistics services during crises. Frontex's growing potential to deploy border and coast guard staff quickly can be considered an asset in disaster response, especially when it comes to search and rescue operations [39].

The principle of Integrated Border Management (IBM) plays a key role in framing the EU's stance on border management. This section involves the coordination of all Member States and relevant agencies to secure external borders while maintaining the right of free movement. This whole-of-society approach is particularly significant in the case of disasters where quick and unblocked cross-border work is necessary. Efficient IBM systems can partially or even completely wipe out the administrative and logistical barriers to cross-border disaster response [3, 20].

The European Agency for the Operational Management of Large-Scale IT Systems, in the Area of Freedom, Security, and Justice (EU-LISA) plays a central role in managing these key IT systems that

support EU security as well as border management policies. Such systems, like Schengen Information System (SIS), Visa Information System (VIS) and European Travel Information and Authorisation System (ETIAS), are very important for the quick detection and control of people across the borders. These real-time information sharing systems, used by the member states, can speed up the deployment of emergency services and aid in the disaster scenarios [43, 44].

### *2.6. Crises the European Union Has Experienced in the Last Decade*

In the last 10 years, the EU has undergone several crises that have put its trans-border response to disasters to the test. The case with the refugee crisis was an eye opener on the difficulties managing huge scale humanitarian emergencies within and especially across EU borders. The situation highlighted the necessity of efficient cooperation within the EU member states and between the EU and non-EU states, as well as attentive consideration of the international humanitarian laws and principles [33, 43]. The COVID-19 pandemic again demonstrated the necessity of EU-wide coordination in public health crisis control. The European Centre for Disease Prevention and Control (ECDC) and European Medicines Agency (EMA) provided crucial leadership in the pandemic response, underlining the importance of EU-level agencies in providing a joint and effective answer to the regional health threat [32]. These crises have stimulated requests for more robust EU mechanisms for crisis management and disaster response, including the improvement of the EU Civil Protection Mechanism in order to aid in preparedness and resilience against future disasters [3,27]. The European Health Union which is designed to strengthen EU disaster response system is an important step in the direction of a more integrated approach to crisis management within Europe [39].

Dealing with the crises that the European Union (EU) has been through in the past decade involves a multi-faceted approach, using political, economic and social strategies. One of the major problems has been the Eurozone crisis that arose following the world financial crisis in 2008 [27]. The Eurozone crisis brought to light deep-rooted flaws in the EU's economic management scheme, hence prompting reforms towards strengthening fiscal discipline, economic coordination and financial stability [27]. The Eurozone crisis was dealt with through various implementations by the EU, for example the establishment European Stability Mechanism (ESM) to provide member states in trouble and also through the creation of the Fiscal Compact to enforce strict fiscal rules and boost economic governance [45].

Beyond just economic issues, the EU has also faced political crises such as when the UK voters opted to exit the EU in 2016. Brexit has created a number of problems for the EU like the cohesion, institutional integrity, and trade, security, and citizens' rights require negotiation [26]. The EU has been a major actor in helping UK to contain the impact of Brexit by actively engaging in negotiations with the UK for a new partnership framework and by strengthening its internal cohesion through deepening integration among the remaining member states [6]. Besides, the EU has been through many migration crises coming from the conflicts, instability, and poverty in the neighboring regions. The migration and refugee crisis impact the EU's asylum and immigration system's capacity, which rises the tensions within member states and challenges the principle of "solidarity" [46]. To this end, the EU has tried to improve links with third countries, reinforce external border controls, and reconsider its asylum policies in order to achieve a more balanced distribution of responsibility [30].

### *2.7. Actionable Strategies for Enhancing Cross-Border Disaster Response Efficiency*

International collaboration is crucial since disasters, whether natural or man-made, disregard national boundaries [7]. The creation of precise legal frameworks and rules is one of the first stages in improving cross-border disaster response. One important point of reference that highlights the significance of international collaboration in disaster risk reduction is the United Nations' adoption of the Sendai Framework for Disaster Risk Reduction 2015–2030 [20,33]. The processes for cross-border assistance, particularly those pertaining to visas and customs, which frequently cause delays, must be included in bilateral or multilateral agreements that countries adopt [37,38,47] . One such system is the European Union's Civil Protection Mechanism, which enables member states to provide effective and timely assistance to one another in the case of a disaster [45]. It is essential to standardize protocols and provide training for disaster response [48]. This covers the implementation of uniform equipment standards, common communication protocols, and cooperative training activities [48]. Globally recognized principles and procedures for urban search and rescue in catastrophe situations are provided by the United Nations-affiliated International Search and Rescue Advisory Group (INSARAG). Countries may make sure that their response teams are ready to work in unison with international teams by implementing these requirements [18,49].

Technological developments present important chances to improve cross-border catastrophe response [11,26,34]. Drones, sophisticated communication systems, and satellite imaging can all be used to enhance situational awareness and reaction coordination [35]. Rapid reaction and resource mobilization are made possible by the efficient use of the Disaster Emergency Logistics System for ASEAN (DELSA) by the ASEAN Coordinating Centre for Humanitarian Assistance on Disaster Management (AHA Center). In addition, creating common spaces for data and information sharing can improve situational awareness and facilitate effective resource management. Local communities have invaluable knowledge of their area and are frequently the first to respond to catastrophes [50]. Cross-border projects may be made much more effective by involving these communities in planning and response activities.

In disaster response, securing sufficient funds and allocating resources effectively is a constant concern [24,47]. In the case of a crisis, setting up specific funds for cross-border disaster response, such as the European Union Solidarity Fund, can offer quick financial support [13,23]. Furthermore, putting money into strengthening a region's capability might lessen the overall effects of disasters and the ensuing need for outside help. It is essential to have a system for ongoing learning and adaptation. According to Mohammad and Mohammad [8], after-action assessments and shared learning platforms may assist nations and organizations in improving their future actions by helping them learn from each crisis response. Such evaluations are frequently facilitated by the UN Office for the Coordination of Humanitarian Affairs (OCHA) in order to improve the efficacy of humanitarian response [10].

