POZNAŃ UNIVERSITY
OF ECONOMICS
AND BUSINESS

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Corporate Risk Management of Natural Disasters: A Study on the Preparedness of Hotels in Greece and Israel to Natural Hazards

Zarządzanie ryzykiem w obliczu katastrof naturalnych: Studium przygotowania hoteli w Grecji i Izraelu na wystąpienie zagrożeń naturalnych

Doctoral dissertation

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Date of submission: …….

Supervisor's signature

Poznań 2024

Dedication

This dissertation is dedicated to Amb. Mordechai David Palzur, my Father, for your endless support, encouragement and love.

Acknowledgments

The author wishes to express sincere gratitude to all those who contributed to the successful completion of this dissertation.

First and foremost, I extend my deepest thanks to Prof. Ewa Mińska-Struzik, my supervisor, for her invaluable guidance, continuous support, and unwavering patience throughout this process. I am grateful to Dr. Agnieszka Kukułka, my assistant supervisor, for her essential assistance and insightful contributions.

This study would not have been possible without the support and assistance of several individuals, whose help at critical moments proved critical. I would like to acknowledge Yael Danieli, Pnina Ben David, Yohay Eldor, Prof. Lea Wittenberg, Adi Ofir, and Sigal Oz - your contributions were vital to the completion of this dissertation.

I would also like to extend my heartfelt appreciation to the following individuals, who assisted me in various ways along the journey (listed in alphabetical order): Avi Bar, Prof. Nir Becker, Dr. Michal Ben Gal, Avi Ben Zaken, Dr. Aya Dolev, Maya German, Shiri Fein Grossman, Prof. Dr. Domenico Giardini, Yael Ifargan Gini, David Ginzburg, Dr. Yuval Levi, Prof. Noam Levin, Jagadeswara Rao Maddukuri, Dr. Sinaia Netanyahu, Asaf Rosenheim, Chen Safiev, Pini Shachar, Dr. Avi Shapira, Dr. Assaf Shmuel, Prof. Deborah F. Shmueli, Ero Touribaba, Dr. Gony Yagoda-Biran, Dr. Moshe Yanai, and Prof. Motti Zohar. Your support and knowledge, each in your unique way, made a significant difference and are deeply appreciated.

Table of Contents

List of Abbreviations

ADB - Asian Development Bank
AI - Artificial Intelligence
APEC - Asia-Pacific Economic Cooperation
ARP - Average return period
BA - Burnt area
BUI - Buildup Index
C3S - Copernicus Climate Change Service
CAPM - Capital Asset Pricing Model
CEO - Chief Executive Officer
CFFDRS - Canadian Forest Fire Danger Rating System
CFFWIS - Canadian Forest Fire Weather Index System
CFO - Chief Financial Officer
COSO - Committee of Sponsoring Organizations of the Treadway Commission
CRED - Centre for Research on the Epidemiology of Disasters
CRO - Chief Risk Officer
DC - Drought Code
DMC - Duff Moisture Code
DRFH - Disaster Resilience Framework for Hotels
DRC - Disaster Research Center, University of Delaware
DRR - Disaster Risk Reduction
EFEHR - European Facilities for Earthquake Hazard and Risk
EFFIS - European Forest Fire Information System
EMTC - The Euro-Mediterranean Tsunami Catalogue
EP - European Parliament
ERM - Enterprise Risk Management
FEDs - Famines, epidemics and droughts
FEMA - U.S. Federal Emergency Management Agency
FFMC - Fine Fuel Moisture Code
FOPI - Fire occurrence probability index
FWI - Fire Weather Index
GAO - U.S. Government Accountability Office
GHS - Global Health Security
GIS - Geographical information systems
GPI - Global Peace Index
GSHAP - Global Seismic Hazard Assessment Program
GTI - Global Terrorism Index
GTP - Greek Travel Pages
IBCDRP - Integrated Business Continuity and Disaster Recovery Planning
IDF - The Israel Defense Forces
IFI - Integrated Fire Index
IFRC - International Federation of Red Cross and Red Crescent Societies
IHA - Israel Hotel Association
ILO - International Labor Organization
IMS - Israel Meteorological Service

IPCC - Intergovernmental Panel on Climate Change
IRM - Integrated risk management
ISI - Initial Spread Index
IT - Information Technology
LULC - land use and land cover
MIH - Maximum inundation height
MM - The Modigliani-Miller theorem
MNEs - Multinational enterprises
MPT - Modern Portfolio Theory
NCDP - National Center for Disaster Preparedness
NPV - Net present value
OLM - Ordered logit model
PGA - Peak Ground Acceleration
POE - Probability of exceedance
PPRR - Prevention, Preparedness, Response and Recovery
SA - Spectral acceleration
SIDS - Small Island Developing States
TASE - Tel Aviv Stock Exchange
UNDRO - Office of the United Nations Disaster Relief Coordinator
UNEP - United Nations Environment Program
UNHCR - United Nations High Commissioner for Refugees
UNISDR - United Nations International Strategy for Disaster Reduction
USGS - U.S. Geological Survey
WHI - Wildfire Hazard Index
WHP - Wildfire Hazard Potential
WUI - Wildland-Urban Interface

Introduction

Scientific evidence presented in the Sixth Assessment Report of the IPCC (2023) highlights a significant rise in the occurrence and severity of climatic events, including hurricanes, wildfires, floods, and droughts, causing widespread devastation and disruption. Unmitigated natural disasters and other extreme events can have a devastating impact on a corporation, depending on the magnitude of the disaster, along with the specific characteristics and circumstances of the corporation. A natural disaster can cause facility damage and human casualties and will most probably slow down or even stop the economic activity in the affected geographical area (Kukułka, 2016). This in turn causes rippling effects with business interruption, leading to problems in the supply chain and possible reduced consumer demand (Thomas & Helgeson, 2021). Communication and IT failures can also appear during natural disasters (Clark, 2012). An underprepared company can witness its stock price plummet (Seetharam, 2017) and higher prices of maintenance and materials. In addition, a corporation without a risk management policy should expect to face higher insurance premiums as insurers withdraw their coverage from high-risk markets or increase prices due to higher perceived risks (Arnold, 2008).

Being ready for the future and for unexpected events that can shake a corporation's stability and even shatter its foundations is important for any company that seeks to successfully survive in the long run. According to Smolka (2006), there has been a substantial increase in the loss burden of companies since the year 1950. Smolka explains that this increase has been driven by "a concentration of population and values in urban areas, the development of highly exposed coastal and valley regions, the complexity of modern societies and technologies and probably, also by the beginning consequences of global warming." Hence, natural disasters will become more influential on businesses in the future. It is only rational to think that corporations consider all the relevant variables affecting their businesses, including the possible impacts of natural disasters, analyze the prospects, reach logical conclusions, and place the necessary measures to mitigate these risks.

The hospitality sector, particularly the hotel industry, is uniquely vulnerable to the impacts of disastrous climatic events due to its frequent presence in high-risk regions (Aliperti et al., 2019) and its reliance on operational continuity and guest safety. Tourism providers who do not pay attention to risk management may put the lives of their guests at risk (Wut, Xu & Wong, 2021). These extreme events - ranging from storms, floods, and wildfires to

earthquakes, tsunamis, and pandemics - can severely damage hotel infrastructure, disrupt operations, and deter tourists from visiting affected destinations, resulting in cascading economic consequences for both the hotels and the local and regional economies that rely on the hospitality sector for economic growth, employment, and income (Garcia et al., 2024; Ivkov et al., 2019). The effects of natural disasters can extend well beyond the impacted zone of the disaster to impact other areas of the country, whether temporarily or even permanently (Estevão & Costa, 2020).

Mikulić et al. (2018) suggest that the natural disasters that hold the greatest impact for tourism are earthquakes, wildfires, and floods, though one should add that the prevalence of terrorism in tourist destinations requires economies and corporations that are heavily dependent on tourism to think holistically about the exposure to these risks and how to address them. One should add pandemics to this list as the COVID-19 pandemic, which, in many regions around the world, restricted the movement of people from place to place to avoid further spread of the virus, largely affected the tourism industry, given the inherent dependency of the industry on travel. The reduction of tourist arrivals and expenditures because of COVID-19 hit the industry and its related stakeholders, thus creating vulnerability (Wut, Xu & Wong, 2021).

Chopra & Sodhi (2004) have observed that while most companies develop plans to care for recurrent, low-impact risks, many, however, tend to ignore high-impact, low-likelihood risks to their supply chain, such as natural disasters. Given the increasing risks and their potential effects, there is an urgent need for hotels to adopt proactive disaster preparedness measures. Mikulić et al. (2018) suggest the application of integrated risk management (IRM) principles. Despite the need, according to recent studies, a lot of destinations are still unprepared for the effects of climate change and other hazards (Girard, 2024). Barriers such as limited risk perception, lack of awareness, and inflexible organizational structures often prevent hotels from implementing effective resilience strategies. For example, a recent study showed that most of the hotel establishments in Naval, Biliran Province, Philippines, a tourist destination prone to disasters, are not prepared to the many types of disasters they face as they lack proactive emergency planning, equipment and staff training (Carreon et al., 2022). Such examples underscore the sector's vulnerability to extreme events.

Other than the listed above, there are various other reasons why businesses, including hotels, remain unprepared or vulnerable to natural hazards. Dixon (2017) suggests that in

some instances, incomplete or uncertain scientific understanding may make businesses hesitant to take preparedness actions. In addition, even if the scientific basis is solid, there are other obstacles such as the "stickiness" of infrastructure, i.e., once built, it is difficult to relocate buildings and infrastructure from one place to another. Also, accurately estimating and securing the capital needed to invest in mitigating future hazards is also a significant challenge (Dixon, 2017).

There are many theories and rationales for the risk management of natural hazards or for the lack of risk management practices. Given the lack of data in the field, the first main purpose of this study is to provide new insights into the preparedness levels for different hazards of hotels located in Greece and Israel, two Mediterranean countries frequently exposed to multiple types of natural hazards. To the best of current knowledge, this information has not been systematically collected and publicly published in the past for the hotel industry in both countries.

Four categories of natural hazards are the subject of the study: earthquakes, tsunamis, wildfires, and pandemics. For two reasons, security crises - such as wars, terrorism, and abrupt refugee inflows - were included in the analysis as well. First, for methodological considerations, the author felt it is crucial to compare how hotels handle natural hazards with how they manage hazards stemming from other sources. Second, security crises are an appropriate choice for comparison given their relevance to the geopolitical circumstances of the Eastern Mediterranean region.

Once an understanding of the preparedness levels for each type of hazard is obtained, the second purpose of the study is to identify key predictors, which help explain the variation in preparedness. These predictors can be categorized into three levels of analysis: external factors, hotel characteristics, and individual-level risk perceptions. By conducting the study, the author aims to provide actionable insights for hotel managers, policymakers, and stakeholders to improve disaster risk management practices. Explaining the reasons behind preparedness levels can help create a national depiction of the gaps that exist in emergency and disaster risk management of the hotel industry, or business sector, in general. The aggregated results of the study can give an indication regarding the private sector's resilience and preparedness, though several generalization limitations exist and will be discussed.

Policy-wise, the results of the study can facilitate different entities in the economy for different uses. First, the study can raise awareness of the necessity of including natural

disasters into corporate risk management, even if some of these events are considered force majeure. Second, understanding why hotels do not consider natural disasters in risk assessments, also in comparison to hotels operating in the other countries juxtaposed with, can help the government decide on the right policies to place in order to encourage such action. Third, the results of the study might indicate a market failure in the field and might stimulate thoughts on regulation. Fourth, such studies can help hotels assess their position in the continuum of disaster preparedness relative to their peers. Previous research emphasizes the need for focused studies to determine best practices for hotel disaster preparedness (Brown et al., 2018). Furthermore, scholars like Ritchie (2004) and Hystad & Keller (2008) have advocated for a proactive and strategic approach to crisis management in tourism, particularly in regions facing escalating environmental challenges. Considering this, this study contributes to the discourse on disaster risk management in the tourism industry by examining how well various theories and predictors account for the observed practices of hotels.

This study includes nine hypotheses to explore the key determinants of hotel preparedness for natural hazards and other extreme events. As mentioned earlier, the hypotheses are classified across three levels of analysis: external factors, organizational characteristics, and individual-level risk perceptions. At the external level, the first hypothesis posits that hotels situated in areas with higher hazard severity will exhibit higher levels of preparedness. The second external level hypothesis tests whether country differences - hotels situated in Greece or in Israel - can explain variations in preparedness levels under the assumption that preparedness levels should not vary significantly across both countries because neither country has laws or regulations requiring preparation measures. The third hypothesis suggests that hotels receiving public assistance in the form of funding, training, or awareness programs are expected to demonstrate higher preparedness levels, given the fact that the leading purpose of external support in to enhance organizational resilience.

At the organizational level, the study focuses on hotel-specific characteristics. Size (hypothesis 4) suggests that larger hotels would be better prepared for hazards due to more resources and capabilities. Ownership patterns are the fifth hypothesis of the study. It is hypothesized that hotels that are part of a local or international chain are better prepared than independent, stand-alone hotels because they can receive support from their corporate headquarters. Cost sharing and shared expertise among hotels in the chain can also lower expenses in each of the hotels. The sixth hypothesis revolves around the presence of a

dedicated employee responsible for disaster preparedness. It suggests that having a paid position for emergency preparedness and disaster management would de facto result in preparedness procedures and measures. The seventh hypothesis suggests that newer hotels or those that have undergone retrofitting to address structural vulnerabilities are expected to exhibit higher preparedness levels. The last organizational variable is related to previous disaster experience. Hotels with prior experience in managing or encountering similar disasters are hypothesized to be better prepared.

On the individual-level of analysis, risk perception is the nineth and last hypothesis of the study. It is theorized that hotels where decision-makers perceive the risks arising from the hazards to be high would engage more actively in preparedness activities, as risk awareness often translates into proactive behavior.

These nine explanatory variables were selected for this study following a thorough review of the disaster risk management and preparedness to natural hazards literature, which found them to have, in various studies, predicting capabilities regarding the study's research question, as to what explains the preparedness levels of hotels to different types of hazards. To examine the variables' ability to explain the preparedness levels of hotels to the five types of hazards included in the study, a survey was circulated among hotels in Greece and Israel in the spring-summer of 2023. Out of 111 questionnaires which were collected, 75 were found complete and valid for conducting the statistical analysis.

The study employed a quantitative approach on 75 hotels, first describing the variations among hotels with regards to the predictors and the preparedness levels. Second, the study applied an ordered logit regression model to explore the relationship between the variables. An ordered logit model (OLM) was chosen since the dependent variable, preparedness, was operationalized with an ordered index score. As the results indicate a relatively low level of preparedness among hotels, the study highlights the importance of integrating preparedness strategies and measures into hotel operations to ensure the sector’s adaptability and long-term sustainability in an increasingly volatile climate landscape and growing number of geopolitical and security events.

The sources of data used in this study include primarily peer reviewed academic studies, in addition to various books, quantitative data sources, and where necessary, information obtained from international organizations, government entities, and media outlets. The data required to conduct this study was not readily available, making it necessary to distribute a

survey to gather the data on the hotel sector. In addition, the data on the different types of hazards, especially wildfires, had to be retrieved from open-sourced datasets and adjusted to meet the needs of the dissertation.

The dissertation is divided into five chapters in two parts. Part I, which aims to set the scene on corporate risk management of natural disasters, includes the first three chapters. Chapter 1 focuses on defining the key concepts of the study. These concepts include the terms *'natural*', '*disaster'*, *'natural disaster*', and '*natural hazards'*. The chapter will also introduce the subject and the scope of the study. Chapter 2 presents the theoretical foundations of corporate risk management, bringing an overview of the theories and presenting firm-level determinants as well as decision-making factors of risk management. Chapter 3 reviews empirical studies on disaster management in the tourism and hospitality sector as well as relevant studies conducted on the risk management of natural hazards among firms.

Following a detailed literature review, Part II of the study focuses on the comparative study between hotels in Greece and Israel. Chapter 4 details the research approach, methodology, including the survey design, data collection process, and statistical tools. Chapter 4 also introduces the hypotheses, and the hazard maps used in the empirical analysis. This empirical analysis is the focus of Chapter 5, which presents the research results and their practical implications. The findings are discussed in relation to the literature and their implications for hotel managers, policymakers, and other stakeholders. In addition to the five chapters mentioned above, the study ends with the Conclusions, which reflect on the research objectives, summarize the key findings, and provide recommendations for future research while addressing the limitations of the study.

Part I. Corporate risk management of natural disasters - setting the scene

Chapter 1. Natural hazards vs natural disasters

Corporate risk management of natural hazards is a multidisciplinary field discussed in the literature from various perspectives and under different terms. This necessitates breaking down its components and defining each one clearly. This section aims to present the subject by explaining the concepts of natural hazards and natural disasters, highlighting the differences between the two, and determining which term will be used in this study.

When deciding how to address natural hazards and define natural disasters, it was essential to identify the most relevant definitions. Chmutina & von Meding (2019) found that, although researchers acknowledge disasters are not solely caused by natural events, they often continue to use the word *natural* in conjunction with *disasters*. This is perhaps because researchers use the word *natural* to describe the source of the disaster though the disaster itself incorporates features not of natural sources as well. This and other related points will be discussed in the next section, which will introduce various definitions of natural disasters and natural hazards and suggest the most appropriate ones for this study.

Let us start with the term *natural disasters*. When defining natural disasters, it is useful to divide the expression into its two words: *natural* and *disaster*. For both terms, there are quite a few varying definitions, which require elaboration. The next section of the chapter will introduce how each concept has been defined and used in the literature. Later, the chapter will focus on discussing the relationship and differences between disasters and hazards.

1.1. The term *'natural'*

As noted above, the word *natural* refers to events related to processes that are not made or caused by humankind. They include geological, meteorological, hydrological, oceanic, biological, and hydro-meteorological processes. Today this definition would also include processes that are induced by mankind, such as climate change (Etkin, Medalye & Higuchi, 2012). Biological hazards, epidemics, and pandemics of diseases and viruses can lead to natural disasters as well (IFRC, 2024; Mohamed Shaluf, 2007) where COVID-19 is an example of such a disaster on a global scale.

MunichRe, a reinsurance company, created a database of disasters caused by natural occurring events. The MunichRe NatCatSERVICE database includes nine main types of natural occurrences, grouped into four categories: (1) geophysical events; (2) meteorological events; (3) hydrological events; and (4) climatological events, as illustrated in Figure 1.1, below:

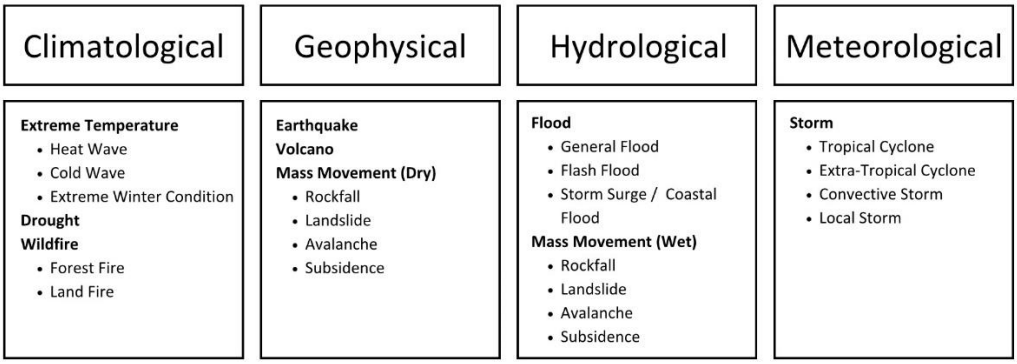


Figure 1.1. The NatCatSERVICE natural disaster classification

Source: Below, Wirtz & Guha-Sapir, 2009

The literature exemplifies how most studies refer to the word *natural* to describe events that are caused by environmental phenomena and are not the result of human actions. One different perspective is that of Harrison & Williams (2016), who included in their study events such as contagious diseases, extreme weather events, volcanoes, flooding and landslides, storm surges, earthquakes and tsunamis, wildfires, and volcanoes. While their study excluded technological disasters such as urban fires or factory explosions, it did include human-related events that do have an impact on natural systems such as the failure of a dam leading to downstream flooding.