### *2.8. Development of the Research Hypotheses*

Literature consistently draws attention to the legal and administrative frameworks' complexity and uncertainty that exist in European countries being a major obstacle to having an efficient disaster response. Vries et al. [22] and Berchtold et al. [11] have identified the operational problems posed by different national laws and policies on disaster management. Moreover, Appleby-Arnold et al. [2] argued that one of the challenges of disaster management is the existence of different legal and

administrative frameworks that can be barriers to smooth cross-border collaboration. This literature led to development of Hypothesis One which states that.

*Hypothesis One (H1): Legal and administrative barriers significantly impede effective cross-border disaster response and management.*

Cultural and linguistic diversity to Europe being a source of strength constitutes a distinct problem at times of disaster management. Studies by Mohammad & Mohammad [8] and Appleby-Arnold et al. [2] show that language impediments and cultural differences can make collaboration and coordination among international rescue teams difficult during disaster response operations. The literature highlights the cases where the lack of understanding from the language barrier causes the response to be delayed. This literature led to development of Hypothesis two which states that.

*Hypothesis Two (H2): Cultural and linguistic differences negatively affect disaster response and management effectiveness.*

The functioning and the efficiency of the existing mechanisms and protocols, for instance, the European Union Civil Protection Mechanism (EUCPM), in enabling the cross-border disaster management is extensively covered in the literature. EU studies by European Union [3] and Bollen & Kalkman [10] point out that the mechanisms' main task is to enhance coordination within EU member states. On the other hand, the critiques from Yap et al. [28] highlight operational inefficiencies and the decision making which challenges these frameworks. This literature led to development of Hypothesis three which states that.

*Hypothesis Three (H3): The existing frameworks and protocols for cross-border disaster coordination have a significant influence on effectiveness of Cross-Border Disaster management*

A constant point of discussion in disaster management literature is the issue of developing innovative and sustainable strategies that will enhance efficiency of disaster response. The debate around strategies that are applicable to different situations, including the use of technology, standardized procedures, and global cooperation, ultimately shows how disaster management can be effectively enhanced. For instance, the literature around the utilization of technology in disaster response showcases how digital tools can help with communication and coordination [15,19,51]. Consequently, debates regarding the role of international cooperation (United Nations, 2016) imply the worth of a collective approach to disaster relief as well. This literature led to development of Hypothesis four which states that.

*Hypothesis Four (H4): Implementing sustainable strategies can significantly improve cross-border disaster response and management efficiency*

## 3. Methodology

### *3.1. Research Design*

The study adopted a quantitative approach, utilizing a descriptive research design. Descriptive research is a type of research that aims to accurately and systematically describe a population, situation, or phenomenon. It is about "describing" rather than "explaining" and often forms the basis of most quantitative research. The combination of a quantitative approach with a descriptive research design in the study provided a robust framework for systematically collecting and analyzing numerical data to paint a detailed picture of the current state of cross-border disaster

response and management from the perspective of Greek experts. This methodological choice allowed for a precise, structured, and reliable exploration of the research questions, facilitating the generation of concrete, generalizable findings.

### 3.2. Study Area and Population

The study focused on the many disaster management experts in Greece who served as a representative of all of Europe. Given Greece's strategic location at the intersection of Europe, Asia, and Africa, it serves as a major hub for interaction between many nations and cultures. Due to its location, it is also vulnerable to a range of man-made and natural disasters, including volcanic eruptions, wildfires, and waves of displaced people. An extensive framework for comprehending the nuances of cross-border disaster management in a European setting is provided by the diversity of disaster kinds. Greece is a part of several EU-wide frameworks for disaster response, such as the European Civil Protection Mechanism, because it is an EU member. Knowledge of these frameworks by Greek professionals provides insights into the advantages and disadvantages of existing European cross-border disaster management systems. With Greece's geographic and political location, professionals in disaster management were specifically sought out since they were more likely to have coordination experience with both European and non-European nations. The intricacies of transnational collaboration in disaster management must be understood via this experience.

### 3.3. Sample Size

The determination of the sample size for this study was based on the Krejcie and Morgan table for calculating sample size for research activities. To conduct the Krejcie and Morgan method accurately, you need to know the estimate of the population beforehand. For the scope of this study, the total population (Greece) means the number of disaster management experts throughout the country. Considering the vast involvement of Greece in cross-border disaster management activities within EU framework, it can be estimated that the number of the experts of such population would amount to 1500. The one we count as part of the disaster management population, which includes everybody from first responders to policy makers.

Applying the Krejcie and Morgan sample size determination table and based on a population size of 1500, the required sample for a population of this size, at a confidence level of 95% and a 5% margin of error, is 233. The sampling method used offers statistically reliable sample size that ensures representativeness of survey results to the extent that generalizations can be made about the disaster management experts' population in Greece with a good degree of accuracy.

The selection of 233 as the sample size represents a compromise between theoretical adequacy and logistical feasibility, considering the extensive and multifaceted nature of disaster management in Europe. The Krejcie Morgan method is employed in this study in order to ensure that the sample size is not only scientifically justified but also in terms of resources is sizable enough for the implementation of the survey.

Stratified sampling subsequently followed to ensure that the study's sample is representative of this population's different segments. Such an approach further strengthens the reliability of the study and the generalization of its findings to the whole group of disaster management professionals in Greece as well as European context.

### 3.4. Sampling Technique

Stratified sampling was used in this study. The population was split up into smaller groups, or strata, each of which is a non-overlapping subgroup of the entire population, to conduct stratified sampling. These strata are founded on shared traits or qualities pertinent to the study. By guaranteeing that all relevant subgroups within the population are fairly represented, stratified sampling improves the accuracy of the data gathered. In comparison to basic random sampling, it also aids in lowering sampling error.

### 3.5. Data Collection

Data were collected using a well-designed questionnaire. The questionnaire focused on areas specific to the different disaster management challenges, the different cross-border collaborations, and the experts' personal experiences and professional opinions on these matters. A likert 5-point scale was used to measure the variables since disaster management is a field that involves complex and subjective assessments. A Likert scale allows experts to express their opinions on various aspects of disaster response and management in a nuanced manner, providing more depth than a simple yes/no answer Questions were tailored to address specific aspects of cross-border disaster management, such as effectiveness of response strategies, communication efficiency, coordination among countries, etc. The Likert scale accommodated a wide range of questions pertinent to the study's focus. Different ethical considerations such as privacy and confidentiality were observed during and after eh process of data collection.