Interestingly, Chmutina & von Meding (2019) assert that continuously attributing development failures to “nature” or “acts of God” allows those responsible for creating disaster risks through inadequate urban planning, socioeconomic disparities, weak policies, and lack of proactive measures, to evade accountability. For this reason, when one talks about disasters resulting from natural causes, it is important to adopt a definition that revolves around triggers from natural occurrences, as elaborated above.

1.2. The term *'disaster'*

Many people use the terms *disaster* and *catastrophe* interchangeably. The literature about disasters is very extensive and there is no consensus on the definition of the basic concept. It

would be presumptuous to try to completely cover the literature on the term, especially when there is great variance between the views, nor is it the purpose of the study. Faulkner (2001) and Albattat & Mat Som (2019) compare the terms *disaster* and *crisis*, stressing the external characteristics of disasters. Accordingly, disasters stem from unforeseen events originating outside the specific industry as opposed to crises to the sector or the organization, which stem from internal characteristics and partially self-inflicted disruptions.

Before turning to discuss the term *natural disaster*, it is important to stress that a natural disaster is only one type of disaster, and that each field of science stresses the aspects related to the discipline; i.e, a sociological definition of *disaster* would focus on the effects of an extreme event on humanity (Kroll-Smith & Couch, 1991), whereas an ecological definition would stress the physical impacts of an extreme event on the environment (Smith & Petley, 2009). Palzur (2024) discusses how the term disaster is used in the economic literature - where economic crises, economic collapses, breakdowns, crashes, meltdowns or economic depressions are considered the disasters. If we look at the disaster discourse in general, disasters can be triggered by a variety of sources and can be characterized by different factors. As we are focusing on natural disasters, it is only fitting to review how scholars in this field define a *disaster*, before turning to the term *natural disasters* itself.

According to UNDRO (1980), a disaster is an event confined in time and space, in which a community experiences human and property damages in such a way that the social structure and the basic functions of society are disrupted (Alcántara-Ayala, 2002). Similarly, the UNISDR (2009) terminology defined a disaster as "a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources". Having mentioned the need for resources, the Centre for Research on the Epidemiology of Disasters (CRED) includes in its definition the fact that a disaster overwhelms local capacity, necessitating external assistance from national or international entities (Papanikolaou & Dequae, 2015). CRED's definition will be elaborated shortly.

Gad-el-Hak (2008) addresses the characteristics of disasters - their degree or scope and the rapidity of the calamity. The extent of a disaster is defined by meeting at least one of two criteria, which involve either the quantity of displaced, distressed, injured, or killed individuals or the area negatively impacted by the event. Gad-el-Hak classifies five scopes of disasters according to their severity. Ball (1979) and Pelling (2001) differentiate between catastrophic

events resulting from rapid onsets, like earthquakes, and catastrophic events, which are caused by long-term processes and chronic conditions, such as sea-level rise.

With regards to the speed of development of the calamity, Ball (1979) organized the different types of disaster events into a continuum, ranging from acute events to chronic events. As depicted in Figure 1.2 below, at the acute end of the continuum, Ball placed human-induced and industrial disasters, such as nuclear reactor explosions and oil spills, and at the chronic end, events of eco-destruction, such as deforestation and the overutilization of groundwater. Here, natural disasters are placed in different points on the continuum according to their characteristics.

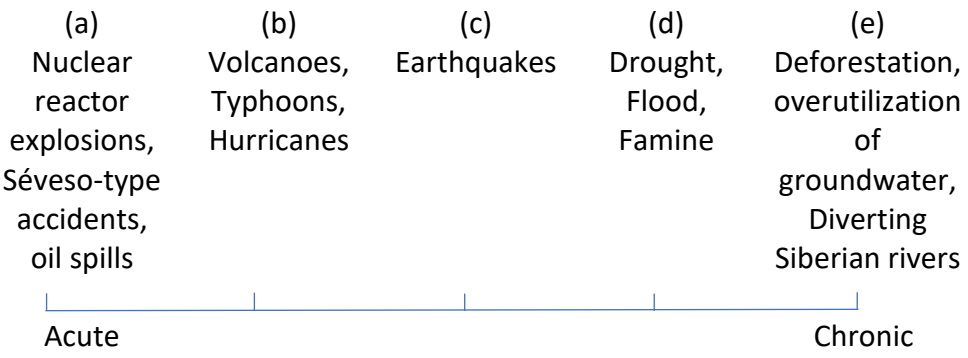


Figure 1.1. Ball's non-conflict disaster continuum

Source: Ball (1979)

Unlike Ball, Quarantelli (2001) referred to disasters not only as *actual* crisis situations caused by sudden natural and technological agents that have significant negative social consequences, but also as the *threat* of such situations. According to Quarantelli, a disaster entails only instances where day-to-day life activities are disrupted and where local resources cannot independently manage the situation, nor cope with the damages. In his definition he included natural occurring events such as earthquakes, floods, hurricanes, volcanic eruptions, tornadoes, and tsunamis as well as technologically induced events, such as toxic chemical spills, radiation fallouts, large-scale explosions and fires, structural failures, massive transportation wrecks and crashes. Quarantelli does not include famines, epidemics and droughts (FEDs) as disasters since he perceives them more as (persistent) social problems than crisis situations.

1.3. The concept of a '*natural disaster*'

Djalante (2012) depicted a *natural disaster* as a physical event of extraordinary dimension that people cannot predict or control. As the literature review below suggests, such a simplistic definition is not enough to address the complexities involved. For natural phenomena to become disasters it is necessary for the events to influence human activity. In addition, one needs to address the severity and the type of natural phenomenon as well (Alexander, 1997). For instance, an extreme weather event or geophysical events can occur; however, if there are no interactions with man and no damages, the event cannot be considered a disaster (Alcántara-Ayala, 2002).

Roughly up to the 1950-1960s, natural disasters were only perceived as the physical event of natural occurrence, such as earthquakes and volcanoes, which could not be prevented by humans. Two literature reviews on the term concisely portray the evolution of the term *natural disasters*; these are Alexander (1997), who, in a special issue of the periodical *Disasters*, illustrated the evolution of the definition of *natural disasters* from the 1970s to the 1990s, and Lukić et al. (2013), who, for the purpose of classifying natural disasters in the Serbian context, thoroughly reviewed the literature on the definition of *natural disasters*. According to Lukić et al., during the 1960s, natural disasters were considered uncontrollable events and a serious threat to society, particularly when disruptive circumstances resulted (Fritz, 1961).

Lukić et al., as well as Alcántara-Ayala, noted that Westgate and O'Keefe (1976) were one of the pioneers in defining *natural disaster* as the interaction between natural phenomena and the vulnerability of humans. The novelty in their definition was the addition of vulnerability, which was quantified by general destruction, injury, and loss of life.

From the 1970s onward, more and more people involved in disaster work, just like Westgate & O'Keefe, started understanding that events described as *natural disasters* are in fact created by the interaction of many elements, only one of which is the natural phenomenon itself. As Ball explained, the triggering mechanism may be the natural phenomenon, but it is the political, social, economic and environmental factors combined with the natural event, which create a situation in which "large numbers of people and some portion of their environment are permanently or temporarily disabled". Alexander (1997) regarded Hewitt (1983) as a turning point from the focus on the physical attributes to the social conditions the events affected.

Alexander (1993) defined a natural disaster as a sudden change in one's natural environment that also affects social and economic systems. A few years later, Tobin & Montz (1997), regarded a disaster as an event that has vast effects on society, and whose occurrence disrupts its usual functioning - causing both fatalities and economic losses. Mileti (1999) viewed disasters as the interaction of the physical environment, the demographic and socioeconomic environment, and the built environment. While Haimes (2012a) pointed out that disasters are caused by the correlations between these three environments (Karanikola et al. 2014).

Alexander (1997) explained there is a clear qualitative difference separating an incident from a disaster, especially in terms of the gravity of the event. In parallel to the discussion on whether and how to include social and economic (qualitative) attributes to the definition, there were also attempts to define the term in numbers. In his review, Alexander mentioned several attempts to provide a quantitative definition of the term *disaster* by using for instance, the number of people killed or summing up monetary losses. Smith & Petley (2009) noted that these quantitative definitions have become the cornerstone of most historical databases on disasters. These definitions use thresholds to define the minimum death toll or economic and social impacts that distinguish between disasters from simple incidents. The elements that have been used to define a *natural disaster* include the following four: (1) number of deaths; (2) value of damage and losses; (3) impact upon the social system (4) geophysical definitions (Alexander, 1997). Neumayer, Plümper & Barthel (2014) shifted the analytical focus of natural disaster damage from the death toll to the economic toll.

From the literature reviewed for the purpose of this study, it appears that most researchers and practitioners in the past years used one of two main sources of statistical information on natural disasters: the CRED database and the MunichRe database, which both in 2009 created a common accord (Below, Wirtz & Guha-Sapir) on the classification and terminology of natural disasters for operational purposes. This accord based the classification of natural disasters on a “triggering hazard / event” logic. This means that if you take for example the 2004 tsunami in South-East Asia, even though most of the damage was caused by the tsunami, it was an earthquake which triggered the disaster. Therefore, according to CRED and MunichRe, the incident should be placed under geophysical disasters (related to earthquakes) and not hydrological disasters (related to floods and wet mass movements) as shown in Figure 1.1.

CRED defines a natural disaster as “a situation or event which overwhelms local capacity, necessitating a request to a national level for external assistance; an unforeseen and often sudden event that causes great damage, destruction and human suffering.” The CRED database has several quantitative criteria for an incident to be included in the database. At least one of the following criteria must be fulfilled: (1) 10 or more human victims; (2) 100 or more local inhabitants reported as affected; (3) proclamation of a state of emergency; and (4) a call for international assistance. (Below, Wirtz & Guha-Sapir).

In addition to the CRED and MunichRe definitions, several other international organizations use other delineations. The United Nations International Strategy for Disaster Reduction (UNISDR), which aims through its terminology publications to promote a common understanding of disaster risk reduction concepts, defined a disaster as “a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources,” when “disaster impacts may include loss of life, injury, disease and other negative effects on human physical, mental and social well-being, together with damage to property, destruction of assets, loss of services, social and economic disruption and environmental degradation.” (UNISDR, 2009).

The academic studies reviewed during this study, like that of Neumayer, Plümper & Barthel (2014), either used one of the definitions listed above, or created a definition adapted to the needs of their study. In Bradt et al.’s (2015) epidemiological analysis of Australasian disasters, the disasters included in the study were those of national significance. A surveillance definition of disaster was developed conforming to CRED’s criteria (≥10 deaths, ≥100 affected, or declaration of state emergency or appeal for international assistance). The authors applied economic and legislative inclusion criteria to identify additional disasters of national significance. These inclusion criteria were economic impact (> $A50 million in losses in current Australian dollars as threshold associated with external assistance) and legislative impact (State or Commonwealth legislation).

1.4. The concept of a '*natural hazard*'

Another perspective on how to define a *natural disaster* focuses on ***hazards*** and how these can transform from being threats to full-fledged disasters. While in everyday speech the terms *risk* and *hazard* are often interchangeably used (Schneiderbauer & Ehrlich, 2004), in the field

of risk management there is a clear distinction between the two. In academic literature, natural disasters are events triggered by natural hazards (Onyango & Uwase, 2017). Unmitigated hazards are causes of risks, that can eventually become disasters.

Just as natural disasters refer to agents and processes that stem from Earth's dynamics, natural hazards refer to the same phenomena. Some of those include atmospheric, hydrologic, geologic, biologic, and technologic phenomena. Alcántara-Ayala (2002) considers natural hazards within a geological and hydro-meteorological framework, where earthquakes, volcanoes, floods, landslides, storms, droughts, and tsunamis are the main types.

For a natural hazard to become a natural disaster, natural hazards must materialize into risks, taking account of the chances of a particular hazard occurring. Chmutina & von Meding (2019) claim that while natural hazards are natural occurrences, disasters are not. Smith & Petley (2009) define a *hazard* as "a potential threat to humans and their welfare" and risk as "the probability of hazard occurring and creating loss." Gregg & Houghton (2008) defined a *hazard* as a natural process that can threaten the things that people value, not only human life or property, but also natural resources, plants and animals. Unlike disasters, hazards cannot be prevented (Chmutina & von Meding, 2019). In this context, Smith & Petley also accounted for the types of threats which natural hazards can inflict, dividing them into categories: hazards to people, including death, injury, disease and stress; hazards to goods, including property damage and economic loss; and hazards to the environment, which include loss of flora and fauna, pollution, loss of amenity.

It is important to state that damage can take place at the moment of occurrence but can also persist for a long period of time after impact. Gregg & Houghton (2008) and Schneiderbauer & Ehrlich (2004) both cite Okrent (1980) as the one who illustrated best the difference between hazards and risks: two people crossing an ocean, one with a liner and the other with a rowing boat, both face the same hazard of death by drowning; however, the risk (probability of drowning) is very different. The threat of drowning is a hazard; drowning itself is a disaster, making a disaster the actual realization of the hazard.

Alexander (1993) and Gregg and Houghton (2008) cite four ways the term *natural hazard* has been defined, all of which stress a physical event that influences man and his environment:

(a) "A naturally occurring or man-made geologic condition or phenomenon that presents a risk or is a potential danger to life or property". They quote the American Geological Institute, 1984;

(b) “An interaction of people and nature governed by the co-existent state of adjustment of the human use system and the state of nature in the natural events system” (White, 1973);
(c) “Those elements in the physical environment [which are] harmful to man and caused by forces extraneous to him” (Burton & Kates, 1964);
(d) “The probability of occurrence, within a specific period of time in a given area, of a potentially damaging natural phenomenon” (UNDRO, 1980).

Just like natural disasters, natural hazards were also traditionally characterized in terms of their physical attributes, i.e., frequency, magnitude, intensity, speed of onset, and duration, together with their spatial and temporal distributions (Gregg & Houghton, 2008). Varnes (1984) explained that a natural process becomes a natural hazard as soon as human beings, as well as tangible or intangible capital, are threatened and/or destroyed.

In Raschky’s (2008) study on institutions and the losses from natural disasters, the author dived into the basic question of how natural hazards affect society, stating that natural occurring events such as flooding are not natural disasters per se. It is only when individuals are affected it becomes a natural disaster. The behavior of human beings is crucial. Tobin & Montz (1997) explained that most disasters involve insufficient human behavior, ranging from “bad planning decisions to inadequate mitigation, preparedness and response.”

Natural hazards, therefore, result from the interaction between geophysical and other natural processes with mankind and how mankind uses Earth’s resources and eco-services. Smith & Petley (2009) note that this interpretation of natural hazards puts humans at the center. It is human lives and their possessions that are impacted by natural processes. Neumayer, Plümper & Barthel (2014) also stressed the potential effects of natural hazards on humankind and natural resources that are considered valuable. They also mention three main factors which determine disaster damage: (1) the magnitude of the natural hazard that triggered the disaster, (2) the wealth of the area hit, and (3) whether protection measures have been put in place to counter the natural hazard; in other words, whether the affected area was resilient enough to fully absorb impact without damage to life or property.

As Smith & Petley put it, human sensitivity to environmental hazards is a combination of both the physical exposure at a particular location, and human vulnerability. The outcome of a hazardous event is contingent on the elements at risk, including factors like population or buildings, and their associated vulnerability to damage or alteration due to the event. Natural hazards are only one component of disaster risk (ADB, 2017). Therefore, in the risk

management discourse, there is a widespread acknowledgment that risk assessment should not solely rely on hazard, which characterizes the likelihood of physical harm. It must also encompass the vulnerability of the element at risk and its exposure to the hazard (Cannon, 1993). Crichton (1999) depicted the interplay among hazard, vulnerability, and exposure within the insurance industry context through the risk triangle, visually representing the well-known equation:

$$\text{Risk} = \text{Hazard} \times \text{Exposure} \times \text{Vulnerability}$$

This equation has been expressed in different ways across the disaster discipline. Smith & Petley (2009) utilize *elements at risk* to express the exposure component. The ADB (2017) illustrates disaster risk for disaster risk assessment as a function:

$$\text{Disaster Risk} = f(p(h_i), e, v),$$

where $p(h_i)$ is a probabilistic function of a given natural hazard of varying intensity in a particular location; e is the exposure; and v is the vulnerability. These equations exemplify how the discussion on hazards and how they are mitigated, relates to, and interacts with other important terms for this study: risks, vulnerability, and resilience. Alexander (1993) and Hewitt (1983) argued that communities contain the seeds of their own destruction through their failure to mitigate hazards. In other words, it is the vulnerability of society to natural hazards, which creates natural disasters. Alcántara-Ayala depicted well what are the components of natural disasters in Figure 1.3.

According to Alcántara-Ayala (2002), natural disasters are the result of the interaction between natural vulnerability and human vulnerability. Natural vulnerability depends on the threats caused by natural hazards, as explained above, while human vulnerability is based on socioeconomic and political systems along with cultural factors.

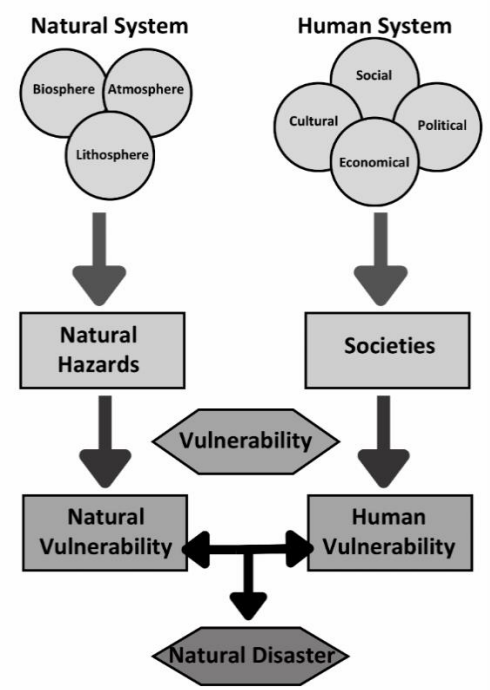


Figure 1.2. The components of natural disasters

Source: Alcántara-Ayala (2002)

After examining the literature on how natural disasters are defined, this study will adopt a refined interpretation based on the UNISDR definition for the types of hazards to be used in later in the empirical analysis. In the context of the hotel industry, the survey accompanying **this study defines a disaster as an extreme event disrupting normal business operations, resulting in casualties, loss of life, extensive asset damage, or significant income loss.**[1]

While the study is primarily focused on addressing risks associated with natural disasters, it aligns with the perspective that natural disasters stem from the manifestation of natural hazards into catastrophic events. To address the concept of disaster risks, there is a need to examine all three components of the risk equation: hazard, exposure, and vulnerability. As UNDRO (1980) and the ADB (2017) explain, to assess the disaster risk of an area, data on natural hazards, exposure, vulnerability, and elements of risk are required. It is fair to say that conducting a disaster risk assessment for a specific firm, for the different types of hazards is time consuming and requires information that is not publicly available, especially concerning vulnerabilities. Firms conduct such assessments for their own use either using in-house employees or by commissioning external consultancy services. Usually, these types of

[1] This definition was quoted in the survey for the respondents to understand what it means to experience a natural disaster or being prepared for natural disasters.

assessments encompass the stages of identifying and understanding the potential risks and vulnerabilities that firms face in relation to natural and man-made hazards, which then help these firms to develop strategies to mitigate these risks and to improve their resilience to disasters. Conducting such an exercise for many firms in a quantitative analysis, such as this study, would require even more resources.

This is why it was decided to solely address in this dissertation the *hazard* component of the disaster risk. The hazard component is external to the firm or hotel, while exposure and vulnerability can be external but usually contain certain internal elements. Vulnerability expresses the characteristics and circumstances of the system that make it susceptible to the damaging effects of a hazard (UNISDR, 2009) and exposure addresses the stock of property and infrastructure that is exposed to a hazard, including socioeconomic factors. It indicates the elements-at-risk that are subject to potential losses (UNISDR, 2015c). Zooming-in on the hazard component alone allows this study to detach the behavioral and internal aspects of risk management from the physical dimension, making the analysis easier to conduct. For the reasons explained here, the study emphasizes how corporations address natural hazards and will use the terminology of managing risks of natural hazards, rather than the risks of natural disasters. The types of natural hazards used in this study will be elaborated later in Chapter 4 as the choice was affected by various methodological issues as well.