### 3.6. Quantitative Data Analysis

The process of analyzing the quantitative data gathered from Greek disaster management experts involved several key steps, each crucial for ensuring the accuracy and relevance of the findings. Initially, the data underwent editing and coding, essential for organizing and preparing it for further analysis. To guarantee that the data is precise, comprehensive, and formatted consistently, this preparation stage is essential. The Statistical Package for Social Sciences (SPSS) was used to enter the data onto a computer once it had been edited and coded. The difficult dataset was analyzed accurately and efficiently thanks to the usage of SPSS. With an emphasis on frequencies and percentages, descriptive statistics served as the main analytical technique. It was simpler to interpret and comprehend the fundamental patterns and trends in the dataset thanks to this method's clear and simple representation of the data. Pearson's rank correlation was used to examine the relationships between the research variables in more detail. This statistical technique works well for determining and measuring the strength of the relationship between several variables. The study's goal in using this method was to find any meaningful correlations in the information gathered. In this case, using a multiple regression model was especially crucial. It made it possible to estimate the various prediction values for every independent variable. Essentially, this model played a key role in measuring the individual contributions of each aspect to the result, offering an all-encompassing perspective of the factors involved in cross-border disaster response and management.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon$$

where

Y = Effectiveness of Cross-Border Disaster management

$\beta_0$ = constant (coefficient of intercept)

$X_1$ = Legal and administrative barriers to cross-border disaster response

$X_2$ = Cultural and linguistic differences

$X_3$ = Existing frameworks and protocols for cross-border disaster coordination

$X_4$ = Strategies for cross-border disaster response efficiency

$\varepsilon$ = Represents the error term in the multiple regression model

$\beta_1 \ldots \beta_3$ = Represents the regression coefficient of the four independent variables which helped in determining the level of influence that the independent variables on the dependent variable.

In this research study, the error term was predicated on the assumption that autocorrelation was absent. This implies that the factor of autocorrelation was not considered during the study. The hypotheses set forth in the research were tested at a 5% (0.05) significance level. The criteria for accepting or rejecting the null hypotheses were based on the p-values derived from the statistical tests. According to this decision rule, if the p-value was greater than 0.05, the null hypothesis would be accepted, indicating that the results were not statistically significant. Conversely, if the p-value was less than 0.05, the null hypothesis would be rejected, suggesting that the results were statistically significant and that there was a meaningful relationship or difference as hypothesized in the study.

## 4. Results

Findings reveal significant disparities in response times and coordination efficiency, often correlated with language barriers and differences in national disaster management policies.

### *4.1. Background Characteristics of Respondents*

The results on characteristics of the study participants are presented in Table 1. The gender distribution among the participants is notably skewed, with a significant majority being male (179 out of 233 respondents, making up 76.8%). In contrast, female respondents constitute only 23.2% of the total (54 out of 233). This disparity could be reflective of the gender demographics in the field of disaster management, suggesting a male-dominated sector. The age distribution of the respondents indicates a concentration in the middle age groups. The most represented age group is 31-40 years, accounting for 63.9% of the participants (149 out of 233). The next significant group is 41-50 years, representing 23.7% (55 out of 233). Interestingly, the younger (<30 years) and older (>50 years) age brackets are less represented, with 7.7% and 4.7% respectively. This distribution suggests that the field is primarily occupied by mid-career professionals. In terms of education, most respondents hold a Diploma (96 out of 233, or 41.2%), followed by those with a degree (131 out of 233, but interestingly listed as 19.6%, which might be a typographical error in the data). Only a small fraction has a Certificate (2.6%). This spread indicates a high level of formal education among participants, with a significant leaning towards diploma-level qualifications. Experience in disaster management among the respondents is varied. A majority have over 10 years of experience (129 out of 233, making up 56.3%), indicating a seasoned group of professionals. Those with 5 to 10 years of experience constitute 36.5% (85 out of 233), while less experienced individuals (less than 5 years) are the least represented at 8.2% (19 out of 233). This suggests that the field tends to retain professionals over longer periods, accumulating substantial experience in disaster management.

**Table 1.** Background characteristics of participants.

| Item | Categories | Frequency | Percent (%) |
|---|---|---|---|
| **Gender** | Male | 179 | 76.8 |
| | Female | 54 | 23.2 |
| **Age bracket** | Below 30 years | 18 | 7.7 |
| | 31– 40 years | 149 | 63.9 |
| | 41 – 50 years | 55 | 23.7 |
| | Above 50 years | 11 | 4.7 |
| **Education Qualification** | Certificate | 6 | 2.6 |
| | Diploma | 96 | 41.2 |
| | Degree | 131 | 19.6 |
| **Experience in disaster management** | Less than 5 years | 19 | 8.2 |
| | 5 to 10 years | 85 | 36.5 |
| | Above 10 years | 129 | 56.3 |
| | **Total** | **233** | **100** |

Source: Primary data (2023).

*4.2. Descriptive Results*

The descriptive results are presented in line with the different objectives of the study and likert scale where SD is Strongly Disagree, D=Disagree, U=Undecided or Neutral, A=Agree, and SA= Strongly Agree.

The study identified the key legal and administrative barriers to cross-border disaster management in Europe and results are presented in Table 2.

**Table 2.** Results on Legal and administrative barriers to cross-border disaster response.

| Index | SD | D | U | A | SA |
|---|---|---|---|---|---|
| European countries face legal and administrative barriers that hinder efficient cross-border disaster response efforts. | 7.1 | 58.6 | 8.6 | 15.7 | 10.0 |
| It is challenging to navigate the different legal systems and regulations when responding to disasters across European borders. | 2.9 | 60.0 | 5.7 | 5.7 | 25.7 |
| Inconsistent administrative procedures and documentation requirements impede swift cross-border disaster response. | 5.7 | 25.7 | 14.3 | 48.6 | 5.7 |
| Streamlining administrative processes and legal requirements could enhance the efficiency of cross-border disaster relief efforts. | 5.7 | 20.0 | 14.3 | 52.9 | 7.1 |
| Coordinating resources and personnel across different administrative boundaries poses a challenge in cross-border disaster response | 24.0 | 46.0 | 7.7 | 10.8 | 11.5 |

Source: Primary data (2023).

A significant majority of respondents (66.7%) either disagreed or strongly disagreed with the statement. This suggests that most respondents believe that there are legal and administrative barriers in place that hinder efficient cross-border disaster response efforts in European countries. Most respondents (62.9%) either disagreed or strongly disagreed with the statement, indicating that they perceive challenges in navigating different legal systems and regulations when responding to cross-border disasters in Europe. A significant majority (74.3%) either agreed or strongly agreed that inconsistent administrative procedures and documentation requirements are impediments to

swift cross-border disaster response. A substantial majority (60.0%) either agreed or strongly agreed that streamlining administrative processes and legal requirements could enhance the efficiency of cross-border disaster relief efforts. A majority (70.8%) either agreed or strongly agreed that coordinating resources and personnel across different administrative boundaries is indeed a challenge in cross-border disaster response.

Objective two was to assess the impact of cultural and linguistic differences on disaster response effectiveness and the results in line with this objective are presented in table 3.

**Table 3.** Results on cultural and linguistic differences in disaster response effectiveness.

| Index | SD | D | U | A | SA |
|---|---|---|---|---|---|
| Language barriers often slow down the exchange of critical information between international disaster response teams. | 4.3 | 10.0 | 8.6 | 51.4 | 25.7 |
| Training programs that promote cultural sensitivity and multilingual skills can improve disaster response effectiveness. | 1.4 | 11.4 | 12.9 | 58.6 | 15.7 |
| Cultural competency and linguistic diversity should be considered when forming cross-border disaster response teams. | 4.3 | 20.0 | 11.4 | 58.6 | 5.7 |
| Efforts to bridge cultural gaps and language differences are essential for efficient cross-border disaster coordination. | 2.9 | 24.2 | 10.0 | 54.3 | 8.6 |

Source: Primary data (2023).

A significant majority of respondents either agreed (51.4%) or strongly agreed (25.7%) that language barriers can slow down the exchange of critical information between international disaster response teams. This indicates a high level of concern about the impact of linguistic differences on disaster response effectiveness. A significant majority of respondents either agreed (58.6%) or strongly agreed (15.7%) that training programs promoting cultural sensitivity and multilingual skills can improve disaster response effectiveness. This suggests that there is support for educational initiatives aimed at addressing these issues. Most respondents either agreed (58.6%) or strongly agreed (5.7%) that cultural competency and linguistic diversity should be taken into account when forming cross-border disaster response teams. This indicates recognition of the importance of diversity in such teams. While a significant proportion of respondents did not strongly agree (8.6%) with this statement, a majority either agreed (54.3%) or disagreed (24.2%). This suggests that while many recognize the importance of bridging cultural and language gaps, there may be some variability in the extent to which respondents view this as essential.

Results concerning the existing frameworks and protocols for cross-border disaster coordination are presented in table 4 below. Most respondents (78.3%) agree that existing frameworks for cross-border disaster coordination in Europe are effective in facilitating cooperation among European nations. This suggests that there is a relatively high level of confidence in the effectiveness of the current coordination mechanisms. Most respondents (69.6%) agree that there is a clear and standardized protocol for requesting and helping across European borders during disasters. This indicates that there is some level of confidence in the existence of established protocols for cross-border assistance. A significant proportion of respondents (48.2%) strongly agree that regular drills and exercises are conducted to test the readiness and effectiveness of existing cross-border disaster coordination frameworks. This suggests that there is a strong emphasis on preparedness and testing in the region. Most respondents (53.2%) agree that improvements are needed in the current systems for sharing resources and information during

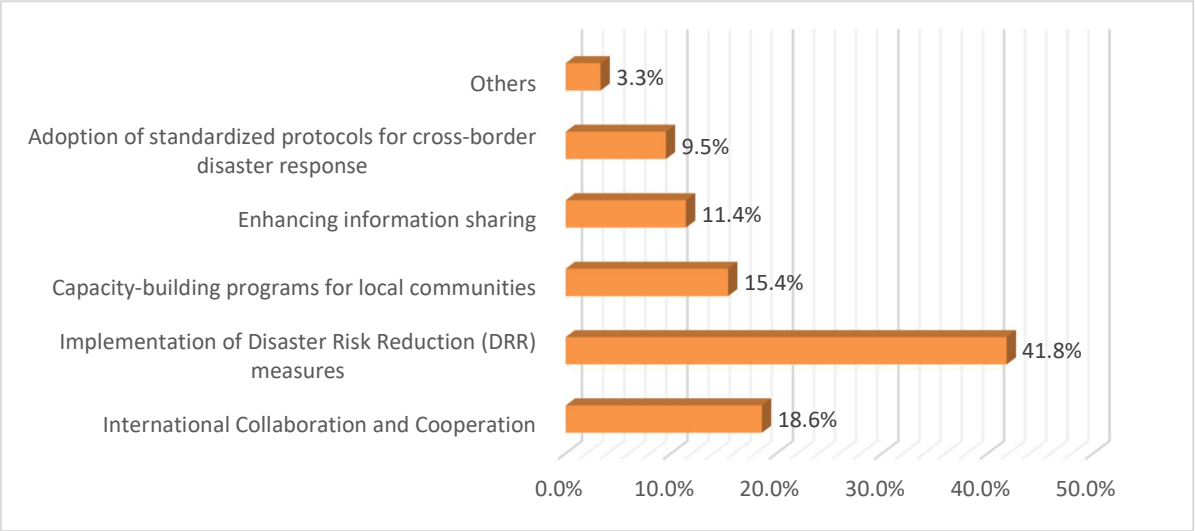
cross-border disasters. This indicates that there is room for enhancement in resource and information sharing mechanisms. A significant portion of respondents (49.1%) agree that European countries should invest more in updating and enhancing cross-border disaster response protocols. This suggests that there is a perceived need for increased investment in improving disaster response capabilities at the European level.