1.5. The subject of the study

The purpose of this study is twofold: first, to see whether firms[2] manage their risks stemming from natural hazards and second, to explain the variation in risk management practices among firms with regards to different types of natural hazards. The initial research proposal for this study included a quick review of the financial statements of the 25 corporations that comprised the Tel Aviv 25 Index in the Tel Aviv Stock Exchange (TASE) as of 2016. Regulations in Israel required corporations to disclose in their annual financial statements a list of their major risk factors. It was assumed that the types of risks included in the list reflect the risks that were found by the corporations to be significant, thus requiring attention and mitigation. The initial review, which appears in Annex I, revealed a great degree

[2] For the purposes of this study, the terms 'firm', 'corporation', 'company', and 'business' will be used interchangeably to refer to commercial entities engaged in economic activities, regardless of their specific legal structure or size. Hotels are included under this definition.

of variance between these companies. Corporations in similar geographic locations or in the same sectors presented a list of different risks, some mentioning natural disasters as risk factors while others did not. This was the initial observation that stimulated the writing of this dissertation.

Initially, it was not the purpose of this study to focus on the hotel sector, but rather look at the preparedness of different corporations from different sectors, when one of the variables would be sector affiliation. In addition, the vision was to address risk management throughout the corporate supply chain - not only of the facilities and installations belonging to the corporation, but to also see whether businesses check their supply chains for risks stemming from natural hazards. There were two main obstacles to such a study:

1) The survey required for this study includes sensitive corporate information that can affect the business performance of the corporations: if a firm admits it does not manage its risks properly, relevant stakeholders can react, the firm's stock price could go down, etc. Therefore, the response level of the study's survey was expected to be an obstacle. Strategies to overcome low response rates of the survey will be discussed later.
2) Many firms have multiple locations and complex supply chains. Indexing the preparedness of such a firm, not to mention asking the firm questions about every single location and checking each location's exact natural hazards risks, would be very overwhelming, especially when such data is not regularly available for the firms themselves. In addition, methodologically it would be very difficult to compare between the complex, multi-location firms and the "simple" single location entities.

For these reasons, especially when looking for a sector that exists in a single location, to allow an easier assessment of physical risks, without the need to address complex supply chains, the hotel sector seemed the right candidate. This is how the focus on the hotel sector was established and the units of analysis in this study are hotels. The fact that many hotels are prone to natural hazards, given their location, served the study's aims well. When reviewing the relevant literature on the subject, it was apparent that the objectives of the dissertation were present in the hotel sector as well: no similar study was previously conducted in Israel and Greece regarding explaining preparedness levels of hotels to the risks of natural hazards.

It is noteworthy that a recent publication by Ritchie & Jiang (2021) conducted a comprehensive review of research in risk, crisis, and disaster management, encompassing both the general field and the specific domain of tourism and hospitality. Of the 210 papers

scrutinized, only 47 pertained to the hospitality sector. The analysis revealed that 80% of the papers were empirical, with a slightly higher prevalence of quantitative studies. This dissertation could be considered an addition to the literature Ritchie & Jiang discuss, with regards to the hotel industry.

Regarding the choice of countries on which this study would be conducted, initially three countries were chosen: Cyprus, Greece, and Israel. All three countries are popular tourist destinations with many hotels scattered around. The countries are geographically located in the East Mediterranean region, which is prone to a variety of natural hazards, including earthquakes, wildfires, floods, and droughts and are situated in a climate hotspot (Tuel & Eltahir, 2020). The region is particularly sensitive to climate change, leading to shifts in weather patterns and an increased frequency of extreme events (Cos et al. 2022). These factors make the three countries good candidates for this study. Including multiple countries also allows for a comparative examination of how diverse hazards impact hotels with distinct national or sub-national circumstances.

Although the study could have expanded to include additional countries, doing so would have demanded extra resources and time for tasks such as constructing a dataset, developing hazard maps consistent and comparative with those of other countries, compiling a list of hotels for outreach, and translating the survey into other languages. Given the number of hotels in all three countries, the variation in the hotels' characteristics, location, and hazard profiles, it was decided that these three countries alone would be a sufficient sample for this study. Having said that, after collecting the responses to the questionnaire, the response rate of the hotels in Cyprus was so negligible (No.= 4), that it was decided to remove the Cypriot hotels from the general sample and the study consisted only of hotels in Greece and Israel, as will be elaborated in Chapter 4.

After presenting the purpose of general scope of the study, including the reasons for focusing on natural hazards, the next chapter will introduce the theoretical foundations of corporate risk management.

Chapter 2. Theoretical foundations of corporate risk management

The previous chapter presented the readers with the main focuses of this study: the focus on natural hazards and on the hotel sector in Greece and Israel. The purpose of this chapter is to present the theoretical background of the study by broadly addressing the question of why firms manage their risks, where hotels are considered just one type of business in a specific industry. It is important to clarify that while this study aims to discuss the preparedness of hotels to the risks stemming from natural hazards, the concept of preparedness is one of several approaches used in risk management to cope with different types of risks.

As a basis for the discussion on preparedness, this theoretical chapter consists of a short survey on the theoretical foundations of risk management in general, which are applicable to preparedness, as a risk management strategy. As illustrated earlier, the risks stemming from natural hazards and disasters constitute just one category of risks that firms face during their lifespan. Therefore, theoretically the ways to manage risks arising from natural hazards can be seen either as part of a general risk management framework or a specific strategy. Later in this study, the concept of preparedness will be discussed along with other concepts related to risk management.

2.1. Overview of the theoretical foundations of corporate risk management

Before delving into the theoretical framework of corporate risk management, it is essential to note that there are numerous established theories that discuss how firms are structured, operate, and behave. Soosay & Hyland (2015) identify 12 organizational theories: (1) resource-based theory; (2) resource-advantage theory; (3) relational view; (4) social exchange theory; (5) dynamic capability view; (6) stakeholder theory; (7) signaling theory; (8) force field theory; (9) transaction cost theory; (10) contingency theory; (11) agency theory; and (12) technology-organization-environment theory. Natural hazards, as explained in the previous sections, are one type of risk faced by firms. As such, these can be examined through different theories, including the theory of the firm and how the firm manages its financial decisions, including investment and tax-related decisions.

The theoretical literature on corporate risk management is directly associated with several breakthrough, award-winning papers in the field of economics, which were introduced around the middle of the 20th century, which will, at this moment, be briefly outlined.

Modern Portfolio Theory (MPT), introduced by Markowitz in 1952, stipulated that under market imperfections and uncertainty, an investor interested in maximizing his discounted expected returns, should not necessarily diversify his funds among securities which each standing-alone give maximum expected returns, but rather create diversification in his investments in such a way that the overall returns of the portfolio are highest (Markowitz, 1952). For reviewing the evolution of risk management theory, it is important to state that the MPT was based on the understanding that the assumption of perfect information, used in basic economic models, does not exist and that rather there is uncertainty in the field of investments: there is a difference between the expected and actual return rates from an investment.

A few years later, Modigliani & Miller (1958) published their theory on capital structure, also known as the Modigliani-Miller (MM) theorem, amidst the debate on the optimal capital structure of the firm (Hommel, 2005). Their theorem indicated that a firm's market value, in the absence of taxes, bankruptcy costs, agency costs, and information asymmetry, is equal to the present value of the expected returns. The theory stipulated the firm's financial structure, and the type of instrument used to finance an investment do not affect its value nor are they relevant to conclude whether an investment is worthwhile or not. According to the MM theorem, the value of a firm is determined only by its assets and not by how it is financed, making corporate risk management irrelevant. Modigliani & Miller also addressed the issue of uncertainty in investment decisions of the firm, explaining the necessity to add a risk premium to the market interest rate to express uncertainty.

In the risk management literature, MM is acknowledged for initiating the debate regarding the economic irrelevance of corporate risk management (Miloš Sprčić, 2007; Hommel, 2005). Numerous economists have developed further the theory by lifting MM's strict assumptions. For instance, Géczy, Minton & Schrand (1997) lifted the assumption of perfect information, and several other scholars have discussed the influence of financial distress on firm value (Mayers & Smith, 1982; 1987; Myers, 1984; Stulz, 1984; Smith & Stulz, 1985; Shapiro & Titman, 1998). Smith & Stulz (1985), who discussed the question of why some firms hedge and others do not, raised the notion that risk management can lower the expected costs of bankruptcy. Accordingly, while in the MM world, financial distress is costless since it does not alter firm value, acknowledging the fact that financial distress usually entails costs means that the firm does have an incentive to reduce its probability. As long as the costs of hedging are lower than

the costs of financial distress, the firm would prefer to hedge the volatility of its earnings (Miloš Sprčić, 2007).

One of the most utilized models for pricing the risks inherent in assets, the Capital Asset Pricing Model (CAPM), was developed by Treynor (1961; 1962), Sharpe (1964), Lintner (1965), and Mossin (1966), as explained by Perold (2004). The main argument put forward by CAPM is that the expected rate of return on capital investments is equal to the sum of the risk-free return and a compensation for accepting the asset's risk (Monda, Giorgino & Modolin, 2013). The asset's total risk, according to CAPM, is composed of two types of risks: unsystematic risk, the risk involved when investing in a specific firm, which can be diversified away; and systematic risk, the unavoidable risk which encompasses the whole sector or stock market (Miloš Sprčić, 2013), such as natural hazards and the risk of natural disasters.

When applied in risk management, the CAPM implies two important points for different stakeholders: (1) investors and shareholders should only take into account the systematic component of total risk since unsystematic risks can be managed by thoroughly diversifying their portfolio (Miloš Sprčić, 2007) and (2) corporate managers should also not be concerned with reducing unsystematic, firm-specific risks since on average, corporations sometimes make profits and sometimes have loses, thus on average, there are no effects on the market value of the firm (Miloš Sprčić, 2013). Hence, only systematic risks, like natural hazards, should be hedged. Later in this chapter, the argument on managerial risk preference will be discussed further.

The theoretical literature on risk management has evolved quite a lot since the introduction of the theories recapped above. As Smith (1995) noted, since risk management allows the firm to reduce firm value volatility, one might presume that all firms would want to use the different instruments of risk management. However, there is quite a discrepancy in the practice of risk management across firms, even among those which have similar exposures. These variations have created a flow of studies, like those by Stulz (1984), Smith & Stulz (1985), Smith, Smithson, & Wilford (1990), Lessard (1991) and more recently Breeden & Viswanathan (2016) on the potential rationales for risk management, stemming from the different capital market imperfections or asymmetric information.

It is exactly at this theoretical junction that this study wants to focus on: by trying to explain why some firms (hotels) manage their risks from natural hazards while others do not. On this subject, several scholars, such as Nance, Smith & Smithson (1993), Froot, Scharfstein & Stein

(1993), Smith (1995), Fatemi & Luft (2002), Hommel (2005), Miloš Sprčić (2007), Servaes, Tamayo & Tufano (2009), and Monda, Giorgino & Modolin (2013) among others, have all done service to the academic community by testing or summarizing, in their respective articles, the main arguments used, in more recent years, in the literature on corporate risk management.

Baird & Thomas (1985) focus their study on strategic risk taking and break down the types of factors that can influence risk (seeking/adverse) behavior. In their study, the external variables of environmental variables (economy, government regulation, technological change and cultural values) and industry variables (public-profit, capital intensity, industry life cycle and competition) have been presented along with internal variables like organizational variables (organizational values, organizational life cycle, structure, incentives, wealth, market share, information system and group involvement in strategy formulation) and managerial variables (self-confidence, knowledge, biases, heuristics and preferences). Baird & Thomas also address the strategic problems facing the firm (reversibility and controllability, outcomes, probabilities, variance of outcomes and framing).

The theories or rationales for risk management mentioned above will be outlined in general in the next section of this chapter. As explained below, the rationales for risk management which are outlined in this chapter are also relevant for the management of risks stemming from natural hazards. This outline will also be useful for understanding the different levels of analysis, for illustrating why the firm level of analysis was chosen for this study, and for explaining why the study will focus on some theories while not on others (Franklin, 2008).

In general, as in other fields of research, the theories in the field of risk management can be grouped according to the level of analysis: external rationales influencing risk management (i.e. regulatory environment, national context, government incentives or disincentives, sector-wide approaches), organizational factors, or firm-based rationales (i.e. value creation, size, location of facilities) and individual factors (i.e., managerial characteristics and interests). These different levels of analysis and their germane rationales are presented in Table 2.1, below. Many of the rationales with regards to organizational features and characteristics of the decision makers follow the list presented by Han & Nigg (2011).

Table 2.1. Grouping of risk management theories / rationales* according to level of analysis**

Level of Analysis	Theory / Rationale	Selected References
External to the firm	National (or supranational) circumstances: regulatory requirements or pressure, government incentives, industry variables	Baird & Thomas, 1985; Tierney, 2007; Pagach & Warr, 2011; Zhao & Singhaputtangkul, 2016; Giambona et al., 2018; Wu, 2024
	Hazardousness of geographical locations	Alexander, 1993
	New Institutional Economics	Williamson, 1998
	Technological change	Baird & Thomas, 1985
	Cultural values	Baird & Thomas, 1985
Firm-based / Organizational Theories of creating firm value	Reducing transaction costs	Fazzari et al., 1998; Li et al., 2006; Bolton, Chen & Wang, 2011; Pagach & Warr, 2007, 2011
	Reducing the corporate tax burden	Smith & Stulz,1985
	Coordinating financial and investment policies	Smith & Stulz, 1985; Froot, Scharfstein & Stein,1993; Froot, Scharfstein & Stein, 1994; Géczy, Minton & Schrand, 1997
	Resolving the risk preference problem	Amihud & Lev, 1981; Smith & Stulz, 1985; Fatemi & Luft, 2002
	Evaluating management performance	DeMarzo & Duffie, 1995; Breeden & Viswanathan, 2016
	Resolving the underinvestment problem	Myers, 1977; Froot, Scharfstein & Stein, 1993; Nance, Smith & Smithson, 1993
	Resolving the asset substitution problem	Jensen & Meckling, 1976
	Claim dilution problem	Smith & Warner, 1979; Ryen, Vasconcellos & Kish, 1997
	Stakeholder Theory	Freeman, 1984, 1994; Sharma et al., 2024
Firm-based / Organizational Firm Characteristics	Firm size	Quarantelli et al., 1979; Drabek, 1991; Dahlhamer & D'Souza, 1997; Beasley, Clune & Hermanson, 2005; Han & Nigg, 2011; Gatzert & Martin, 2015; Golshan & Rasid, 2012; Zhao & Singhaputtangkul, 2016
	Age of business	Quarantelli et al. 1979; Drabek, 1991; Banerjee & Gillespie, 1994
	Ownership patterns (individual firm or franchise)	Quarantelli et al. 1979; Drabek, 1991; Dahlhamer & D'Souza, 1997; Han & Nigg, 2011
	Sector affiliation and sectoral diversification	Drabek, 1991; Mileti et al., 1993; Dahlhamer & D'Souza, 1997; Chikoto, Sadiq & Fordyce, 2012; Giambona et al., 2018
	Property status (owned or leased)	Turner, Nigg & Paz, 1986; Han & Nigg, 2011

Level of Analysis	Theory / Rationale	Selected References
	Previous disaster experience	Drabek, 1994; Mileti et al., 1993; Barlow, 1993; Gillespie & Streeter, 1987; Banerjee & Gillespie, 1994; Dahlhamer & D'Souza, 1997; Faulkner, 2001; Spillan & Hough, 2003; Guo & Li, 2016; AlBattat & Mat Som, 2019
	Financial condition	Quarantelli et al. 1979; Alesch et al. 1993; Han & Nigg, 2011; Pagach & Warr, 2007; Gatzert & Martin, 2015
	Location patterns (single/multiple location(s))	Quarantelli et al. 1979; Drabek, 1991; Han & Nigg, 2011
	Institutional ownership (being owned by institutional investors which are highly regulated)	Liebenberg & Hoyt, 2003; Cornett et al., 2007; Hoyt & Liebenberg, 2011; Gatzert & Martin, 2015
Individual - Decision-makers in the firm	Executive characteristics	MacCrimmon & Wehrung, 1990; Han & Nigg, 2011; Hoskisson et al., 2017
	Risk perception	Burton & Kates, 1964; Kates, 1971; Fischhoff et al., 1978, Kahneman & Tversky, 1979; Douglas & Wildavsky, 1983; Short, 1984; Douglas, 1985; Slovic, 1987; Omer & Alon, 1994; Slovic et al. 2004; Wachinger et al., 2013; Birkholz et al., 2014.

* The list of risk management theories and rationales presented in general in this study and specifically in Table 2.1 (including the selected references) is not exhaustive. The list presents the more common explanations found for risk management, especially in the discourse on natural hazards and disasters.

** It is important to note that the level of analysis presented in Table 2.1 refers to the analytic unit, not to the source of the risk.

Source: Own elaboration

When discussing external factors affecting a firm's risk management objectives and activities, there are factors on the national or international levels, such as regulatory requirements (i.e. the financial sector is regulated through frameworks such as Basel III and Solvency II) and government incentives. Wu (2024), as an example, discusses how federal incentives, increasing risk awareness and regulations are important to achieve better disaster preparedness and response in California. This illustrates how the interaction between state and official actors with the business sector can influence if and how firms manage their risks. Another perspective on regulation and mandates comes from Quarantelli et al. (1979), who suggested that firms with multiple sites (i.e. chain stores, different logistical warehouses, offices, etc.) are more likely to engage in disaster preparedness because they tend to have corporate mandates and policy directives that instruct them to formulate disaster preparedness programs. This is mostly true with regards to chemical plants and other dangerous facilities that are tightly regulated to prevent environmental accidents.

Sectoral affiliation is also considered a variable that was suggested to explain variation in risk management practices among firms (Giambona et al., 2018; Chikoto, Sadiq & Fordyce, 2012; Han & Nigg, 2011; Sadiq, 2010).

Another factor, external to the firm, is what Alexander (1993) referred to as the hazardousness of geographical locations. According to this point, there are geographic areas which are more prone than others to various natural hazards. Alexander (1993) also discusses why people continue to live in hazard-prone areas despite the existence of measurable and recognized levels of risk.

Most of the earlier economic works, like those of Markowitz (1952), Modigliani & Miller (1958), and Smith & Stulz (1985), emphasize the firm as the level for research analysis. This stems from the basic economic assumption that firms aim to create value or reduce the volatility of firm value. Hence, the literature on the subject stresses risk management rationales aimed at firm value creation. In fact, it is important to stress that the classification of risks into groups (i.e. financial, enterprise, legal, technological) does not alter the goal of risk management *to a firm*. Ultimately, risk management aims at creating firm value or at least reducing firm losses to a minimum. Supply chain disruptions, for example, can influence production, which in turn reduces the amount of merchandise a firm can sell, which sequentially negatively influences the firm's cash flow and value. This depiction is the same for natural disasters, which can have a negative effect on a firm's value. Therefore, the following overview of the different theories for risk management can be applied to risks stemming from natural hazards and natural disasters.

It is quite difficult to evaluate all the theories in one study. The selection of theories to be included in this study will be done after reviewing the literature, taking into account only those which have been found in previous studies to be relevant and/or predictors of corporate risk management of natural hazards.

The difference between examining risk management practices on the firm level of analysis versus on the individual level of analysis lies in the characteristics of risk management as a process. Examining risk management on the individual level of analysis includes looking at the preferences, points of view, knowledge and other personal traits of those individuals making the decisions. This is opposed to the analysis on the firm level, which presupposes that the risk management process of the firm has checks and balances which places the "risk-prone areas under one watchful organizational umbrella" (Hyden, 2011); therefore, the process

usually does not reflect the preferences or traits of a specific person in the firm, but rather the result of an organizational process of assessment, which includes the many stakeholders involved such as the CEO, the CRO, the CFO, and the board of directors.

For the purpose of this study, it would be useful to categorize the different rationales for corporate risk management by distinguishing between six types of explanations: (1) rationales external to the firm; (2) rationales based on corporate objectives (i.e. lowering the financial distress of the firm or hedging the corporate tax burden), which can explain corporate risk management at the firm level, (3) rationales which stem from human interactions (i.e. agency theory and underinvestment problem); (4) the firms' characteristics, which can influence their ability and willingness to manage risks (i.e. firm size, location and property ownership); (5) rationales stemming from the individual level of analysis (preferences, points of view, knowledge and other personal traits of key individuals in the risk management process); and (6) risk perception.