**Table 4.** Results concerning existing frameworks and protocols for cross-border disaster coordination.

| Index | SD | D | U | A | SA |
|---|---|---|---|---|---|
| Existing frameworks for cross-border disaster coordination are effective in facilitating cooperation among European nations | 0.0 | 0.0 | 10.8 | 78.3 | 10.9 |
| There is a clear and standardized protocol for requesting and providing assistance across European borders during disasters. | 4.2 | 9.0 | 1.4 | 69.6 | 15.8 |
| Regular drills and exercises are conducted to test the readiness and effectiveness of existing cross-border disaster coordination frameworks. | 1.8 | 4.3 | 5.2 | 40.5 | 48.2 |
| Improvements are needed in the current systems for sharing resources and information during cross-border disasters | 4.3 | 2.2 | 10.1 | 53.2 | 28.4 |
| European countries should invest more in updating and enhancing cross-border disaster response protocols. | 1.7 | 11.5 | 13.8 | 49.1 | 19.7 |

Source: Primary source (2023).

The study also identified the different Strategies for cross-border disaster response efficiency and the results are presented in Figure 1.



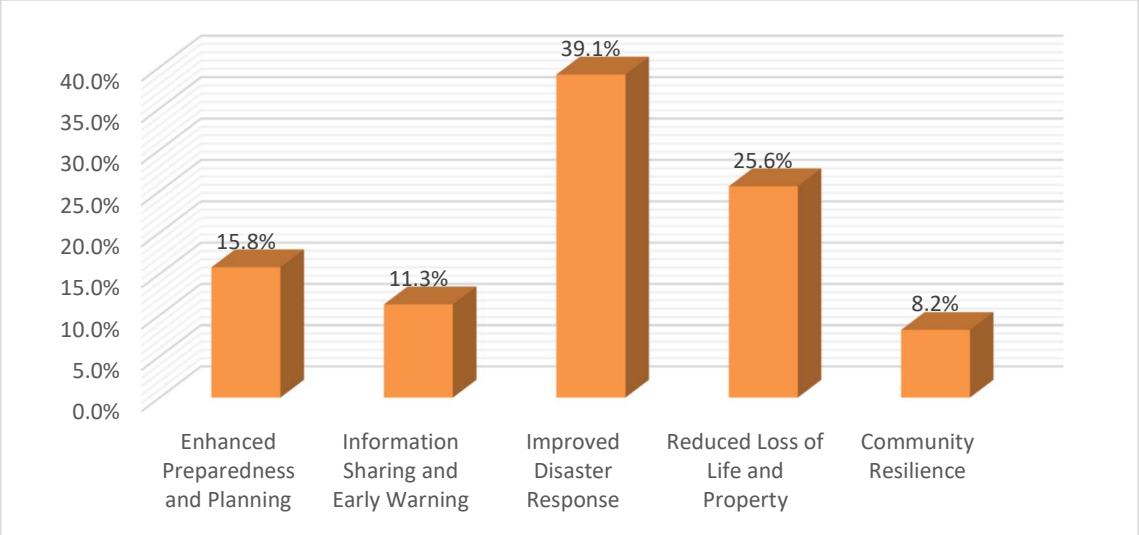

Source: Primary data (2023).

**Figure 1.** Strategies for cross-border disaster response efficiency.

Figure 1 shows that most of the respondents (41.8%) indicated that the most effective strategy for improving cross-border disaster response efficiency is the implementation of Disaster Risk Reduction (DRR) measures. This suggests that many experts and stakeholders in disaster management recognize the importance of proactive measures to reduce the risk of disasters in the first place. DRR measures can include activities such as infrastructure improvements, early warning systems, and community education to enhance resilience. By investing in DRR, countries can significantly reduce the impact of disasters and the need for cross-border response efforts.

International Collaboration and Cooperation, with 18.6% support, also received substantial attention from the respondents. This indicates that a significant portion of the experts recognize the significance of working together across borders to address disasters. International collaboration can involve sharing resources, expertise, and coordinating efforts to respond more effectively to disasters that transcend national boundaries. Cooperation between countries can lead to quicker and more efficient responses, as well as the pooling of resources to support affected areas. Capacity-building programs for local communities, chosen by 15.4% of respondents, highlight the importance of empowering local communities to be better prepared for disasters. Building the capacity of communities to respond effectively to disasters can help reduce the reliance on external assistance, making disaster response more efficient and less resource intensive. Enhancing information sharing (11.4%) and the adoption of standardized protocols for cross-border disaster response (9.5%) both emphasize the importance of communication and coordination in disaster response efforts. Sharing timely and accurate information across borders can help streamline response efforts, while standardized protocols can ensure that responses are efficient and well-coordinated, even amid a crisis. Lastly, the respondents also identified other strategies, such as incorporating environmentally sustainable practices into disaster response and involving local communities in disaster planning, although these options received relatively lower percentages (3.3%). These strategies, though less favored, still play essential roles in enhancing disaster response efficiency, as they promote long-term resilience and community engagement.

The results presented in Figure 2 indicate the various of improved cross boarder disaster response and management, as perceived by the respondents in this study.




Source: Primary data (2023).

**Figure 2.** Outcomes of improved cross boarder disaster response and management.

Most of the respondents, accounting for 39.1%, believe that "Improved Disaster Response" is the most significant outcome of effective cross-border disaster management. This high percentage underscores the importance that responders and affected communities place on timely and effective responses to disasters. It suggests that when disaster management is efficient, the immediate response to emergencies is significantly enhanced, leading to better handling of crises. The second-largest outcome, as indicated by 25.6% of respondents, is the "Reduced Loss of Life and

Property." This outcome is crucial as it directly correlates with the primary objective of any disaster management effort—saving lives and minimizing damage to property. The substantial percentage here reflects the effectiveness of cross-border collaborations in mitigating the severity of disasters, thereby preserving human life and reducing material losses. "Enhanced Preparedness and Planning" received 15.8% of the responses. This indicates that a significant number of respondents recognize the importance of proactive measures in disaster management. Effective planning and preparedness are key to minimizing the impact of disasters, and this percentage reflects an acknowledgment of the need for better strategies and resources in readiness for potential emergencies. Furthermore, "Information Sharing and Early Warning" was identified by 11.3% of the respondents as a critical outcome. This highlights the role of communication and the dissemination of information in managing disasters. Early warnings and the sharing of relevant information are essential for timely responses and can significantly influence the effectiveness of disaster management strategies. Lastly, "Community Resilience" is seen as a notable outcome by 8.2% of the respondents. This aspect focuses on the ability of communities to recover from disasters. The lower percentage might suggest that while community resilience is acknowledged as important, it is perhaps seen as a longer-term or indirect result of effective disaster management. The results reflect a comprehensive view of the various aspects of disaster management, with the greatest emphasis placed on improving immediate responses to disasters, followed by reducing the tangible impacts of these events, such as loss of life and property. It also highlights the importance of preparedness, information sharing, and community resilience as integral components of effective disaster management strategies.

### *4.3. Regression Analysis*

The results from the multiple regression analysis provide valuable insights into the challenges of cross-border disaster response and management from a European perspective. R square value of 0.614 that measures percent of variability in independent variable (effectiveness of cross-border disaster management) which is explained by the independent variables (legal and administrative barriers, cultural and linguistic differences, existing frameworks and protocols for cross-border disaster coordination, and strategies for cross-border disaster response efficiency) is obtained in the multiple regression analysis of the current study. An R2 of 0.614 implies that about 61.4% of the variance in the effectiveness of cross-border disaster management can be explained by the predictors in the model.

Statistically, and from research perspective, R-square value of 0.614 is substantial, especially in social science research, where human behaviors and complex systemic interactions are at issue. In such circumstances, obtaining a high R-squared value is rather complicated as the social phenomena are known to be inherently variable and unpredictable. It indicates that the variables selected for the study have a high explanatory power since the R square is above 60%. Therefore, the model can effectively predict the outcomes of cross-border disaster management.

The R-square value also needs to be evaluated in the context of disaster management research. Cross-border disaster management and response contain several actors, such as governments, NGOs, communities, and international organizations, each having different laws, norms, and operational procedures. The nonlinearity of these interactions makes exact forecasting impossible. Consequently, the ability to explain over 60% of variance in disaster management being the major

achievement highlights the significance of selected variables in line with the study objectives. The F statistic of 40.25 with a significant p-value (0.000) indicates that the overall model is statistically significant.

**Table 5.** Multiple Regression Analysis results.

| Independent variable | Unstandardized coefficients | | Standardized coefficient | T | Sig. | R square | Adjusted R square | F |
|---|---|---|---|---|---|---|---|---|
| | B | Std. error | Beta | | | | | |
| (Constant) | 41.07 | 4.67 | | 4.36 | 0.012 | 0.614 | 0.541 | 40.25 |
| Legal and administrative barriers to cross-border disaster response | 0.414 | 0.152 | 0.046 | 0.194 | 0.001 | | | |
| Cultural and linguistic differences | 0.041 | 0.038 | -0.010 | 2.03 | 0.020 | | | |
| Existing frameworks and protocols for cross-border disaster coordination | 0.314 | 0.112 | 0.076 | 1.14 | 0.001 | | | |
| Strategies for cross-border disaster response efficiency | 0.241 | 0.257 | 0.135 | 1.08 | 0.000 | | | |
| Dependent Variable: Effectiveness of Cross-Border Disaster management | | | | | | | | |

The unstandardized coefficient (B) is 0.414, indicating that for every unit increase in legal and administrative barriers, there is a 0.414 unit increase in the impact on the effectiveness of cross-border disaster management. The significance (Sig.) value of .001 is less than the conventional alpha level of 0.05, suggesting that the influence of legal and administrative barriers is statistically significant. Therefore, Hypothesis One (H1), which posits that legal and administrative barriers significantly impede effective cross-border disaster response and management, is supported by these results.

The coefficient for cultural and linguistic differences is 0.041, which is relatively small, indicating a minor impact on the effectiveness of disaster management. However, the significance value of 0.020 is below 0.05, suggesting that cultural and linguistic differences do have a statistically significant, albeit small, negative effect on disaster response and management effectiveness. Thus, Hypothesis Two (H2) is accepted, but with the caveat that the impact is not as pronounced as it might be for other factors.

The coefficient of 0.314 for existing frameworks and protocols denotes a moderate positive influence on the effectiveness of cross-border disaster management. The significance level of 0.001 strongly supports the conclusion that these frameworks and protocols significantly influence the effectiveness of disaster management. This finding leads to the acceptance of Hypothesis Three (H3), confirming that existing frameworks and protocols for cross-border disaster coordination significantly impact the effectiveness of cross-border disaster management.

The coefficient for "Strategies for Cross-Border Disaster Response Efficiency" in the multiple regression analysis is 0.241, and its standardized coefficient (Beta) is 0.135. This indicates a positive relationship between the implementation of efficient response strategies and the effectiveness of cross-border disaster management in Europe. In other words, as organizations and authorities adopt more efficient and sustainable strategies for disaster response across borders, there is a corresponding improvement in the overall effectiveness of managing disasters. Furthermore, the

significance level (Sig.) is 0.000, which is less than 0.05. This indicates that the relationship between the implementation of sustainable strategies for cross-border disaster response efficiency and effectiveness is statistically significant. Therefore, Hypothesis four (H4) indicating that implementing sustainable strategies can significantly improve cross-border disaster response and management efficiency**.**