The last category of explanations raises the question of how firms / individuals who make corporate decisions *perceive* risks. Some people might view *risk perception* as an explanation for risk management decisions based on the individual-level of analysis since perceptions are manifestations of the human mind. However, as will be demonstrated later, this is not entirely accurate. In many cases, the perceived risk is reflected on the firm level, for several reasons which will be elaborated further on, either because of a lacking assessment process, or because risk perception affects individuals' cognition and knowledge, therefore influencing the final decisions of the firm (Schwarzkopf, 2006).

Following the categorization of rationales presented above, Figure 2.1, as taken from Hommel (2005), provides a helpful graphic breakdown of the main economic motives used in the literature to create firm value, as a basis for risk management. Figure 2.1 addresses only rationales based on corporate objectives and rationales which stem from human interactions in the firm. Following the visualization, these rationales and the others listed in Table 2.1 will be concisely described below:

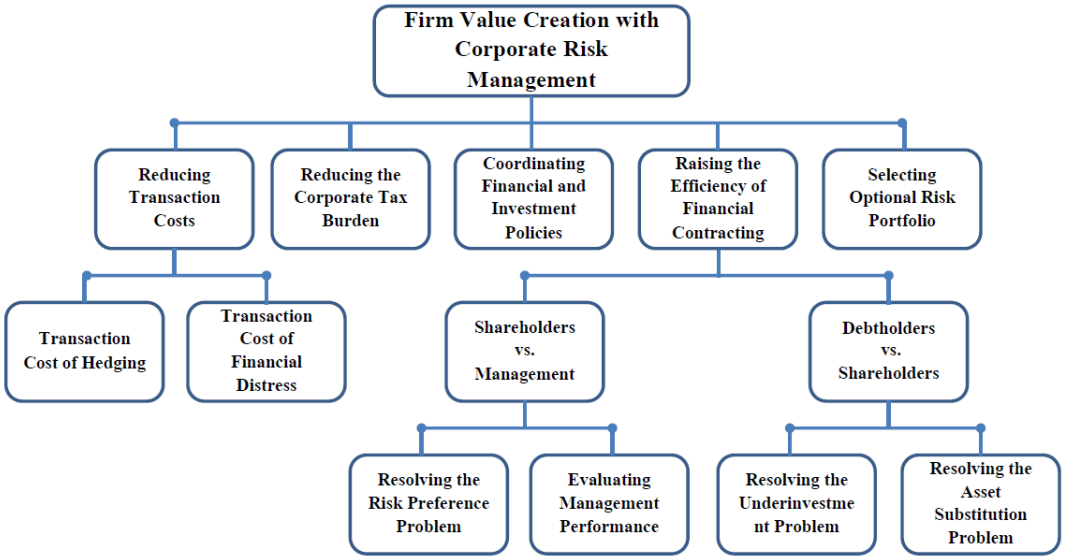


Figure 2.1. Economic motives for corporate risk management

Source: Hommel (2005)

2.2. Firm-level determinants of risk management

The following section of the chapter will present the motivations driving corporate risk management strategies, which are linked to the firm's specific objectives and characteristics. These rationales are mentioned in Table 2.1 above. First the issue of corporate objectives will be discussed and later firm characteristics.

2.2.1. Determinants derived from theories of firm value creation

Reducing transaction costs

A firm can experience serious problems because of variance in its cash flow. To the extreme, these problems may include financial distress and even bankruptcy. However, more routinely, a firm experiencing low internal cash flow will need to rely more on debt financing, which incurs additional costs (Fazzari et al. 1998; Li et al, 2006). Therefore, in the case of reducing transaction costs, there are two rationales for risk management:

a. **Reducing the costs of financial distress**: Financial distress, and at the extreme - bankruptcy - are obviously undesirable consequences of cash flow volatility. Therefore, reducing the volatility of cash flows through hedging instruments allows the firm to diminish the possibility of financial distress (Miloš Sprčić, 2007). Pagach & Warr (2007) note that bankruptcy and financial distress involve both direct and indirect costs. Direct costs include expenses for lawyers and courts. Indirect costs, which can be substantial, may include loss of confidence among consumers and suppliers, reluctance to enter long-term

contracts, and employee fears about job security. Taking care of financial distress can help maintain the confidence of these important corporate stakeholders.

b. **Reducing transaction costs of hedging**: As mentioned above, hedging instruments allow firms to reduce cash flow volatility because they enable the firm to carry more debt. However, these hedging instruments also create additional transaction costs such as fees, tighter margin requirements or higher liquidity or capital requirements (Carter & Sinkey, 1998). To reduce these transaction costs of hedging, the firm turns more towards its cash for risk management (Bolton, Chen & Wang, 2011).

Reducing the corporate tax burden

According to this argument, presented by Smith & Stulz (1985), it is possible to reduce the corporate tax burden by using hedging instruments, such as futures, forwards, or options, when the tax schedule is convex or progressive. A firm's revenue is not necessarily even over a certain period of time, which can result in tax payments being higher than they would be if the revenue had remained at a constant level (Miloš Sprčić, 2007).

Coordinating financial and investment policies

Investment in any firm is a function of the available cash, which can be obtained internally or externally. When external finance is more costly than internally generated sources of funds, it is crucial to secure the firm's cash flow. As cash flow is critical for investment, a firm would take the necessary risk management measures to reduce fluctuations in exchange rates, commodity prices, and interest rates, as these constitute disruptive movements of external factors to the firm. Therefore, financial risk management makes it possible for a firm to have enough cash to make value-enhancing investments (Froot, Scharfstein & Stein, 1993, 1994).

Raising the efficiency of financial contracting

Social sciences focus on the interactions between individuals. In the past, one of the most widely used assumptions for human behavior in economics, has been rational behavior, which has evolved over time to other concepts such as approximate or bounded rationality (Simon, 1955) and even been questioned with theories of irrational behavior (Aumann, 1997).

If we stay within the premise of rational choice theory, given that rational individuals aim to maximize their personal economic utility, conflicts of interest between individuals can

develop. This is especially true in the principle-agent problem, which arises when one individual (the principal) delegates a responsibility, action or decision-making authority to another individual (the agent). There is likely reason to expect that the agent will not always behave in the best interests of the principal because both individuals are presumed to be utility maximizers (Jensen & Meckling, 1976). Therefore, in the risk management literature, several theories have been introduced to explain why and how principals manage the risks of having agents work on their behalf (Eisenhardt, 1989). The main conflicts of interest will be reviewed below:

Shareholder vs. management

Managers (the agents) work on behalf of their firms' shareholders (principals). While the interest of the shareholders is usually to maximize the firm's value, according to Monda, Giorgino & Modolin (2013), they face several problems when having managers as their agents. First, managers enjoy an information advantage over shareholders. Second, the firm's outcomes not only depend on the performance of the managers but also on external factors. Third, managers are self-interested and will try to maximize their own utility. The issue of risk-sharing that emerges when shareholders and managers have varied risk preferences is another issue raised by Eisenhardt (1989). Below are a few issues of interest in the risk management literature:

a. Resolving the risk preference problem

Trying to find a sufficient explanation for the conglomerate merger phenomenon, Amihud & Lev (1981) empirically tested the risk preference problem rationale for risk management. Their findings were consistent with the suggestion that managers engage in conglomerate mergers, which can stabilize the firm's cash flow to decrease their largely undiversifiable *'employment risk'*. Amihud & Lev explain that when using the CAPM dichotomy of unsystematic and systematic risks, since shareholders can diversify away the firm-specific risk, they are left only with the systematic component of total risk. Managers differ from shareholders as they face both types of risks.

Fatemi & Luft (2002) add that when the interests of the shareholders are not aligned with the interests of the managers, the latter might try to find ways to manage their personal risks (or just for gaining personal wealth) by taking advantage of their control over the firm's activities, with special attention to its investment, operating and financing policies.

Amihud & Lev's discussion of managerial risk aversion as a potential explanation for risk management was expanded upon by Smith & Stulz (1985). They recommended that managers take their compensation plans into consideration in their hedging decisions. Possible mechanisms, which can allow shareholders to reduce the risks from the agency problem, include monitoring the activities of the managers, constraints or punishment on managers behavior or misbehavior, using performance-based payment systems, and using incentives which align the manager's interests with the firm's interests, such as rewarding him/her with stock options or shares (Monda, Giorgino & Modolin, 2013).

b. *Evaluating management performance*

Evaluating management performance is an issue arising from the agency problem; therefore it is important to present several studies on the subject. First, DeMarzo & Duffie (1995) stressed the informational effect of hedging by demonstrating that the type and scope of accounting information presented by the managers to shareholders influence which hedging policy these managers will adopt. This is because hedging reduces background *'noise'* of the different firm risks, thus allowing shareholders to evaluate managerial performance better. Under these circumstances, when full transparency is expected from shareholders, the managers will tend not to hedge and will tend to limit the information available to evaluate their performance.

In addition, Breeden & Viswanathan (2016) conducted a study on managerial competency as a rationale for risk management, focusing on the relationship between managers and shareholders. They proposed that managers with superior abilities in handling certain risks or uncertainties strive to demonstrate these skills to the market quickly. To achieve this, they tend to hedge risks beyond their control or expertise. This approach allows managers to 'lock in' their performance advantages while mitigating uncontrollable risks through risk management.

Hommel (2005) further elaborated on this concept, suggesting that competent managers signal their quality to shareholders by not only meeting firm targets but also by implementing corporate risk management programs. These programs eliminate 'background noise,' allowing shareholders to better evaluate managerial performance. Conversely, incompetent managers may attempt to obscure their poor performance by attributing it to other issues. This perspective highlights how risk management can serve

as a tool for competent managers to showcase their skills, while potentially being misused by less capable managers to hide their shortcomings.

Another strand of research mentioned in Figure 2.1 explores risk management in relation to the agency problem, specifically focusing on the tension between shareholders and debtholders, as explained below:

Debtholders vs. shareholders

Shareholders and debtholders have conflicting claims from a firm. Shareholders seek dividends, deriving from the firm's financial situation at a certain point of time, while debtholders expect to receive back a fixed amount equal to their investment in the firm along with an interest. In this case, one can perceive the debtholders as the principles, who want to protect themselves against adverse decisions taken by shareholders, whereas the latters are the agents, who have the option to default on debt. In this regard, it is important to note that according to the hierarchy of bankruptcy codes, if a firm defaults, debtholders usually have seniority over shareholders when it comes to receiving liquidated assets. Such differences in interests raise specific agency problems, especially in the context of the firm's investment policy. These differences of interest suggest the use of risk management tools to lessen concerns.

Hommel (2005) raised two possible issues, the underinvestment problem and the asset substitution problem, while another type of rationale for risk management here is the issue of claim dilution, as described by Smith & Warner (1979).

a. Resolving the underinvestment problem

Froot, Scharfstein & Stein (1993) addressed the issue of firm investments in the absence of sufficient internal cash. In such situations, because external financing tends to be more expensive than using the firm's cash flow for investments, the firm tends to cut investments below the optimal level. Using external debt for investments means that bondholders are reimbursed before shareholders. Given the limited resources shareholders have, undertaking a positive NPV project which increases the profits of debtholders rather than the wealth of the shareholders, makes certain projects not worthwhile. Shareholders would prefer to be first in line to receive the gains (Myers, 1977; Nance, Smith & Smithson, 1993). According to Froot, Scharfstein & Stein (1993), a firm can hedge its activities in such a way that allows it to have a sufficient cash flow available for value enhancing investments.

b. *Resolving the asset substitution problem*

Jensen & Meckling (1976) have addressed the asset substitution problem which occurs when managers (acting on behalf of the shareholders) make reductions in the value of the bonds by exchanging low-risk assets for high-risk investments. In practice, once the debt is in place, the asymmetry in information regarding investment policies allows the firm to substitute the low-risk asset with a much higher-risk asset at the expense of debt holders. This action involves a redistribution of wealth from the bondholders to the shareholders because as investments increase, the expected payments to debtholder decrease.

According to Jensen & Meckling, bondholders are motivated to write expensive covenants and monitor the manager's activities in order to alleviate the issue brought by the asset substitution problem. The formulation of contracts aimed at mediating the agency relationship has become quite widespread in corporate financing.

c. Claim dilution

Adding to Hommel's set of explanations, one can argue that the claims of existing debtholders can be diluted either when the firm issues additional debt of the same or higher priority or via dividend policy (Smith & Warner, 1979; Mateti, 2009). Dividend payments are possible when cash is transferred to shareholders instead of making investments, through raising debt to finance payouts, or through selling assets. When these dividend payments are unanticipated or excessive, the dilution of bondholders' claims can arise (Mansi & Wald, 2011). Risk management through bond covenants allows bondholders to protect themselves from the dilution problem of their investments (Smith & Warner, 1979; Ryen, Vasconcellos & Kish, 1997).

A similar direction of research, suggested first by Freeman (1984), discusses what is known as the stakeholder theory by iterates that the essence of a firm lies not primarily in profit-making, but in creating value for the firm's stakeholders who include employees, customers, communities, investors, and suppliers. The relationships between a firm and these stakeholders are fundamental to business operations and should be a key focus for management.

2.2.2. Firm characteristics as determinants of risk management

Another body of literature which addresses rationales for risk management and addresses the question of why some firms manage risks while others do not, focuses on firms' different characteristics, such as size, age, and location. This next section of the chapter will introduce

the major internal firm characteristics and several external environment factors found in the literature, which were raised as possible explanations for the variation in risk management practices.

The main firm characteristics found in the literature as possible explanations for risk management and the variability in risk management among firms are summarized in Table 2.1. The following section will explain, in short, the logic behind the relationship between the specific firm characteristics as they appear in Table 2.1 and risk management. It is useful to mention, that most of the literature on the corporate risk management of natural hazards, which will be elaborated in the next chapter (literature review), has used firm characteristics as possible determinants to explain the variation observed in risk management, rather than using theories of firm value creation.

Firm size

The rationale regarding firm size focuses on the generalization that larger firms tend to have an increasing scope and complexity of risks (Gatzert & Martin, 2015), making them more vulnerable to different types of hazards, than smaller firms. As Beasley, Clune & Hermanson (2005) described, larger firms face a wider array of events, differing in nature, timing and extent that threaten their existence. Therefore, they have a greater need for risk management. It has also been suggested that larger firms are more likely to engage in preparedness activities since they may have greater ability and resources to implement disaster risk management systems (Han & Nigg, 2011; Beasley, Clune & Hermanson, 2005; Golshan & Rasid, 2012; Zhao & Singhaputtangkul, 2016).

Firm age

According to this straightforward rationale, the age of the firm indicates the experiences and capacity of the organization to deal with risks (Banerjee & Gillespie, 1994). Firms with longer operational histories may have enhanced disaster preparedness due to the accumulation of knowledge and the development of risk management protocols over time.

Ownership patterns

Two possible options regarding ownership patterns are whether the firm is an individual firm or part of a franchise. It is assumed that firms that are part of a larger franchise or corporation would have risk management schemes in place since larger corporations tend to

have more capabilities and the desire to address risk management as the risks they face are more wide-spread and diverse (Dahlhamer & D'Souza, 1997; Han & Nigg, 2011). Zhao & Singhaputtangkul (2016) address government ownership as an explanatory variable in their study on the ERM practices of Chinese construction firms operating in Singapore.

Sector Affiliation and Sectoral Diversification

The rationale of sector affiliation implies that firms in different sectors have different levels of risk management activities according to governmental regulations (Han & Nigg, 2011), hedging needs, and preferences. Some systematic risks are more evident and influential on specific sectors, making this rationale logical. Such sectors would employ staff relevant for dealing with the risks and would show higher risk awareness among workers and managers (Mileti et al. 1993).

A somewhat different approach is that of sectoral diversification, which denotes that firms that operate in several sectors of the economy are, on the one hand, better diversified, thus potentially helping to reduce operational and financial risks (see, e.g., Pagach & Warr, 2011). On the other hand, a higher sectoral diversification of the firm brings about higher risk complexity. According to Gatzert & Martin (2015) this situation will eventually lead to a positive relation between the firm's level of diversification and its risk management strategy.

Property status

Whether a property is self-owned or leased can have an influence on the preparedness of firms for natural disasters. Property owners bear the full risk associated with their assets, which may motivate them to prioritize risk reduction measures. In contrast, leasers typically face lower consequences from disasters since they do not own the property, potentially resulting in less concern for risk mitigation (Han & Nigg, 2011).

Previous disaster experience

The rationale here is that experiencing previous disasters and perhaps experiencing losses in life and assets, makes firms more aware of the risks involved. Hence, making them actively involved in preparing and implementing risk management schemes due to learning from the past (Dahlhamer & D'Souza, 1997). Helsloot & Ruitenberg (2004) examine how citizens respond to disasters and propose that communities experiencing repeated occurrences of

specific types of disasters tend to cultivate 'disaster subcultures.' In these communities, the emphasis lies on the exchange of knowledge, drills, and other preparedness measures. Such subcultures contribute to quicker and more effective responses to disasters. Several authors categorized the subject of pervious disaster experience with a change in the perception of risk following past experiences (Guo & Li, 2016). The theoretical foundations of risk perception in the risk management literature will be elaborated later in this chapter.

Financial condition

Financing capabilities can be an acute factor in risk management. It is not enough to be willing to prepare for disasters and emergencies; firms also need to have the required resources (Han & Nigg, 2011). Gatzert & Martin (2015) divide the financial condition of the firm into several aspects, including (1) financial leverage; (2) earnings or cash flow volatility; (3) stock price volatility; (4) asset opacity; and (5) growth opportunity. Liebenberg & Hoyt (2003) and Pagach & Warr (2007) suggest that firms with greater growth opportunities face an increasing degree of uncertainty with respect to future cash flows and are thus more likely to implement risk management processes.

Location patterns

According to earlier research, Han & Nigg (2011) proposed that location patterns can affect disaster preparedness, arguing that firms with multiple sites or those affiliated or part of larger national chains are more likely to participate in disaster preparedness. While it was difficult to find studies addressing this specific rationale, a recent study depicting the risk management complexities faced by multinational enterprises (MNEs) is that of Rushkovskyi & Rasshyvalov (2023). The constantly changing environment around the world requires MNEs to design better and more effective corporate risk management approaches to respond to global economic, geopolitical, technological and social changes. While this does not say anything about the difference between corporate location patterns, it does suggest that the more complicated and geographically dispersed the firm, the more the firm needs risk management.

Acharya, Bhardwaj & Tomunen (2024) add a different perspective to the relationship between location patterns of a firm and risk management. With specific reference to heat shocks, they suggest that multi-location firms are more resilient to heat shocks because they have the capacity to redistribute their economic activity across locations to reduce the impact

of heat stress on their workers and facility operations. This is an example of corporate risk management of the effects of climate change.

The two examples above demonstrate that while the location patterns of firms may necessitate increased risk management efforts, they can also serve as effective solutions for mitigating risks.

Institutional ownership

Institutional investors, such as pension funds and insurance firms are expected by regulation to meet high standards of risk management, as they invest the public's savings. According to Gatzert & Martin (2015) and Cornett et al. (2007), firms with a higher proportion of institutional investors share of ownership in a firm are more likely to see these institutional investors act as corporate monitors of the firm and demand the introduction and implementation of risk management mechanisms (see Liebenberg & Hoyt, 2003; Hoyt & Liebenberg, 2011). Cornett et al. (2007) also discusses the dichotomy of institutional investors: pressure-sensitive institutional investors, which might be less willing to challenge management decisions due to existing or potential business relations with the firm and pressure-insensitive institutional investors, which are independent of the firm and therefore may be less subject to pressure to accept management decisions.

Having dedicated employees for risk management

Firms which have employees focusing on risk management or crisis management were found by Spillan & Hough (2003) to exhibited greater concern for enterprise risk management and disaster response compared to those without such teams. While having a dedicated employee or team to manage crises would imply that the firm already recognizes the need to mitigate the risks of crisis situations or disasters, it does not necessarily mean that these mitigation measures were done.

2.3. Decision-makers level determinants of risk management

Regarding managers, MacCrimmon & Wehrung (1990) studied the characteristics of risk-taking or risk aversive executives, taking into consideration personal characteristics such as age, dependents, education, nationality, wealth and income along with professional characteristics such as position, authority, seniority, firm size, and industry.

There have been several studies dedicated to specific managerial attributes. For instance, Ghofar (2024) investigated the effect of board diversity on Enterprise Risk Management (ERM) in companies in three countries: the United States, China, and Indonesia. Trisnawati, Mustikawati & Sasongko (2023) examined the relationship between Indonesian CEOs' characteristics and attributes (such as financial expertise, overconfidence, tenure, and gender), and ERM disclosure according to ISO 31000:2018 (International Organization for Standardization, 2018).

One should note that although the disclosure of ERM practices does not guarantee effective risk management, it can serve as a reasonable indicator of a firm's commitment to risk management. The presence of an ERM framework implies that the company has implemented structured processes to identify, assess, and mitigate risks. Therefore, ERM disclosure can be considered a useful proxy for evaluating a firm's risk management efforts, even if it does not provide absolute assurance of optimal risk management practices.

The other studies found for this theoretical review focus more on explaining the characteristics of executives that *take* risks rather than focusing on why executives *manage* risks. While it might be intuitive to view risk-taking and risk management as opposites, assuming that factors driving managerial risk-taking negatively impact risk management, this perspective oversimplifies the relationship between the two concepts. Such an approach does not meet the brass tacks of attaining causality, especially considering that risk-taking and risk management are not inherently antithetical. A risk-taking manager might take risks after great scrutiny, and especially when the firm's risks are hedged.

Hoskisson et al. (2017) review several theoretical frameworks for analyzing managerial risk-taking actions and behaviors. These include several of the rationales presented above, such as the agency theory, behavioral theory of the firm, and prospect theory, but also include in their article other interesting theories such as the behavioral agency model, the socioemotional wealth perspective, and upper echelons theory (by Hambrick & Mason, 1984). Given the fact that these theoretical frameworks have not been specifically presented in the context of risk management, but rather in relation to risk-taking, these theories will not be considered in this study, nor they will be presented here in the theoretical background. Nevertheless, other theoretical frameworks integrating decision-maker determinants of risk management will be introduced with regards to risk perception below.

Risk perception

The discipline of risk management assumes that individuals use logical calculations of probable outcomes and associated costs and benefits to decide on how to manage a certain risk (Birkholz et al., 2014). This is not the case with perceived risks, which reflect the *apparent likelihood* of a hazard to affect the individual rather than reflecting *risk probability*, which results from the calculated statistical probability (Sullivan-Wiley & Short Gianotti, 2017). This is because perceived risks are not based on statistical calculations but rather originate from the disciplines of sociology, anthropology, psychology, geography, and political science (Slovic, 1987). According to Slovic "whereas technologically sophisticated analysts employ risk assessment to evaluate hazards, most citizens rely on intuitive risk judgment, typically called 'risk perceptions'."

In the empirical literature on the subject,[3] one cannot dispense with the fact that risk perception does influence whether individuals will or will not manage these risks (Wachinger et al., 2013). Smith & Petley (2009) explain that risk perception "has to be regarded as a valid component of risk management alongside more scientific assessments" because individuals perceive risks intuitively and not necessarily based on objective assessments. Omer & Alon (1994) suggested individuals can have a cognitive bias towards risks, since they tend to underestimate the probability or magnitude of the expected disruption. Conversely, Méheux & Parker (2006) discovered that the perception of the likelihood of harmful natural hazards within the tourism industry on Tanna, Vanuatu, tends to be generally accurate or overestimated, depending on the specific hazard type. This has prompted the adoption of various preparedness and mitigation measures. However, the authors propose that having accurate perceptions does not necessarily ensure the implementation of sufficient mitigation and preparedness measures. These results highlight the significance of risk perception as a key explanatory variable for the variation in risk management behavior among firms concerning natural hazards.

There are many factors determining an individual's perception of risk. Just like in the discussion on the definition of *natural hazards*, which constitute the interaction between man and the source of the hazard - nature (Kates, 1971) - the perception of risks also considers the hazard itself. Sullivan-Wiley & Short Gianotti (2017), who focus on technological hazards,

[3] For a systematic review of European studies on risk perception of natural hazards and disaster preparedness go to Wachinger et al., 2013.

illustrate the extended research into the subject of how individuals perceive risks. Among the factors influencing risk perception are not only characteristics of the individual perceiver, but also the characteristics of the hazard itself and trust in communicating institutions, especially the accuracy and relevance of the message channeled from the experts to the non-experts. Sullivan-Wiley & Short Gianotti have summarized the factors shaping risk perception, as illustrated in Table 2.2. To their hazard characteristics another important factor was added - the geographic proximity of the hazard, as explained by O'Neill et al., (2016).

Table 2.2. Factors of importance in shaping risk perception*

Factor Categories	Factor
Hazard Characteristics	Likelihood of occurrence, severity of consequences (catastrophic potential), sensationalism, controllability, voluntariness, equitability of impacts, scientific understanding, geographic proximity of the hazard
Individual Characteristics	Self-efficacy characteristics (gender, age, education, children, employment, cultural identity, personal experience)
Trust in communicating institutions	Similarity heuristic, knowledge and expertise, openness and honesty, and concern and care; important under conditions of uncertainty

Source: Sullivan-Wiley & Short Gianotti (2017)
*For selected references for each factor category, see original table

Burton & Kates (1964) note that even among professionals and personnel there is great divergence between the perception of the nature of hazards, their scale, and their location in time and space. They attribute this divergence to differences in experience and training between the personnel, but mostly to human ignorance.

To understand these variations, it would be useful to note that the risk perception literature evolved into two paradigms: the rationalist paradigm and the constructivist paradigm. Under the rationalist paradigm, according to Birkholz et al. (2014), there are three leading approaches to risk perception: (1) revealed preference, which makes use of historical data to evaluate the social cost considered acceptable within the cost-benefit analysis of the risk; (2) the psychometric paradigm, (Fischhoff et al., 1978; Nunnally, 1978), which uses different rating scales and multivariate analysis techniques to produce "cognitive maps" of risk perceptions. Within the psychometric paradigm, individuals make probabilistic judgments about risks by relying on their analytic resources, which are prone to judgmental biases (Slovic, Fischhoff & Lichtenstein, 1977; Slovic, 1987; Siegrist, Keller & Kiers, 2005); and (3) prospect theory, which describes how individuals make decisions under uncertainty based on their

personal evaluations of potential gains and losses (Kahneman & Tversky, 1979; see also Kahneman, Slovic & Tversky, 1982). According to this theory, individuals value losses and gains differently; specifically, when given the choice between two options both offering the same result, the individual will tend to overweight small probabilities to guard against losses. This is because people resort to mental guidelines and to emotions to make judgments in the context of uncertain risks and because losses cause greater emotional impact on the individual than the equivalent amount of gain (Kahneman, Slovic & Tversky, 1982). The fact that individuals dislike losses more than an equivalent gain ("overweighting of low probabilities"), may contribute, according to Kahneman & Tversky (1979), to the attractiveness of actions aimed at avoiding losses; i.e. gambling or insurance.

Birkholz et al. (2014) note that many sociologists and anthropologists have questioned the assumptions of the rationalist paradigm for risk perception. These scholars, such as Short (1984), Douglas (1985) and Johnson, Wilke & Weber (2004) have introduced a different paradigm, the constructivist paradigm, that, as elaborated below, rejects the idea that hazards are "objective phenomena external to the social system." According to the constructivist school of thought, hazards and risks are a result of the dynamics of the social system, which includes culture, institutions, organizations, values, beliefs, etc. (Birkholz et al., 2014).

There are two main approaches in the constructivist paradigm: (1) Political ecology and the social construction of risk and (2) the cultural theory of risk. The first approach has shifted the focus of risk research to explore the role of contextual factors in shaping risk and how risks are socially constructed. This approach rejects the notion that hazards are objective phenomena external to the social system. Instead, hazards and risks are viewed as socially constructed, intertwined with the dynamics of the social system, including culture, institutions, organizations, values, and beliefs. Weichselgartner (2001) adds that what may be considered a hazard in one social context may be seen as a resource in another.

The second constructivist approach presented by Birkholz et al. (2014) is the cultural theory of risk (mostly associated with Douglas & Wildavsky, 1983), which tries to explain risk perception from the sociological perspective (Guo & Li, 2016) and suggests that since individuals perceive risks differently, they also react differently to risks. These reactions aggregately create social or cultural structures that reflect how individuals in that specific social or cultural context behave. Consequently, it should be possible to determine likely risk perceptions from these social or cultural backgrounds. According to the cultural theory of risk,

risk perception is related to the assumption that individuals follow their cultural background and that they base their actions on past experiences and cumulative knowledge (Douglas & Wildavsky, 1983).

Slovic et al. (2004) and Slovic & Peters (2006) have advanced the risk perception literature to include an affective component of feelings. According to their articles, alongside the rational "analytic system", which uses algorithms and normative rules to calculate risk assessments lies the intuitive "experiential system." This system relies on affect heuristic (i.e., quality of "goodness" or "badness") and cognitively raise images and associations and linkages between experience and emotion to tell us whether something is good or bad, risky or not. The experiential system links past experiences and emotions to inform risk judgments. This model suggests risk perception involves both rational calculation and intuitive, emotional elements.

That being said, Dynes, Quarantelli & Kreps (1981) raise the problem that there are many misconceptions on how individuals respond and behave in disasters. The problem is of deep concern, especially when officials base their planning and policies for disasters preparedness on these misconceptions. They claim that "incorrect ideas have become embedded in planning and are frequently the basis for specific decisions during disaster operations." This depiction stresses the negative side of using heuristics and intuitiveness in decision-making in general, and specifically in risk management. In any case, understanding the aspects of risk perception is necessary since these risk perceptions shape individuals' mental attitudes, their cognition and knowledge construction in social dialogues (Payne & Calton, 2004).

Indeed, later developments in economic theory suggested that risk management is also a function of the interests, points of view, and characteristics of the key decision makers in the firm, mainly CEOs, CFOs, CROs and the board of directors. The focus on the decision makers brought forth a vast body of literature regarding why some managers decide to manage the firm's risks while others do not and regarding their perception of risk. There is vast multi-disciplinary academic literature on the subject of rationales for risk management on the individual level of analysis, as exemplified here:

Specific studies have been conducted on the role of each stakeholder in the risk management process (see Aebi, Sabato & Schmid, 2012, for a study on the relationships between the CRO, CEO and board of directors and their influence on risk management-related corporate governance). Wagner (2014) specifically addressed board of directors; Daud, Yazid,

& Hussin (2010) studied the influence of Chief Risk Officers (CROs) on ERM practices; Colquitt, Hoyt & Lee (1999) conducted a survey on the role of risk managers in risk management; Beans (2010) addressed the importance of the CROs for steering through unlikely, high-impact crises; and March & Shapira (1987) put the emphasis on risk attitudes and behavior among managers.

According to the risk perception approach, an individual will implement risk management only when the risk is perceived as one, either after analysis or because of psychological and cognitive processes. The approach of risk perception implies that the objective presence of risk does not necessarily mean the situation is perceived as risky, and therefore does not imply that managers will address these risks (Fischhoff, 1995).

Though the literature reviewed on risk perception suggests that individuals will act according to how they perceive risks, Wachinger et al. (2013) account for the risk perception paradox. They found that even though individuals perceive some risks as high, these same individuals do not necessarily take actions through risk mitigation behavior to mitigate the risks. Wachinger et al. suggest three possible explanations for this paradox: (1) Individuals comprehend the risks they face but choose to accept them possibly because the perceived benefits appear to outweigh the potential negative impacts, (2) Individuals understand the risks but do not think it is their responsibility to mitigate them; and (3) Individuals understand the risks but are unable to affect the situation due to limited resources or expertise. Wachinger et al. stress the importance of understanding the reasons for inaction to promote awareness and preparedness.

Lastly, Birkholz et al. (2014) also mentions the protection motivation theory as a possible explanation for risk management. According to this theory, there are four factors motivating self-preservation behavior: (1) the perceived severity of a threat, (2) the perceived probability of the occurrence (vulnerability), (3) the perceived effectiveness of any recommended response, and (4) perceived ability to implement a response. According to Birkholz et al., action would be most evident when both threat appraisal and coping appraisal were high and would be least evident when the administrative measures appraisal was high.

This chapter has presented different theories and rationales for risk management, including explanations external to the firm, rationales based on corporate objectives, rationales stemming from human interactions, the characteristics of the firms that may affect its risk management practices, rationales stemming from the individual level of analysis, and

presented the issue of risk perception, which today is also offered as an explanation for variability in risk management.

The purpose of the next chapter will be to introduce the literature review on the use of the different theories and rationales of risk management in the natural hazards and natural disaster discourse, with an emphasis on the hotel sector, as this is the focus of the current study. It will be evident that not all the rationales and theories, which were introduced in this chapter, have been used in this field of research. In addition, several of the rationales have not been found empirically convincing in explaining the variation among firms, in general, or specifically among hotels, in the risk management of natural hazards. The literature review along with the theoretical review will be the basis for choosing the explanatory variables of this research.

Chapter 3. Empirical studies on the management of natural hazards

The previous chapter, which focused on the theoretical foundations of corporate risk management, has reviewed the main theories and rationales relevant for the study of corporate risk management of risks stemming from natural hazards. It should be noted that not all the theories included in the theoretical chapter have been associated with the natural disasters discipline and/or the hotel industry, which has been chosen to be the focal point in this study.

The purpose of this current chapter is twofold. First, it aims to present previous empirical studies that have tried to explain why some firms manage the risks associated with natural hazards while others do not. Some of the studies reviewed here address firms in general, while others zoom into the literature on the hotel or accommodation industries. The literature review in this study incorporates relevant research on corporate risk management, which is relevant to the specific focus of the current research. Each study is presented in a way that clarifies its contribution to shaping the understanding of corporate risk management and that describes, where applicable, its direct relevance to the subject of this dissertation. This is important as the insights gathered from the reviewed literature have played an important role in the choice of explanatory variables and the subsequent methodology applied in this study.

The second purpose of this chapter is to introduce how scholars have operationalized and measured disaster resilience and preparedness. Drawing from insights in the existing literature on the topic, the second sub-chapter will assist to explain why later in the study *preparedness to natural hazards* was chosen as the dependent variable of this study.

3.1. Reasons for managing the risks from natural hazards

There is vast literature on the risk management of natural hazards on the individual or household level of analysis (i.e. Turner, Nigg & Paz, 1986; Quarantelli, 1991; Dooley et al. 1992; Lindell & Perry, 2000; Grothmann & Reusswig, 2006; Terpstra & Gutteling, 2008; Koerth et al. 2013, Kim & Kim, 2022; Fazeli et al. 2024), the community or community based organizations level of analysis (Gabor, 1981; Abarquez & Murshed, 2004; Cutter et al., 2008; Maskrey, 2011; Austin, 2012; Shaw, 2012; Osti & Miyake, 2013; Zhang, Yi & Zhao, 2013; Cutter, Ash & Emrich, 2014; Koliou et al. 2018; Ma, Qirui & Lv, 2023; Zaman & Raihan, 2023, just to name a few), or the national level of analysis (Perry & Lindell, 1997; Britton, 2007; Noy & Vu, 2010; Greer,

2012; Kasdan, 2016), with the national level usually focusing on a wider array of disaster risks, not just natural hazards. The perception of natural disaster risk has also been discussed in length, especially with regards to the individual or household levels of analysis (Siegrist & Gutscher, 2006; Eiser et al., 2012; Działek, 2013; Mărgărint et al., 2021; Bodas et al., 2022). One article of relevance to this study is that of Carreon et al. (2022) which aims to assess the level of disaster preparedness and level of awareness in disaster preparedness among the employees of selected hospitality establishments in Naval, Biliran Province, Philippines. Ghaderi, King & Hall (2022) have also focused on the individual level of analysis by assessing crisis preparedness of hotel managers in Malaysia and exploring how their perceptions affect crisis planning and preparedness.

If we look at the literature in the field of corporate risk management of natural hazards, we can find a wide range of studies dealing with topics closely related to the field of research in question, mainly on *how* to prepare and manage these risks (i.e. Bell, 1991; Barton, 1993; Salter, 1997; Johnson, 2001; Cruz & Okada, 2008; Abe & Ye, 2013; Park, Hong & Roh, 2013); surveys to understand the status of preparedness (Murray & Watson, 2019); or studies aimed to explore the economic consequences of natural disasters (Durkin, 1984; Kroll et al. 1990; Tierney, 1997a; 1997b; Benson & Clay, 2004; Athukorala, & Resosudarmo, 2005; Modica & Zoboli, 2016, just to mention a few). As an example, Barlow (1993) conducted a study on the earthquake preparedness of twenty industrial plants in the earthquake-prone area of the Mississippi River. Safety officers were interviewed about their plants' readiness for a Richter Scale 7 or greater earthquake. The survey revealed that most plants did not take the risks related to earthquake seriously and were inadequately prepared. However, it should be noted that the study did not explore why these firms lack preparation, highlighting a gap in understanding why businesses address natural hazard risks differently.

If we turn to the literature trying to explain the reasons why firms manage their risks from natural hazards, it is useful to look at the origins of this body of literature. Several leading scholars in the field find the roots of disaster risk management as an academic discipline in social science beginning with the opening of the Disaster Research Center (DRC) at Ohio State University in the 1960s. The center later moved in 1985 to the University of Delaware (UNDRR, 2024). The Center has been home for several prominent scholars, including Professors E.L. Quarantelli, Russell R. Dynes and J. Eugene Haas who founded the center.

The studies conducted through the center have focused both on how and why organizations, including profit-seeking corporations address the issue of natural hazards and disasters. Tierney, Lindell & Perry (2001), who have also based their research on the DRC database, summarize in their book findings on the factors that affect behavior across social units in the fields of disaster preparedness and response. They include the following factors: risk perceptions, perceptions of hazard adjustments, disaster experience, sociocultural and sociodemographic factors (ethnicity and minority status, language, social bonds, income inequality and economic resources, gender, etc.), disaster agent characteristics. Most of these factors will be discussed in the studies mentioned below.

Though not specifically related to natural disasters but rather to technological risks associated with chemicals, one of the first comparative studies aimed to examine this issue was that of Quarantelli et al. (1979) which addressed the difference in disaster preparedness to relatively sudden disasters resulting from chemical agents among 14 communities. These communities consisted of organizations and companies alike. The study comprised of interviews which allowed the researchers to investigate how different communities and organizations perceive the threats arising from possible major chemical incidents. Quarantelli et al. found that companies in the chemical industry tend to perceive the probability of chemical disasters as less likely than do public emergency organizations and found that larger companies in the chemical industry had engaged in more planning than the smaller companies in the industry; these smaller companies were seen as reluctant to undertake any actions related to disaster planning.

The preceding studies have established the groundwork in the literature for understanding differences in emergency and disaster risk management across firms. Subsequent studies have endeavored to identify specific firm or managerial characteristics, such as size and prior disaster experience, that contribute to business preparedness for natural disasters. The studies found for this literature review will be presented below, generally in a chronological manner and later summarized in Table 3.1 at the end of this section, allowing the readers to compare the study populations, purpose, variables, and main findings of each study.

Gillespie & Streeter (1987) tested the relationship between preparedness and several explanatory variables on a population of 80 emergency social service organizations. Though their study did not focus on profit-seeking companies, they tested several similar explanatory variables which are of interest for this dissertation and they included: previous experience

(the number of times the organization had participated in disaster response efforts), inter-organization formalization (nature of agreements between pairs of organizations), disaster subculture (organizational type, i.e. social service agencies or municipal / county disaster offices), organizational capacity (scale of how many emergency services they provided), interorganizational exchange (types of services delivered to and received from other organizations in the network), and organizational formalization (mainly the degree of routineness and health functionality of the organization). Their research found that disaster preparedness is positively and significantly associated with experience, capacity, formalization, disaster sub-culture, inter-organizational formalization, and inter-organizational exchange.

Several years later, Drabek (1991) conducted a survey among 65 businesses in the tourism industry to determine which executive and firm characteristics explain the variation in the disaster evacuation planning initiatives among the different firms. Among the managerial characteristics were risk perception by the executive, position, years of schooling, gender, years in job, years in community, degree of community integration and participation, and prior evacuation experience. Firm characteristics included type of business (lodging, restaurant, etc.), independent or part of franchise/chain, size, and age of firm. The study found that larger firms, the firm's missions (or type of business) and firms in business more than six years tend to have a greater degree of evacuation planning than other firms.