## 5. Discussion

The discussion explores the implications of these findings, highlighting the need for a more unified approach to disaster management in Europe. The study's emphasis on the issue of legislative and administrative barriers to cross-border disaster response in Europe is extremely pertinent to the complexities and challenges identified in the corpus of recent research. Cross-border catastrophe response is fundamentally hampered by the diversity and complexity of legal frameworks governing emergency operations across different European states. Vries et al. [22] have pointed out that disparate national laws and policies concerning catastrophe management can create operational obstacles. The results of the study support this perspective by showing that negotiating these disparities is a significant difficulty. Legal disparities among EU member states highlight the need for more unified legal frameworks, as investigated by Appleby-Arnold et al. [2]. This is important because legal ambiguities or conflicts might compel response teams to postpone necessary operations during emergencies. Another major obstacle is the unwillingness of nations to ask for or accept aid because of worries about their political or national sovereignty. Shukla et al.'s [19] discussion of this topic is especially pertinent in the European setting, where independence and national identity are widely prized. According to the study's findings, this hesitation may cause responses to be delayed. These findings are consistent with those of Bollen & Kalkman [10], who examine the political aspects of cross-border disaster management. This problem has strong roots in the political and social structures of the participating countries in addition to being a logistical one [8,15,18,46]. Administrative obstacles are a major factor in the complexity of cross-border disaster response, in addition to legal concerns. The bureaucratic obstacles that European nations must overcome are examined in Sun & Doh's [18] study. These problems include disparities in administrative processes, paperwork needs, and resource distribution regulations. The study's findings support these conclusions, showing that these administrative differences greatly impede the response time. Rexroth et al. [5] also draw attention to the challenges associated with navigating several administrative systems, highlighting the necessity for more streamlined procedures to improve collaboration efficiency.

The results of the study demonstrate that a complex and important facet of cross-border disaster response in Europe is the influence of linguistic and cultural differences on the efficacy of disaster management. The way that nations and communities react to disasters is significantly influenced by cultural norms and beliefs [25,49]. This variation can result in a variety of methods to crisis management, impacting everything from decision-making procedures to the order in which response activities should be prioritized. For example, Carter et al. [7] found that cultural variables could have a big impact on how disaster response plans are put together and carried out. These distinctions may cause miscommunications or confrontations in a multi-national setting such as Europe, where numerous cultures collide. The results of the study support this assertion by demonstrating how important cultural competency is to efficient cross-border collaboration [11,52,

53]. Adrot and Aguerre [25] underscore the significance of comprehending indigenous practices in disaster relief efforts, stressing that a lack of awareness of cultural subtleties might impede efficient aid delivery and perhaps generate conflict. Language barriers present even another significant difficulty. Coordination of multinational teams and timely distribution of orders and information depend on effective communication [54,55]. The participants in the study highlighted the noteworthy obstacles caused by language difficulties, which is consistent with the findings of Rexroth et al. [5] and Serraglio et al. [55]. The effectiveness of disaster response operations may be impacted by these obstacles, which may cause misunderstandings, holdups, and mistakes. This difficulty is exacerbated by the linguistic diversity of Europe, which includes a wide range of languages and dialects [17].

The study's findings about the structures and procedures now in place in Europe for cross-border disaster coordination show that while these systems are generally thought to be effective, there is recognition of areas in which they may be strengthened. This viewpoint is consistent with research that has examined the intricacy and usefulness of these frameworks in European contexts [8,37,52]. One major area of concentration is the European Union Civil Protection Mechanism (EUCPM), which is essential to cross-border disaster response. A general confidence in existing procedures was found in the survey, and this is echoed in literature such as that of the European Union [3], which addresses the function of the EUCPM in coordinating activities among EU member states. It is essential for the EUCPM to be able to mobilize resources and knowledge across national boundaries, especially when dealing with a variety of unanticipated calamities [56]. Still, Yap et al. [28] highlighted issues such resource integration and decision-making procedures, which align with the study's finding that these frameworks should be improved. As demonstrated by Kiberu [29], bilateral and multilateral agreements play a crucial role in enabling cross-border response. According to the World Health Organization [14], these agreements—which are frequently defined by historical ties and physical proximity—can speed up the sharing of resources and aid but have varying degrees of efficacy. This is supported by the study's findings, which point to the need for more reliable and standardized processes. The literature's emphasis on readiness and interoperability is consistent with the regularity of drills and training activities. The study's conclusions support Zillmer et al.'s [23] emphasis on the value of cooperative training in acquainting responders with standardized protocols. These drills are essential for guaranteeing cross-border coordination's preparedness and efficacy, highlighting a sector that requires ongoing funding and development [20,45,56].

The study shows that the effectiveness of disaster management is greatly impacted by the development of digital platforms, information and communication technologies (ICTs), and geographic information systems (GIS). Rexroth et al. [5] have pointed out that social media sites like Twitter have become essential for early warning systems and for disseminating information in real time during emergencies. These digital platforms provide a quicker and more effective way to communicate by overcoming conventional boundaries of geography and jurisdiction. The notion of "digital volunteers," as expounded by Ogie et al. [6], exemplifies the capacity of social media to facilitate community response and assistance, frequently extending beyond national boundaries. Decision-making and situational awareness have significantly improved with the use of ICTs in disaster management. As UNDP [32] emphasizes, real-time data gathering and analysis techniques improve the capacity to monitor disasters and coordinate responses. The 'Public Protection and

Disaster Relief' (PPDR-TC) project of the Community Research and Development Information Service (CORDIS) of the European Commission demonstrates how cutting-edge communication technologies support international cooperation during calamities [11,27,57]. Mapping and damage assessment of areas affected by disasters are made possible using GIS and remote sensing technology. The crisis mapping study by Ogie et al. [6] demonstrates how these technologies offer vital spatial data that facilitates the organization and carrying out of coordinated responses. According to IFRC [35], problems including misinformation, data overload, and the digital divide might affect how effective these technologies are. In order to facilitate efficient communication and data sharing, the Danish Refugee Council [36] emphasizes the necessity of standardization and interoperability of technical systems across national boundaries.

A key component of tackling the complex issues Europe faces in this area is the study's focus on practical methods for improving cross-border disaster response effectiveness. The results of the study confirm how important it is to have clear legal frameworks and policy. The significance of international collaboration in disaster risk reduction is underscored by the United Nations' adoption of the Sendai Framework for Disaster Risk Reduction 2015–2030 [20,33,40,58]. This is consistent with the study's conclusion that administrative and legal obstacles seriously hinder cross-border disaster response. Reducing delays brought on by customs and visa requirements can be accomplished by creating bilateral or international agreements that specify protocols for cross-border assistance. Such procedures are modeled after the European Union's Civil Protection Mechanism, which enables member nations to provide effective and timely assistance in the event of a disaster [11,19]. According to the findings, it's critical to standardize protocols and provide training for disaster response. This entails establishing uniform equipment standards, consistent communication procedures, and cooperative training activities. Globally accepted principles and procedures for urban search and rescue during disasters are provided by the International Search and Rescue Advisory Group (INSARAG) [33]. The study highlights the importance of established protocols and regular drills, and by adopting these standards, nations may make sure that local response teams are ready to work in unison with international teams. Technological innovations like drones, satellite imagery, and sophisticated communication networks have enormous potential to improve cross-border disaster response. The findings of this research emphasize how creating common spaces for data and information sharing can improve situational awareness and facilitate effective resource allocation. It is crucial to integrate local populations' knowledge into cross-border disaster response methods [21,32]. Local communities have significant expertise about their area and are sometimes the first to respond to calamities. The study's findings demonstrate that include these populations in planning and response activities can greatly increase the efficacy of cross-border initiatives [3,19,23].

## 6. Conclusion

The research provides an in-depth assessment of the multifaceted difficulties and prospects of transboundary disaster management within Europe. It emphasizes the huge roadblock posed by the administrative and legal constraints to the effective administration of the transnational disasters. Differences in laws, regulations, and administrative procedures among European nations causes operational problems and delays in emergency responses. Additional evidence is provided by the regression analysis, depicting a positive correlation between the amount of administrative and legal

barriers and inefficiency in the disaster management process. Language and cultural differences may not be as significant as administrative and legal barriers, but they remain an obstacle for disaster relief efforts effectiveness. These disparities may cause the lack of understanding, different ways of dealing with disaster management, and communication breakdown. To alleviate this issue, cultural sensitivity and multilingualism should be developed within disaster response teams, through training and composition adjustment. This research emphasizes the crucial role of developed mechanisms such as EU Civil Protection Mechanism in enhancing disaster management efficacy. However, development still needs to be done; in areas such as resource and information sharing, as well as the adaptation of protocols to handle new challenges. Technology plays a vital part in building up cross-border disaster response capacity by virtue of digital platforms and geographic information systems that provide possibility for enhanced coordination, communication, and situational awareness. In this sense, the study pinpoints the need for multilateral and coordinated responses that will enhance effective cross-border disaster management capabilities in Europe. Through the implementation of the recommended actions, policymakers and practitioners may tune the existing policies and the operational practices to be more suitable for the purpose. Capacity augmentation in legal frameworks, cultural and linguistic competencies, and coordination mechanisms with the help of technology can make EU member states pioneers in disaster management. This methodical research-based evidence supports basing of well-informed decisions and actions in developing efficient cross-border disaster response capacities.

### *6.1. Contribution of the Results on the Body of Knowledge*

1. This study not solely underlines administrative and legal obstacles as among the main bottlenecks for a successful cross-border disaster management but also, it measures their influence. The study uses regression analysis to demonstrate the influence these barriers have on disaster management efficiency indices directly connecting them to the calls for simplified administrative procedures and harmonized legal frameworks with empirical evidence to back them up. The understanding is, therefore, not just at the policy level but implementation as well. This way Europe is shown the urgency of overcoming the barriers, not only at the policy level but in the actual protocols and operational procedures as well.
2. Unlike other studies, this work is unique as it explores the extent to which cultural and linguistic factors have an effect. The data also shows that such disparities though not as much as administrative barriers have a great impact on the management process of disaster. This result implies the need for making the cultural sensitivity and multilingual competence part of the disaster response training and making up of the teams, including the guidelines regarding the improvement of communication and collaboration among the diverse response teams.
3. The issue of the operation of existing coordination mechanisms, like the European Union's Civil Protection Mechanism (EUCPM), is a hotly debated matter. Nevertheless, the research herein offers tangible proof for the veracity of the claim that improving of disaster response efficiency may be achieved through strategic partnerships and better resource and information sharing. This thorough evaluation helps provide a comprehensive view of these frameworks and the situations where they work and fail, thereby recommending in which areas the policies and operations should be redesigned.

### 6.2. Recommendations

Based on the results of the study, several recommendations can be made to enhance the effectiveness of cross-border disaster response and management in Europe:

1. Given the significant impact of legal and administrative barriers, there's a pressing need to harmonize these frameworks across European nations. This could involve developing a standardized set of regulations and procedures for disaster response that all EU member states agree upon. Efforts should also be made to streamline bureaucratic processes to facilitate swift and efficient cross-border cooperation in times of disaster.
2. Developing and enforcing laws that facilitate cross-border disaster management ought to be the main priorities of policymakers. This entails using diplomacy to fortify global collaboration, obtain financing, and guarantee that catastrophe management stays a top political priority.
3. Cultural sensitivity training and multilingual capabilities should be improved across the disaster response teams. Training programs should be oriented towards raising awareness and cultivating constructive interactions among different cultures and languages to increase harmony and cohesiveness in disaster management operations.

### 6.3. Limitations and Suggestions for Future Research

The study aimed at disaster management specialists of Greece with a goal to make it appropriate to the wider European framework. Whilst Greece is advantageously located and represents a compelling example, the diversity of experiences, laws and structures of governance in European nations have an effect, and therefore, the findings may not be a fully accurate reflection of the level of complexity in other countries. Distinctive issues or advantages, often specific to other countries and not identified in the current study, may find different countries. Consequently, to broaden the geographical scope, it is crucial to include a broader range of European nations or, on the contrary, conduct comparative studies between the regions. The findings also show that legal and administrative barriers significantly impede cross-border disaster management, future studies should delve deeper into specific legal and administrative hurdles faced by different European countries. Research could explore harmonization possibilities and the development of a unified legal framework that respects the sovereignty of nations while promoting efficient cross-border disaster response.

**Funding:** This research received no external funding.

**Conflicts of Interest:** The authors declare no conflict of interest.

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(Executive Editor: Wang-Jing Xu)