Drabek also found that firms which had to the greatest extent written procedures and policies were more likely to have extensive disaster evacuation planning. He also found being part of a national chain or franchise was partially associated with the extent of disaster evacuation planning. As for managerial characteristics, Drabek concluded that these impacted the disaster evacuation planning of firms to a very limited degree. Drabek also addressed the possibility that firm location (different communities) could explain the variance in disaster evacuation planning yet found serious gaps between firms in the same community.

Drabek continued his research into the subject and in 1995 surveyed another 120 firms to expand his sample total to 185 firms. Through this study (Drabek, 1995) he reaffirmed that firm size was an extremely strong predictor of disaster evacuation planning; however, the age of the business became a weaker predicter than in the previous study. There were no changes to his other conclusions with the bigger sample.

Mileti et al. (1993) also addressed questions of how and why do businesses, government agencies, health, safety and welfare organizations, and citizens prepare for the next big Bay Area Earthquake. Regarding firms, a sample of 54 businesses in the San Francisco Bay area were analyzed. These businesses were divided into eight sectors: retailing, development, manufacturing, transportation, finance, health, service and high technology. The study also addressed the issue of organizational risk perception and found that firms with executives who had higher levels of earthquake risk perception or perceived their organizations as vulnerable, were more likely to prepare for future earthquakes. In addition, other conclusions included that (1) organizations part of an earthquake-related interorganizational network were more likely to take steps to get ready for an earthquake; (2) firm type was related to preparedness for earthquakes, especially with regards to health, safety, and welfare organizations, since their workers already had an interface with earthquake activities as part of their day-to-day jobs and (3) a major constraint to achieve disaster preparedness was not having the resources to act, especially employees who address earthquakes as part of their job.

Addressing the same issue, Banerjee & Gillespie (1994) tested whether having an organizational strategy can explain the organization's preparedness for disasters. By studying a population of 80 disaster response organizations in the United States (which included 53 Metro Key Resource Chapters of the American Red Cross and several police and fire departments, emergency management agencies, utility companies, health related organizations, social service agencies, etc.), the scholars measured strategy as the degree to which administrators focus on administrative, entrepreneurial and engineering concerns. Along with strategy, they checked whether previous disaster experience, the organization's capacity for disaster response, age and size of the organization are factors influencing the organization's preparedness levels. The results of their study indicated that among their five independent variables, strategy, previous experience, and capacity were found to be the strongest predictors of preparedness, while organization size and age are less important in relation to preparedness. These results are not consistent with most of the other studies presented in this literature review.

Webb, Tierney & Dahlhamer (2000) have reviewed and summarized the findings of the Disaster Research Center large-scale surveys and studies that were conducted up till then, regarding the factors influencing business preparedness to disasters. One of these studies,

stemming from the DRC is that of Tierney & Dahlhamer (1995), who aimed to evaluate business vulnerability to earthquake-related disruptions and damage, and find how businesses mitigate and prepare for such disasters. To explain business preparedness, they conducted a survey with 737 businesses responding. Tierney & Dahlhamer included several firm characteristics in their model for explaining the levels of preparedness: the age of the business, whether the business is an individual firm or a franchise or part of a chain, whether the business property is owned or leased, business size, the financial condition of the business, as assessed by the business owner, and business sector.

In their survey, Tierney & Dahlhamer included questions relating to experience with previous disasters and questions about the owners' perceptions of the likelihood of a future earthquake. For the purposes of the study, they built an index for assessing how important the owners perceive the four types of lifeline services (electricity, telephones, water, sewage and water) for business activities. Using a regression analysis, four of the model's variables were found to be significant predictors of business disaster preparedness: business size, whether the business property was owned or leased, business type (businesses in the F.I.R.E.[4] sector were more likely to engage in preparedness activities than other businesses), and risk perception.

Another attempt to test the variables explaining business preparedness to natural hazards was published a year later by Dahlhamer & Reshaur (1996), also through the DRC. The two conducted a study on businesses with regards to the 1994 Northridge earthquake, which took the lives of 57 people, injured over 10,000, and created direct losses of an estimated $30 U.S. billion (Tierney, 1995).

The purpose of Dahlhamer & Reshaur's research was to answer three central questions that appear here as in the original text:

(1) To what extent did businesses prepare for disaster both before and after the Northridge earthquake?
(2) What types of preparedness activities are businesses likely to engage in?
(3) What factors constrain or facilitate preparedness among private firms?

The researchers developed a model that attempts to explain the preparedness levels of businesses before and after a disaster. They included the following explanatory variables in

[4] F.I.R.E. – Finance, Insurance and Real Estate

their model: business age, number of full-time employees, whether the property is owned or leased, type of ownership (franchise or individual company), types of business (wholesale / Professional Services, Manufacturing / Construction, or F.I.R.E.), previous experience with disasters, and financial status of the business before the earthquake.

A total of 1,110 business owners answered the survey, which examined how several business characteristics affect pre-earthquake preparedness. The variables that were found significant were the number of full-time employees, size of the business (larger businesses undertake more preparedness measures), the age of the business, the financial condition, previous disaster experience, and type of business (companies in manufacturing, service and F.I.R.E. were significantly more likely to engage in preparedness measures than other categories of businesses). As for post-earthquake preparedness, the study found five variables that had significant direct effects: the age of the business, the number of full-time employees, manufacturing business, pre-earthquake levels of preparedness and business closure. These findings are consistent with previous studies.

The study conducted by Dahlhamer & D'Souza (1997) was actually first published in 1995 through the DRC as Preliminary Paper #224. They explored what are the predictors of business disaster preparedness in two U.S. metropolitan areas - Memphis/Shelby County, Tennessee and Des Moines/Polk County, Iowa. With a large sample of firms for their study (1,816 firms), the scholars examined which of the following variables predict preparedness activities undertaken by businesses: type of business, business size, age of business, sector of business, whether the business is an individual firm or franchise, whether the business property is owned or leased and previous disaster experience. Findings of a regression analysis showed that business size was the strongest predictor of preparedness. Followed by whether the business property is owned or leased and by prior disaster experience. According to the study, the type of business was related to preparedness among businesses in Memphis/Shelby County (where finance, insurance, and real estate businesses were more likely than other businesses to engage in preparedness activities), yet not in Des Moines/Polk County.

One nuance into the field of perception is a study by Fowler, Kling & Larson (2007), who conducted an empirical study that addressed the issue of perception of crisis preparedness, where *crisis* can be terrorist related, natural disaster, major accident or workplace violence. They tried to explain the determinants of high or low perception of crisis preparedness using variables such as leadership levels; size of the city in which the organization is located; type of

organization (for profit vs. nonprofit or public); and organizational size. Their findings indicate that (1) top-level and middle level managers have a higher level of perceived preparedness than other employees; (2) Public organizations expressed higher levels of preparedness perception than other types of organizations; (3) organizations with more than 500 employees expressed the highest degree of preparedness perception. There were no differences between the organizations with regards to their location.

A study by Hystad & Keller (2008) looks at how the 2003 forest fire in Kelowna, British Columbia, Canada had affected the local tourism industry. The study investigates the preparedness, response, and recovery strategies of tourism-related businesses following the disaster. By analyzing data from two phases - initial telephone surveys conducted three months after the fire with 104 tourism businesses and follow-up surveys 2.5 years later with 60 businesses - the study highlights the vulnerabilities of the tourism sector to sudden natural disasters. It identifies key gaps in preparedness, noting that most businesses were reactive rather than proactive, with only 5% having formal written disaster management plans in place.

The results suggest that although the tourism sector experienced considerable short-term disruption, most businesses recovered in 6-10 months. The food and beverage sector recovered the fastest. The study illustrated how small businesses face challenges due to limited resources and awareness. In order to increase preparedness, the study ends by promoting a destination tourism disaster management framework. It emphasizes the need for proactive planning, increased cooperation amongst tourism stakeholders, and strategies to mitigate the long-term economic and reputational risks posed by natural disasters.

Sadiq (2010) published a paper on the determinants of mitigation and preparedness to disasters, such as floods or earthquakes, at the organizational level. The data used in the study was taken from a survey which focused on organizational characteristics and earthquake decision-making in private, public and nonprofit organizations in the Memphis/Shelby County, Tennessee. Sadiq used a Tobit model to test the relationship between organizational mitigation and preparedness to variables such as concern over disaster impact (whether concern was low or high); different organizational obstacles elaborated below. Ownership pattern (franchise or single location); size; sector; lack of funding; lack of support from upper-level management or mid-and lower-level organizational members; ignorance of the frequency and severity of disasters; inability to provide compelling information about the

possible effects of disasters; and unclear organizational benefits from disaster planning and mitigation were among the organizational challenges included.

In short, the results of the Tobit analysis suggest that there is a significant positive relationship between mitigation and preparedness measures and concern over disaster impacts (which can also be phrased as risk perception), organizational obstacle and organizational size. Organizational patterns are also a significant factor in mitigation and preparedness measures, as single location organizations are less likely to engage in these activities compared to organizations with multiple locations. Sadiq also reached the conclusion that preparedness and mitigation levels are significantly correlated with organizations in the health and educational sectors.

A 2011 study by Han & Nigg (2011) investigated the determinants of business disaster preparedness, specifically addressing the 1989 Loma Prieta Earthquake. Using a large-scale questionnaire survey in Santa Cruz County, California, which 922 businesses answered in 1997, the study analyzed the influence of different organizational and decision makers' characteristics on business disaster preparedness. The organizational characteristics included in the study were firm size and age, location patterns, property ownership, financial conditions, sector differences and previous disaster experiences. The characteristics of decision makers which were included in the study were risk perception, gender, and the ethnicity of the individual.

The findings of this last study are fairly consistent with the previous studies presented above: the size of the businesses and their lifeline losses following previous disasters are the two most consistent and significant factors explaining business disaster preparedness. At the personal level, the risk perception of the decision makers is the strongest and most significant predictor of business disaster preparedness. As to sector affiliation, Han & Nigg find businesses in finance, insurance, and real estate tend to prepare more for disasters than firms in other sectors. Finally, the study concludes that the effects of a firm's age, location pattern, and property ownership are not clear.

Regarding preparedness to disasters, Gruman, Chhinzer & Smith (2011) conducted a survey in the Canadian hospitality sector to assess the level of disaster preparedness, where the hospitality sector includes accommodations facilities such as hotels, motels, bed and breakfasts, recreational vehicle parks, camping grounds and food services such as restaurants and bars. The survey encompassed questions covering various themes related to disaster

preparedness, including experience with a preparedness plan, its scope, initiation, maintenance, asset protection, recovery, breadth, training, communication, relationship management, workforce planning, perceived threat levels, and company characteristics. These themes aimed to evaluate activities occurring before, during, and after a crisis, employing several response formats, such as “yes/no”, Likert-type scales, and open-ended questions. The findings indicated a generally insufficient level of preparedness among businesses in the Canadian hospitality sector, with more than 80% of respondents stating that they either lacked a plan, had a minimal plan, or had a plan that would necessitate 50% improvisation in the event of a disaster.

One other study, focusing on other variables, is that of is that of Henriet, Hallegatte & Tabourier (2012), which explored the concept of “economic robustness” rather than the concept of preparedness. Their paper suggested a theoretical framework to investigate economic robustness to natural disasters and proposed two aggregate indices - concentration and clustering - as important drivers to economic robustness. Henriet, Hallegatte & Tabourier explored the role of economic networks and the interdependence of actors in the economy. Their rationale for analyzing the concentration concept is the assumption that less concentration, or in other words, redundancy of suppliers and customers, can be a sharing mechanism against the risk of shock to the supplier or customer. In the case of clustering, which is an index of geographical interactions between production units, it was suggested that a high clustering index indicates that production units in the same area interact primarily with each other, making a higher rippling effect following a natural disaster in their area.

Their results indicate a significant correlation between the concentration index and robustness of the economy, meaning the more concentrated the economy, the larger the output loss in the event of an exogenous shock. For their clustering hypothesis, the results were unclear as small groups of production units can be, on the one hand, extremely vulnerable to exogenous shocks, but, on the other hand, can be less affected by disasters because of their isolation. While this study is not specific to the hotel industry, it does raise concepts that can be applied to the hospitality industry.

Chikoto, Sadiq & Fordyce (2012) did not explore the reasons why organizations mitigate and prepare for disasters. Nevertheless, their research is valuable because it examines whether there is a difference in mitigating and preparing for disasters between three types of organization: nonprofit, private, and public organizations. The study used a survey which was

distributed among organizations in Memphis, Tennessee. To assess mitigation and preparedness, the survey included questions related to organizational risk factors. These covered aspects like the presence of risk managers, allocation of resources for disaster planning, the extent of concern about disasters, utilization of disaster information, the consequences of disasters, involvement in mitigation and preparedness efforts, channels for disaster information, and challenges encountered in disaster planning. Their dependent variable was an index of 10 organizational disaster mitigation activities, where each respondent was required to answer “yes” or “no” for each of the 10 activities. Their results indicate that despite potential resource constraints, nonprofits exhibit a higher adoption of mitigation and preparedness activities compared to private corporations. Public organizations also surpass private ones in implementing these measures, but it is not clear whether public organizations also surpass nonprofits in this regard.

AlBattat & Mat Som (2014) have studied the disaster preparedness levels of hotels in Malaysia and Jordan by interviewing top management individuals. The managers were asked several questions, mostly focusing on the extent their hotels were prepared for emergencies in the past, how they managed and overcame emergencies, and what factors contributed to successful emergency planning in the hotel industry. In Malaysia, a significant number of respondents disclosed the absence of disaster emergency planning. In addition, Jordanian hotels reported a deficiency in strategies essential for effective planning to mitigate and preempt the adverse effects of emergencies. Relevant to this study, it is worth mentioning that AlBattat & Mat Som stated that their findings emphasize that the organization type, age, size and whether the organization has faced a disaster before have a great effect on the proactive planning of hotels.

Building on the research done by Sadiq in 2010, Sadiq & Graham (2014) wrote a paper on whether having a risk manager in an organization helps predict the adoption of risk reducing strategies. They also tried to determine whether risk perception at the organizational level is associated with the adoption of risk reducing measures. Using a database of information collected in 2006, the organizations tested were public, private and nonprofit in the Memphis/Shelby Country area, Tennessee. The control variables included in the study were: organization size, ownership pattern; sector, the concern about disaster impact and organizational obstacles. The study concluded that having a risk manager leads to the

adoption of risk-reducing measures. With regards to organizational risk perception, it was found that this variable is also associated with the adoption of risk-reducing measures.

A newer study by Marshall et al. (2015) examined the pre-existing characteristics that lead to business demise following Hurricane Katrina. Although not exactly aligned with the present study's focus, Marshall et al.'s use of same or similar variables for explaining business demise demonstrates how the survival of a business following a natural disaster is related to the level of preparedness and to other factors. Marshall et al. have examined which pre-existing characteristics of a small business or the owner explain the business's operating status after a natural disaster. Those relevant to the owner were his/her education and experience in business, gender, race/ethnicity, veteran status (from military service), owner household, and owner resilience. The variables relevant to the business were firm size, industry sector, age of business, legal form of business ownership, previous disaster experience, and operating location.

The study's results indicate that the businesses which were the most likely to meet demise were those owned by women, minorities, and veterans. They also found that more experienced or older owners, and businesses with previous disaster experience were less likely to meet demise, along with larger businesses (number of employees) and service-based businesses. Other interesting outcomes of the study by Marshall and associates are that businesses with prior cash flow problems or home-based businesses were less likely to meet demise, whereas businesses located in coastal counties were more likely to meet demise.

Sadiq & Graham (2016) conducted a study aimed to examine the antecedents of preparedness for natural disasters at the organizational level. This time, their study was composed of a nationally representative sample which included a survey of 2,008 U.S. employees in private, public and nonprofit organizations across the country. Building on the previous studies in the field, Sadiq & Graham tested the relationship between the following variables and the adoption of preparedness activities: risk perception; organization size; previous disaster experience; single or multiple location; ownership of business property; organization age; and organizations in the education, health, finance/insurance/real estate, and wholesale/retail trade sectors. They conducted the analysis twice; once for employer-level preparedness activities and once for employee facility-level preparedness activities.

The study did not find a significant relationship between employee risk perception and the adoption of preparedness measures. The authors explain that this result is contrary to

previous studies, perhaps since the employees might not be aware of the risks as much as the owner or manager, or due to the different definitions of risk perception in each study or the existence of mediating variables. When focusing on the results of the employer-level preparedness activities, a positive relationship was demonstrated between organization size at the facility level, previous disaster experience, and organization age. Still at the employer-level, according to the study, being a part of a franchise does not explain preparedness activities, nor does ownership of business property or organization sector.

Bilić, Pivčević & Čevra (2017) conducted an empirical study exploring how hotel managers in Split-Dalmatia County (SDC), Croatia, handle crisis situations. Using a questionnaire, they surveyed 59 hotels, focusing on crisis management practices and hotel characteristics. The study aimed to understand managers' perceptions and readiness for crises, comparing independent and chain hotels to assess their preparedness. Additionally, it examined whether incident probability and crisis frequency correlate with business volume and hotel size. Results showed that managers recognize their pivotal role in crisis management but highlighted insufficient employee training and crisis protocols. Interestingly, the study found no significant differences in crisis preparedness between independent and chain hotels, nor did it find a correlation between crisis frequency and hotel size.

A very relevant paper to this study, by Brown et al. (2019), addressed the need to measure disaster resilience within the hotel sector, using an exploratory survey among hotel staff and managers in Wellington and Hawke's Bay, New Zealand. To measure disaster resilience, the study used the Disaster Resilience Framework for Hotels (DRFH), which includes six capital groups to categorize the different predictors. Having more components in place of these capital predictors means the hotel has more disaster resilience. The study found that the presence of the predictors of disaster resilience was overall positive among the hotels in the study, meaning that the hotels had positive attributes of disaster resilience. Later, this chapter will provide a detailed description of the DRFH in the section covering the operationalization of the dependent variable in this dissertation.

Ivkov et al. (2019) followed Brown et al. (2018) by using a similar multi-capital-based approach to assess natural disaster resilience within the hotel industry. Ivkov et al. conducted a survey-based study on 63 hotel managers from 12 European countries with regards to their hotel's resilience to natural disasters by testing several variables and their influence on natural disaster resilience within the hotel industry.

They suggested that previous experience of hotel managers in natural disasters, both as managers or generally in life, affects their risk perception and perception of natural disaster resilience; longer managerial experience aids better perception of natural disaster resilience; higher hotel category positively affects the perceived level of natural disaster resilience and finally, larger organization size positively affects the perceived level of natural disaster resilience. Their results indicate that hotels run by managers who have previous experience with natural disasters, or by managers with longer employment in the hotel industry, show a higher degree of awareness to the importance of investing in the resilience of the hotel. The study also found that larger hotels and those with higher category (stars) are more resilient.

In their book, Albattat & Mat Som (2019) discuss disaster planning and preparedness in the hotel industry. From their account of the literature on the subject, disaster and emergency planning has been incorporated into hotels as a reactive response to the growth in disaster recurrence in the last few decades. The aim of their book is to assess the preparedness of three-, four-, and five-star hotels in Jordan in handling disaster and emergency situations. The findings indicate that major players in the industry either entirely or partially overlooked disaster and emergency management, planning, and preparedness.

The results underscore the crucial role of emergency planning and preparedness throughout such situations. Notably, industry players emphasizing learning and training activities demonstrated greater success in emergency management. The study revealed that only five-star hotels had effective emergency planning and management policies. The study illustrates that the majority of lower-rated hotels lacked preparedness due to insufficient training and financial capacity, indicating a high vulnerability of the tourism industry to uncertainties.

One other study focusing on whether business organizations have adopted disaster risk reduction and preparedness measures is that of Murray & Watson (2019) who focused on Caribbean SIDS. Their study, which examined different sectors of the economy in Trinidad and Tobago and Grenada, has brought some insights on what businesses are doing about their natural disaster exposures, and about what factors influence these actions. Examining 15 organizations across seven sectors (energy, banking, utility providers, conglomerate group businesses, agriculture, fishing, and hotels), the study identified organizational size and sectoral affiliation as potential factors influencing variations between businesses. Interestingly, the study noted that prior disaster experience did not appear to impact disaster

risk reduction and preparedness measures. Instead, organizational size played a role, with larger companies implementing more preparedness measures than smaller entities within the islands. Additionally, an industry effect was observed, particularly in Trinidad, where energy and banking businesses subject to regulatory standards implemented more measures compared to conglomerate subsidiaries.

Gatsi (2020) investigates whether four- and/or five-star hotels in Greece provide adequate training to their staff in dealing with extreme natural events and asked for the respondents of her survey for their opinion regarding the current versus the potential impact of Artificial Intelligence (AI) in such crisis. The author found that gender, employment experience, experience with previous crisis situations all have an effect on their attitude on implementation of AI to confront unexpected natural phenomena. Women, longer employment experience and those with previous crisis experience were more likely to agree that disastrous natural phenomena are very likely to occur in Greece and the need to use AI.

Another study conducted on Greek enterprises is that of Mpekiaris et al. (2020) who examined three issues: the factors explaining the implications of natural disaster awareness, the factors explaining natural disaster preparedness within companies, and the factors explaining natural disaster resilience among Greek companies. Mpekiaris et al. shed some important insights for this research first because the sample is in Greece and, second, because the purposes of their study are very similar to the purposes of this dissertation. By conducting a survey among 331 owners or facility managers of each company, the study revealed a low level of awareness and preparedness in terms of disaster impact and recovery planning among the companies included in the study.

The scholars found that larger companies and companies located near urban centers or within industrial zones were found to be better prepared to respond to emergency natural events and are more resilient to natural disasters. Several interesting points to mention from the study are as follows: only 43% of the companies were aware that they operate in high seismic activity areas; 74% lack awareness of disaster risks and business continuity planning, and roughly 90% of the Greek companies surveyed have no preparedness plans.

One more important study examining the level of emergency and disaster preparedness in the hospitality sector is that of Ismiyati & Lestari (2020) who focused on two cities in Indonesia, Palu and Gorontalo. Their analysis used the Asia Pacific Economic Cooperation-Tourism Risk Management (APEC Tourism Risk Management) tool, which was adapted from

the A/NZS 4360-1999 standard, and the Tourism Resilience Index to assess preparedness among hotels and resorts in the two Indonesian cities. The questionnaire used in the study corresponds to the APEC tourism risk management and tourism resilience index, which consists of eight variables: prevention/mitigation, preparedness, response, recovery, business plan, disaster preparedness, workforce, and relation with government.

The study found a greater level of preparedness in the hospitality sector in Palu City relative to that of Gorontalo City. While the study did not test the reasons for this result, the authors did suggest different explanatory variables, based on other studies. For instance, the recent experience of handling a disaster influences how individuals perceive preparedness, consequently affecting the organization (Brewer et al. 2020). They also mentioned that there is a difference between 1-star and 2-star hotels, and the size of the hotel also affects emergency and disaster management (Johnston et al., 2007).

Another study addressing star ratings is that of Nhep, Schott & Sahli (2021), which focused on a related issue - that of climate change adaptation, a related term to those of resilience and preparedness. The purpose of their study was to investigate the adaptation measures to climate change of fifty hotels in the coastal city of Sihanoukville, Cambodia and analyze whether there are differences in the hotels' adaptation measures considering key hotel characteristics such as star rating, size, ownership and length of operation. The researchers found that the adaptation measures varied considerably between hotels with large hotels applying higher levels of adaptation and budget and Khmer-owned hotels showing limited adaptation measures.

With regards to hotels in China, Wu, Xia & Bao (2021) conducted a study during COVID-19. First, their study tried to identify the main risks that may threaten hotels in Wuhan City, China and second, to investigate the state of emergency preparedness of five-star hotels in the city. They used a list of strategies and actions before, during and after a disaster, all of which together represent emergency management preparedness. The findings reveal that in the pre-disaster/crisis preparedness stage, all participating hotels have formal emergency plans, early warning systems, safety training, community-based preparedness activities, and disaster insurance. In the response phase, all businesses have rescue procedures, emergency supplies, evacuation maps, and organized drills. Most hotels have sufficient supplies for at least 72 hours. Additionally, while many hotels appointed staff for temporary emergency positions, less than half of these hotels have a list of multilingual staff members. In the post-

disaster/crisis recovery stage, all respondents have provisions for protecting documentation, asset protection plans, and recovery plans, with roughly two-thirds having procedures to assess damage.

A recent study by Sharma et al. (2024) applied Stakeholder Theory to assess the resilience of the tourism industry in Pokhara, Nepal, to climate change and disasters. Using a mixed-methods approach, the study collected quantitative data from 150 hospitality enterprises and qualitative data from key informants. It addressed four key areas: climate change trends, disaster impacts, future concerns, and deficiencies in disaster preparedness. The findings highlighted that hotels and restaurants in Pokhara were most concerned about earthquakes (53.4%), followed by river floods (18.3%) and landslides (12.9%). The study also revealed a lack of disaster preparedness plans and found that managerial education and higher initial investments are linked to greater concern for future disasters, with current strategies heavily reliant on external aid.

The final study included in this literature review is that of Garcia et al. (2024), who discussed the perceived level of preparedness and response strategies implemented by hotels in Batangas, Philippines, to mitigate the impact of different natural hazards they are faced with. The study first identified the common natural hazards faced by these hotels: Taal volcano eruptions, typhoons, earthquakes, ashfall, and sulfur dioxide emissions. Next, the study tried to answer the following questions: (1) What are the existing strategies utilized by hotels in terms of readiness and response to natural hazards? (2) What are the challenges faced by hotels in implementing effective preparedness and response strategies for natural hazards? (3) What is the perceived level of preparedness of hotels in mitigating the impact of natural hazards? (4) Based on the findings of the study, what Disaster Risk Management Preparedness Strategic Plan may be proposed? (as they appear in Garcia et al., 2024).

To conduct the study, seven hotel executives from different hotels situated in Batangas were interviewed using a qualitative research design. These interviews illustrated that the hotels in Batangas endorse certain common strategies to prepare and respond to natural hazards such as evacuation procedures and guest safety measures; staff training and preparedness measures, communication and coordination measures; and preventive measures and standard safety measures. The study also accounted for several challenges faced by the hotels in implementing effective preparedness and response strategies for natural hazards, addressed the issue of the hotel executives' perceived level of preparedness,

and quoted several recommendations for enhancing these hotels' preparedness and response strategies to natural hazards.

Further variations with similar themes are articles on corporate preparedness of pandemic influenza (Watkins, Barnett. & Links, 2008) or risk analysis and management of technological hazards (Kates & Kasperson, 1983). Another theme in this field is private sector involvement in disaster management (Izumi & Shaw, 2014). Tsai et al. (2020) discussed measuring of hotel staff literacy in disaster prevention, focusing on four key dimensions: disaster prevention knowledge, disaster prevention attitude, disaster prevention skills, and disaster prevention services. While it might be useful to mention these studies, they were found less relevant to elaborate on here.

For clarity, Table 3.1 concisely outlines the sample, purpose, methodology, variables and pertinent findings of each of the studies included in the above literature review.

Table 3.1. Summary of the reviewed empirical studies on the management of natural hazards

Source	Study population	Purpose of study	Variables tested	Main relevant findings	Methodology
Quarantelli et al. (1979)	Communities and organizations, including chemical companies that are prone to the risk of chemical disasters	Community and organizational planning and preparedness for acute chemical hazard disasters	Threats and awareness to chemical disasters; recent experience with agents; resources; and social climate and linkages, including federal and state legislation regarding the handling of hazardous materials; social cleavages and conflicts in communities	Organizational size, previous experience, type of organization	Research model: interviews and collecting documentary and statistical data
Gillespie & Streeter (1987)	Emergency organizations	Conceptualization and measurement of the concept of disaster preparedness	Organizational characteristics: previous experience, disaster subculture, organizational capacity, formalization External environment: Interorganizational formalization, inter-organizational exchange	Disaster preparedness is positively and significantly associated with experience, capacity, formalization, disaster sub-culture, inter-organizational formalization, and inter-organizational exchange	Cross-sectional survey of 80 emergency social services organizations, both private nonprofit and public sector
Drabek (1991)	Businesses in the tourism industry	Explaining the variation in disaster evacuation planning among tourist-oriented firms	Managerial characteristics: i.e. degree of risk perception, position title, years of schooling, prior evacuation, gender, years in job, etc. Organizational Characteristics: mission, sponsorship type, no. of full-time employees, age of firm, formalization, full-time security officer. Community variation	Risk perception appears related. Several firm characteristics (mission, sponsorship base, size and degree of formalization and differentiation) account for some of the variation	Interviews with 65 owners or managers of tourist-oriented firms
Drabek (1995)	Businesses in the tourism industry	Explaining the variation in disaster	Multi-variable analysis of over three dozen variables that	Factors accounting for variation: intra-	Interviews and questionnaires of

Source	Study population	Purpose of study	Variables tested	Main relevant findings	Methodology
		evacuation planning among firms	reflect managerial, firm, and community characteristics	organizational factors, assistance by local gov. emergency manager, high no. of full-time employees, high level of risk perception, managerial professionalism, presence of community disaster sub-culture	185 owner / managers in 9 American communities
Mileti et al. (1993)	54 businesses from 8 sectors: retailing, development, manufacturing, transportation, finance, health, service and high technology. Part of a larger study	How and why do businesses and the public respond to newspaper inserts to prepare for earthquakes by checking the preparedness measures taken before and after the distributed newspaper insert	Risk perception, organizational culture, resources	Firms more likely to prepare for earthquakes: high risk perception among executives, organizations part of an earthquake-related interorganizational network, firm type, and having the resources to act	Questionnaires sent to the public and to businesses. Interviews among specific community leaders, and collection of publicly available earthquake risk and readiness documents
Banerjee & Gillespie (1994)	80 disaster response organizations in the United States	Examine the relationship between organizational disaster preparedness and five independent variables	Strategy, experience, capacity, age and size	Strategy, previous experience, and capacity were found to be the strongest predictors of preparedness, while organization size and age are less important in relation to preparedness	Telephone interviews with 72 top administrators in 72 disaster response organizations
Tierney & Dahlhamer (1995)	Businesses in five sectors in the	Assess business vulnerability to earthquake-related	Age of business, individual firm, franchise or part of a chain, property owned or leased,	Business size, whether the business property was owned or leased, business	A survey was sent to 1,840 businesses

Source	Study population	Purpose of study	Variables tested	Main relevant findings	Methodology
	Memphis / Shelby County, Tennessee	damage and disruption and find what are the preparedness measures adopted by businesses to mitigate these risks	business size, financial condition of the business, business sector; owners'; perceptions of the likelihood of a future damaging earthquake; owners' assessments of the importance of four lifeline services and previous disaster experience	type (businesses in the F.I.R.E. sector), and risk perception were found to influence engagement in preparedness activities	and answered by 737 businesses
Dahlhamer & Reshaur (1996)	Businesses in five sectors in Los Angeles and Santa Monica	To understand the extent to which businesses prepare for disasters and which firms are more likely to do so	Age of business, no. of employees (size), own or lease, firm or franchise, type of business (sector), disaster experience, and financial condition	No. of employees (size), age of business, type of business, previous disaster experience and financial condition are all predictors of pre-earthquake preparedness	Survey using a series of mailings and phone calls and a modified version of Dillman's (1978) "total design method"
Dahlhamer & D'Souza (1997)	Businesses in five sectors	The determinants and variation of business disaster preparedness in the private sector	Age of business, no. of full-time employees, owned or leased, firm or franchise, disaster experience, sector, two locations	Business size, whether the business property is owned or leased, and prior disaster experience were found all related to business disaster preparedness	Survey using a series of mailings and phone calls and a modified version of Dillman's (1978) "total design method"
Fowler, Kling & Larson (2007)	Employees in profit, nonprofit, and government organizations from a broad range of employment levels	Assessing the perceived organizational preparedness of organizations to five types of crises: secondary / major terror attack, natural disaster, accidental	Managers vs. employee perception of crisis preparedness, organization's location (densely populated area or not), type of organization (for-profit, non-profit, government), organization size	Top-level and middle-level managers have a higher level of perceived organizational preparedness	Questionnaire completed by 398 alums of an association of business schools in south-western United States

Source	Study population	Purpose of study	Variables tested	Main relevant findings	Methodology
		disaster, workplace violence			
Hystad & Keller (2008)	60 tourism businesses in Kelowna, British Columbia, Canada for a follow up study (out of 104 in the original sample)	Long-term impacts of the 2003 forest fire on Kelowna's tourism industry - examining changes in business disaster preparedness and management practices compared to the first survey	The preparedness levels and responses and long-term recovery outcomes were tested with independent variables: sector (food & beverage, accommodation, entertainment), business characteristics (size, resources, recovery strategies), and perceptions of disaster management responsibility and preparedness plans	The tourism industry was poorly prepared for the disaster, with most businesses adopting a passive and reactive approach	Telephone interviews. Surveys included quantitative and qualitative questions covering long-term impacts, responses, and preparedness. Analysis of secondary data
Sadiq (2010)	Organizations (private, non-governmental, and public) in Memphis/Shelby County, Tennessee	The determinants of mitigation and preparedness to disasters at the organizational level	Concern over disaster impacts, organizational obstacles (lack of resources, support, information, etc.), single vs multiple locations (pattern of ownership), organizational size, sector	Organizational size, ownership pattern, and concern over disaster impact and organizations in health and educational sectors are strong positive determinants of mitigation and preparedness in organizations	Interviews as first phase; survey as second phase using a modified version of Dillma's (1978) "total design method". Tobit regression analysis on a sample of 227 organizations
Han & Nigg (2011)	Businesses in Santa Cruz County	Explore the influences of organizational and decision makers' characteristics on business disaster preparedness	Organizational features: firm size, age, location patterns, property ownership, financial condition, sector, previous experience.	Larger size, companies in finance, insurance and real estate, risk perception of owners, and previous disaster experience explain better disaster preparedness, while better	Large-scale mail questionnaire survey in Santa Cruz County, California following the 1989 Loma Prieta earthquake,

Source	Study population	Purpose of study	Variables tested	Main relevant findings	Methodology
			Characteristics of decision makers: risk perception, gender, and ethnicity	financial condition makes the company less likely to engage in disaster preparedness	using a modified version of Dillman's "total design method" (Dillman, 1978)
Gruman, Chhinzer & Smith (2011)	Hospitality sector in Canada	Assess the level of disaster preparedness of companies in the Canadian hospitality sector	Disaster preparedness was evaluated with variables such as experience with a preparedness plan, its scope, initiation, maintenance, asset protection, recovery, breadth, training, communication, relationship management, workforce planning, perceived threat levels, and company characteristics	The study found insufficient levels of preparedness among businesses in the Canadian hospitality sector, with more than 80% of respondents stating that they either lacked a plan, had a minimal plan, or had a plan that would necessitate 50% improvisation in the event of a disaster	Online survey among 42 companies in the Canadian hospitality industry
Henriet, Hallegatte & Tabourier (2012)	Economy / network of production units (PUs)	Investigate economic robustness to exogenous shocks such as natural disasters	Concentration; clustering; and blocks connections	There was a significant correlation between the concentration index and robustness of the economy, meaning the more concentrated the economy, the larger the output loss in the event of an exogenous shock	The research employs a dynamic model that depicts a regional economy by disaggregating sector-scale input-output tables, representing it as a network of Pus
Chikoto, Sadiq & Fordyce (2012)	Nonprofit, private, and public organizations	Are there differences in mitigating and preparing for disasters between different types of organizations:	Sector belonging. Control for organizational demographics such as organizational size, ownership pattern – single or multiple locations, and organizational service industry	Main finding: nonprofit organizations and public organizations adopt more disaster mitigation and preparedness activities than private organizations	Use of previous survey conducted on organizations in Memphis / Shelby county, Tennessee

Source	Study population	Purpose of study	Variables tested	Main relevant findings	Methodology
		nonprofit, private, and public organizations?	(education, health, travel, restaurants, lodging, finance, etc.)		
AlBattat & Mat Som (2014)	Hotels in Malaysia and Jordan	Comparative analysis of emergency planning and disaster preparedness among hotels	Hotels were asked to explain the types and magnitude of emergencies that occurred in their hotels in the past; explain to what extent their hotels were prepared in the past; what factors contribute to successful emergency planning in the hotel industry	Main finding: Hotels face challenges in implementing proactive emergency planning for disasters, and various constraints hinder their success in this aspect.	Qualitative research methodology: Face-to-face interviews of managers from three-, four-, and five-star hotels in Kuala Lumpur and Penang in Malaysia, and Amman and Petra in Jordan
Sadiq & Graham (2014)	Public, private, and nonprofit organizations in the Memphis / Shelby County area, Tennessee	Questions: Can having a risk manager in an organization predict the adoption of risk reducing measures. The relationship bet. organizational risk perception and the adoption of risk reducing measures	Risk perception, risk manager, control variables: organization size, ownership pattern; sector, the concern about disaster impact and organizational obstacles	Having a risk manager leads to the adoption of risk-reducing measures; risk perception is associated with the adoption of risk-reducing measures	Using data from a 2006 survey using a modification of Dillman's total design method
Marshall et al. (2015)	Small businesses	Examining the pre-existing factors that led to business	Characteristics of business owner: education, experience, gender, race/ethnicity, veteran status, owner household, owner	More likely to meet demise: businesses owned by women, minorities, and veterans; businesses located	Telephone interviews of small businesses in Mississippi that

Source	Study population	Purpose of study	Variables tested	Main relevant findings	Methodology
		demise following Hurricane Katrina	resilience. Characteristics of business: firm size, industry, age, legal form of ownership, previous disaster experience and operating location	in coastal counties. Less likely to meet demise: more experienced owners, older businesses, larger businesses, service-based businesses, home-based businesses, prior disaster experience, prior cash flow problems	were impacted by Hurricane Katrina
Sadiq & Graham (2016)	Employees in private, public, and nonprofit organizations across the United States	Examine the determinants of the adoption of disaster preparedness activities. Dependents variable: perceived organizational preparedness among employers and among employees	Risk perception; organization size; previous disaster experience; single or multiple location; ownership of business property; organization age; and sector (education, health, finance, insurance, real estate, wholesale, retail, trade)	Regarding employer-level preparedness activities, size, previous disaster experience, and organization age are predictors of preparedness	Online survey administered by GfK on the national level
Bilić, Pivčević & Čevra (2017)	Hotel managers in Split-Dalmatia County (SDC), Croatia	Examine the capacity of hotel managers to successfully plan and overcome crisis situations and study potential determinants for crisis events and crisis management practices	The study assesses hotel managers' crisis management readiness and their perceived role in security protocols. It compares independent and chain hotels' preparedness for potential crises, suggesting higher incident probabilities in larger hotels	Managers acknowledge their crisis management role but note lacking employee training and protocols. No significant differences were found in crisis readiness between independent and chain hotels, nor in crisis frequency based on hotel size	Survey conducted on 59 hotels operating for more than 2 years. Crisis management practice mostly consisted of 5-point Likert scale type questions

Source	Study population	Purpose of study	Variables tested	Main relevant findings	Methodology
Brown et al. (2019)	Hotels in the Hawke's Bay and Wellington regions, New Zealand	Measuring disaster resilience within the hotel sector	Disaster resilience was measured using a capital-based approach with six groups of capital predictors: economic, social, human, physical, natural, and cultural	Hotels in the sample were found to have positive attributes of disaster resilience across all six capital predictors	Survey with 72 questions for staff and general managers of hotels
Ivkov et al. (2019)	Hotel managers from 12 European countries	Examining what explains hotel resilience to natural disasters using a multi-capital predictor-based approach	Previous experience with natural disasters as managers or in life in general (risk perception), length of managerial experience, organizational factors: hotel category, hotel size	Managers' previous experience of natural disasters, duration of managerial experience, and organizational category and size have a positive effect on hotel resilience	Survey among 63 hotel managers from 12 European countries
Albattat & Mat Som (2019)	Hotels in Jordan	Examine disaster and emergency planning among hotels and what are their current levels of planning and preparedness	Tests models of disaster planning and preparedness including measures before, during and after an emergency; checking the factors and barriers for effective emergency planning	While five-star hotels showed capability to handle emergencies due to established planning and management policies, numerous lower-rated hotels lacked adequate preparedness, focusing on reactive measures rather than proactive planning, displaying an inability to detect, manage, and recover from emergencies	In-depth interviews conducted with the hotel managers of three-, four-, and five-star hotels in Jordan
Murray & Watson (2019)	Businesses in Small Island Developing States	Examine the disaster risk reduction and preparedness measures implemented	Different sectors, two different countries (Trinidad and Tobago and Grenada), size, previous disaster experience, availability of financial resources, the	Previous disaster experience does not seem to explain levels of risk reduction and preparedness. Size and	Face to face interviews and a questionnaire

Source	Study population	Purpose of study	Variables tested	Main relevant findings	Methodology
		business in two SIDS and possible explanations for variation	nature of operations and the incidence of regulation	sector were found to correlate with preparedness	
Gatsi (2020)	Hotels in Greece	Investigate the level of preparedness of 4*and 5* hotel units in Greece for natural disasters	Experience, demographic characteristics of the respondents and their effect on opinion disaster management, including AI	Gender, age, working experience, and experience with crises influence attitudes on disaster management affect opinions on the need to develop and utilize new technologies and techniques to prepare for disasters	Questionnaires distributed among employees and managers of hotels in Greece
Mpekiaris et al. (2020)	Greek companies contacted through the Greek Chamber of Commerce and Industry and the Hellenic Federation of Enterprises	Examine the factors explaining the level of natural disaster awareness, natural disaster preparedness and natural disaster resilience among Greek companies	The variables included company legal form, size, ownership (tenure status of facilities), location, years of operation	The study found low levels of awareness of the implications of disasters and low levels of preparedness in terms of the impacts of disasters and recovery planning. Size, legal form and location were found as possible explanatory variables for corporate responsiveness	Questionnaire answered by 331 owners / managers with 45 questions divided into four sections: demographics, awareness, preparedness and resilience
Ismiyati & Lestari (2020)	Hotels and resorts in Palu and Gorontalo, on Sulawesi Island, Indonesia	Comparative analysis between two cities - examine the level of emergency and disaster preparedness in the hospitality sector	The resilience index includes 8 variables: prevention/mitigation, preparedness, response, recovery, business plan, disaster preparedness, workforce, and relation with government	The hotels in Palu City have a higher level of preparedness when compared to hotels in Gorontalo City. Previous experience and category of hotel can account for variations	Questionnaire adapted from the APEC tourism risk management and tourism resilience index

Source	Study population	Purpose of study	Variables tested	Main relevant findings	Methodology
Nhep, Schott & Sahli (2021)	50 hotels in Sihanoukville, Cambodia	Explore the extent of climate change adaptation practiced by Cambodian hotels and addressing key hotel characteristics	Examining adaptation measures across four key hotel characteristics: star rating, ownership (Khmer- or foreign-owned), size, business age	Large hotels reported significant, diversified adaptation measures, while budget and Khmer-owned hotels reported limited adaptation measures	A combination of semi-structured interviews with hotel managers with informal site observations and government reports
Wu, Xia & Bao (2021)	Five-star hotels in Wuhan, China	Identify the main risks that may threaten hotels and investigate the state of emergency preparedness of five-star hotels in Wuhan, China	To assess emergency preparedness of disaster situations, a list of strategies or actions in different emergency management stages (pre-disaster/crisis, during disaster/crisis, post-disaster/crisis) was used	The study revealed that hotels in Wuhan are well prepared for disasters and crises that may threaten their activities	Interviews among general managers and a survey sent to safety and security managers of the hotels
Garcia et al. (2024)	Seven hotels in Batangas, Philippines	Understand the natural hazards faced by hotels and the perceived level of preparedness; investigate the readiness and response levels to natural hazards and the required strategies to lessen the impact of future disasters	Rather than hypotheses, the study searched for commonalities and differences among hotels with regards to effective preparedness and response strategies; perceived level of preparedness and the challenges faced by the hotels	The study revealed the different strategies used by hotels to mitigate the impacts of natural hazards, the challenges they face when preparing for and responding to natural hazards (financial constraints, infrastructure limitations, resource scarcity, dependency on external support)	Qualitative study using in-depth interviews with seven hotel executives from distinct hotels situated in Batangas

Source	Study population	Purpose of study	Variables tested	Main relevant findings	Methodology
Sharma et al. (2024)	150 hospitality enterprises in Pokhara, Nepal	Investigate climate change impacts on the hospitality industry: trends in key weather elements; disaster patterns affecting the sector; factors influencing concern for future disasters; and gaps in current disaster preparedness strategies	Variables included in the study: Enterprise type, size, investment type, and establishment age. Manager type, education level, sustainable tourism awareness, sustainable consumption and production awareness, informants' experiences with previous disasters	Climatic disasters threaten the hospitality industry. Disaster experiences and preparedness are influenced by managerial awareness of sustainable practices and enterprise size. Stakeholder perspectives, green technologies, education, and enterprise size play key roles in improving disaster preparedness and long-term resilience	Quantitative data were collected via structured questionnaires and analyzed using trend tests, multinomial and probit regression. Qualitative data were analyzed through thematic analysis

Source: Own elaboration.

3.2. Operationalization and measurement of disaster resilience and preparedness

What does it mean in practice to manage the risks arising from natural hazards? Does it mean to have a business continuity plan, a resilience framework, is it to have a crisis management framework or a contingency plan? Deciding on the choice and definition of the dependent variable for this study has been one of the most time-consuming parts of this dissertation. This is mostly because there is no one accepted definition or framework for operationalizing risk management of natural hazards and natural disasters in the academic literature nor in practice, among firms.

To illustrate this, some businesses adopt frameworks or voluntary standards for emergency management, others for business continuity management (Herbane, 2010; Sudo et al., 2019), and some adopt frameworks for organizational/economic resilience (Graveline & Grémont, 2017) or disaster preparedness (Murray & Watson, 2019). There are internationally accepted standards like ISO 31000:2018 (Risk Management), which is a voluntary general framework for risk management of organizations that can be applied to natural disasters and ISO 22301: Societal Security - Business Continuity Management Systems, which focuses on business continuity management, encompassing planning and preparedness for various disruptions, including natural disasters. Rajić, Maksimović & Milosavljević (2023) suggest an emergency planning and disaster recovery management model (EPDRM) for the hospitality sector, which links the ISO 31000:2018 (Risk Management) requirements with the Plan-Do-Check-Act cycle.

There are also national standards in the field. In the United States, ASIS SPC.1-2009: Organizational Resilience emphasizes enhancing organizational resilience, which involves preparing for and recovering from different disruptive events. There are frameworks that integrate the different concepts together, such as ISO/PAS 22399:2007 (Tangen & Seigel, 2008) which provides organizations with best practice for preparedness and continuity management and COSO Enterprise Risk Management (ERM) Framework, which provides a comprehensive approach to enterprise risk management including risks also arising from natural hazards and disasters. The Sendai Framework for Disaster Risk Reduction 2015-2030 provides guidelines for organizations and other stakeholders to manage risks associated with natural disasters (UNISDR, 2015d).

Such a wide array of frameworks and concepts poses a challenge for choosing how to define the risk management of natural hazards in this study. One should also mention the evolving

dimension of the field - what constitutes risk management today, might not be the most prominent practice in a few years' time. The purpose of this section of the study is to acquaint the readers with the main concepts that are used to measure and conduct risk management of natural hazards among firms as they appear in the academic literature, and to explain why the concept of “disaster preparedness” was chosen for the operationalization of the independent variable.

As explained above, in the realm of risk management of natural hazards, there are different competing and complementary concepts existing. A good starting point to address this issue is with the different stages of a disaster. Dynes, Quarantelli & Kreps (1981) discussed the time phases of disasters, distinguishing between four noticeable phases of any disaster: the pre-disaster phase which is the regular situation; the pre-impact phase, which begins with the earliest sign of possible danger and is the time between initial warning and actual impact; the emergency phase when there is a need to respond to the immediate demands presented by the disastrous event; and the recovery phase which includes attempts to mitigate any long-term effects of the disaster event and return back to normal, everyday conditions. Much of the academic literature discussing risk management of natural hazards addresses a timeline of actions as well.

A general framework in the field of disaster risk management is disaster risk reduction (DRR) which is a framework used by the United Nations and many others, including countries, organizations, and communities, to address disaster risks. Another framework in the field is the PPRR framework of the disaster management cycle, which includes prevention, preparedness, response, and recovery. It was created in the United States as a comprehensive emergency management framework in response to the fragmentation of the field of emergency management and has been widely used but also criticized (Wenger, 2017). Vulnerability, as concept, is also widely used in the context of disaster risk reduction and natural hazards (Joseph, 2013). Becken et al. (2014) and Mahon, Becken & Rennie (2013) focus on disaster vulnerability in the tourism industry and discuss measures to reduce these vulnerabilities, specifically focusing on DRR measures.

When surveying the literature and practices, there are two main concepts that stand out as the most significant for checking how companies address the risks from natural hazards. Putting aside the concept of vulnerability, these are resilience to natural hazards and preparedness to natural disasters. As will be shown, the academic literature does not have a

single accepted definition for each of the terms; and it is apparent that some scholars include preparedness measures in the definition of resilience (Crichton, Ramsay & Kelly, 2009; Bhamra, Dani & Burnard, 2011) though a large body of literature addresses disaster preparedness and crisis management, regardless of resilience (e.g. Pearson et al. 1997, Mitroff, Pearson & Harrington, 1996; Bilić, Pivčević & Čevra, 2017). Kyne (2023) takes a different approach by examining the connection between community resilience and individual disaster preparedness. The study's findings reveal statistically significant associations between disaster preparedness and community resilience. This strengthens previous findings other studies which underscore the interdependence between the two concepts, even though the focus in this case is not on the organizational level of analysis.

Other concepts that are also commonly used are those of business continuity (Pheng Low, Liu & Sio, 2010); emergency management (FEMA, 1993); disaster recovery (Decker, 2005; Menoni & Schwarze, 2020); business agility (Harrald, 2006); crisis or disaster readiness (Light, 2008), and adaptive capacity (Gallopín, 2006, Dayton-Johnson, 2004 and Klein, Nicholls & Thomalla, 2004). Dayton-Johnson, who presents in his OECD working paper a conceptual framework for understanding natural disasters and their effective risk management by countries, defines adaptive capacity as "a combination of a society's ex ante vulnerability to damages from natural hazards and its ex-post resilience or ability to cope with the damages that result."

Light (2008) uses the concept of crisis readiness as "the desired end state of organizational preparedness, crisis management and business continuity planning all together". According to his study, crisis readiness includes emergency or disaster preparedness, emergency response, and disaster recovery all together. Huss, Sadiq & Weible (2012), too, include emergency management in an organization's preparedness to disasters. Others, such as Pearson et al. (1997) use the terms *readiness* and *preparedness* interchangeably.

Decker (2005) emphasizes the importance of preparedness for extreme events, highlighting the need for a business continuity plan that incorporates disaster recovery. Pinta (2011) underscores the integration of disaster recovery planning into the broader framework of business continuity management. Additionally, Cook (2015) takes a similar approach, proposing a comprehensive six-stage BC/DR planning cycle within a unified risk management model. Both last studies are in-line with Herbane (2010), who traces the evolution of business continuity management, as is practiced today, to the use of disaster recovery, which evolved

in the mid-1970s. As Herbane explains, the first uses of business continuity stressed the outcome of its use rather than stressing it as a planning methodology or management approach (and mentions both Gallup, 1989 and Moretz, 1989 in that regard). Today, both disaster recovery and business continuity are considered planning methods rather than ends in a structured management process. Haimes (2012b), who used a broader systems-based approach to natural and human-made disaster preparedness, response, and recovery, serves as an example of this. His approach asserts that the intricate processes involved in preparedness, response, and recovery from disasters align closely with the principles of risk assessment, management, and communication, and all these terms are viewed with regards to the resilience of a system.

The definition of disaster preparedness used by Mpekiaris et al. (2020) also focuses on the ability to recover from the disaster. For them, preparedness involves consistently implementing measures and controls to enhance the probability of recovery. These actions encompass the implementation of corrective measures to reasonably ensure the resilience of essential business processes. Their use of preparedness is linked to resilience, which will be discussed in detail in the next section.

The short review above illustrates how academic literature uses various terms to discuss risk management of disaster risks. It seems that there are two leading concepts that are in use more than others when discussing how to manage the risks of disasters prior to the catastrophic event itself, and these are *resilience* and *preparedness*.

3.2.1. The concept of *'resilience'*

Though there are many definitions to the term, resilience can be generally defined as the capacity of a system to cope or bound back from an unanticipated danger (Wildavsky, 1988). This system can be on any one of the levels of analysis, where it be a person (where resilience usually refers to his or her psychological, psychiatric or health state), a community or organization, and a whole economy or country (McAslan, 2010).

Manyena (2014) and Brown et al. (2017) explain that resilience originates from the Latin word ‘resilire’, which translates to bounce back’. McAslan suggests that the term was first used in the field of material sciences to measure and compare the strength of materials. In the field of ecology, according to Holling (1973) resilience measures “the persistence of systems and their ability to absorb change and disturbance and still maintain the same

relationships between populations or state variables." Today, as it is used in different disciplines, resilience is used to describe a desirable property of either materials and natural or human systems, including communities, organizations, and countries (Klein, Nicholls & Thomalla, 2004; McAslan, 2010).

Over the past few decades, the body of research on resilience has evolved and greatly expanded, taking on various interpretations across the different scientific disciplines, such as ecology, physics, engineering, and many fields of the social sciences, such as economics, psychology, sociology, anthropology, public health, geography, organizational studies, and disaster management (Tierney, 2003 and Shim & Kim, 2015). Carrio Carro, Castro Delgado & Arcos González (2019) claim that resilience has emerged in recent years as a key concept in disaster risk management.

Since the 1970s many scholars have discussed the term; many of them stressing resilience in terms of a system's ability to survive, withstand, cope with, respond or recover from a (natural) disaster, extreme event, major disruption or failure (Manyena, 2006; Berke & Campanella, 2006; Cutter et al. 2008; Buckle, Mars & Smale, 2000; Tierney & Bruneau, 2007). Rose & Krausmann (2013) use the concept of economic resilience in terms of the ability to recover from a shock. Hence, resilience is not defined in terms of pre-determined preparedness characteristics but rather in terms of how the business recovers from the disasters. Haimes (2009) adds that it is not enough just to survive the disruption, but also to withstand it with acceptable costs and in a framed timeframe.

Other scholars have emphasized the circumstances allowing a system to be resilient. For instance, in Dovers & Handmer's (1992) view, the circumstances are not only external to the system, but internal. They discuss three types of resilience: (1) resistance to change and maintenance of the status quo; (2) adjustment or change at the margins, and (3) flexibility and openness in response to change. They suggest that societies that rely on the first two types of resilience may find it difficult to adapt to totally different circumstances as reactive measures are not always enough. Therefore, proactive measures and the use of planning ahead to confront hazards are necessary.

Rose (2004, 2007) and later Cutter et al. (2008) stress the variance that exists between *inherent* resilience, which refers to the existing ability to deal with crises, and *adaptive* resilience, which refers to the ability during a crisis to make the changes required to absorb the impacts of an extreme event. This view has also been put forward by Tierney & Bruneau

(2007), who mention the issue of disaster resistance and stress the need to practice pre-disaster mitigation measures to reduce the losses and ensuing disaster.

A popular definition of the term resilience is that of the 2009 UNISDR Terminology on Disaster Risk Reduction (UNISDR, 2009), which defines resilience as "the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions." Additionally, definitions that include adaptation measures (Comfort, 1999) and vulnerability (Paton & Johnston, 2001), have been constructed as well. By some, resilience has been described as the opposite or the other side of vulnerability (Graveline & Grémont, 2017). Zhang, Lindell & Prater (2009) elaborate four dimensions of business vulnerability: capital vulnerability, labor vulnerability, supplier vulnerability and customer vulnerability. Each dimension can negatively affect the business once a disaster hits and affects business operations. Sheffi & Rice (2005) explain that by decreasing vulnerability, a business can increase its resilience and lower the likelihood of a disruption. For further elaboration on the evolution of the term resilience and its different definitions, see Manyena (2006), de Bruijne, Boin & van Eeten (2010), Bhamra, Dani & Burnard (2011), Bergström, van Winsen & Henriqson (2015), Hosseini, Barker & Ramirez-Marquez (2016), and Carrio Carro, Castro Delgado & Arcos González (2019).

For the purpose of this study, it was important to see how the concept of resilience has been applied to corporations and whether it can be used as an operational definition in the context of corporate risk management. The literature on resilience to natural hazards on the firm-level of analysis can be identified in several fields in the social sciences, such as disaster and crisis management (Santana, 2004), organization and management sciences, and economics (de Bruijne, Boin & van Eeten, 2010). While not all scholars make this distinction, each field emphasizes different elements and features of resilience. Tierney (2003) suggests four interrelated dimensions to the term *resilience*: technical, organizational, social and economic. The technical dimension offers to identify and measure resilience through system performance and the interrelations between key functions of the system, such as the use of utilities, communications, and transportation (de Bruijne, Boin & van Eeten, 2010). The organizational dimension refers to the organizations' capacity to reduce disaster vulnerability and impacts through their decision-making process and practices. The social dimension of resilience refers to the factors that reduce any negative social or community consequences of

disasters, while economic resilience refers to the capacity of either firms and local, regional, and national economies to “absorb, contain, or reduce both direct and indirect economic losses resulting from disasters.” (Tierney, 2003)

Scholars such as Rose (2004), Rose & Liao (2005), Briguglio et al. (2009), Graveline & Grémont (2017), Rose & Krausmann (2013), and Hallegate (2014) address the concept of economic resilience, which is also relevant to companies, but also to other types of entities. This field of research seeks to measure the economic impact of a disaster on a system, either prior to a disaster by modeling the effects or after a disaster by determining the resilience of the system. The focus is on the system's economic indicators, such as damage costs and revenue losses brought on by business interruption.

While it is both possible and crucial to delve into the economic aspects of resilience and the various dimensions proposed by de Bruijne, Boin & van Eeten, this dissertation primarily concentrates on the risk management practices of firms. The economic ramifications largely stem from how organizations handle their risks. While all the facets of resilience outlined above hold significance and merit investigation for a comprehensive understanding of organizational resilience, when specifically examining how corporations manage their risk, scrutinizing practical approaches becomes of importance. In this context, the academic literature predominantly emphasizes organizational resilience.

In this context, Rose (2007) emphasized that building resilience in organizations is closely tied to crisis and continuity management, highlighting the link between disaster management and broader organizational and management sciences. However, Denyer (2017) presents a different perspective, viewing organizational resilience as “the capability to foresee, prepare for, respond to, and adjust to both gradual shifts and sudden disruptions.” Lee, Vargo & Seville (2013) characterize resilience within organizations as a multifaceted sociotechnical phenomenon that deals with how individuals or groups navigate uncertainties. They view organizational resilience as a dynamic goal that requires adapting to shifting circumstances. This viewpoint aligns with Hamel & Valikangas (2003), who see resilience as the ability for ongoing reconstruction, involving innovation in organizational values, processes, and behaviors to prioritize long-term sustainability over short-term change.

This dynamic and systemic view is also in line with Quendler (2017) who suggests that achieving operational resilience entails addressing operational risk across multiple dimensions simultaneously. Such a practice would encompass aspects such as people, technology,

information, facilities, supply chain, management, and both cyber and physical dimensions. The view is of an organizational system, conceived as an interlinked network of systematically arranged systems working collectively to provide a product or service.

Annarelli & Nonino (2016) raise the question addressed in this study of why some organizations successfully overcome shocks while others are not able to do so. In their literature review on organizational resilience, for the purpose of creating a bibliographic analysis, they define organizational resilience as follows:

> "Organizational resilience is the organization's capability to face disruptions and unexpected events in advance thanks to the strategic awareness and a linked operational management of internal and external shocks. The resilience is static, when founded on preparedness and preventive measures to minimize threats probability and to reduce any impact that may occur, and dynamic, when founded on the ability of managing disruptions and unexpected events to shorten unfavorable aftermaths and maximize the organization's speed of recovery to the original or to a new more desirable state".

For a clearer comprehension of organizational resilience, Mallak (1998) dissected the concept into seven principles: (1) perceive experiences constructively; (2) preform positive adaptive behaviors; (3) make sure there are sufficient external resources; (4) extend the boundaries of decision-making; (5) engage in bricolage; (6) cultivate a tolerance for uncertainty; and (7) create virtual role systems.

Petak (2002) has also illustrated the framework of achieving organizational risk management with reference to earthquakes. Figure 3.1, based on Petak's work, highlights the various factors that influence risk management decision-making within organizations. Petak emphasizes that decision-makers must consider a range of elements, including the organization's mission, goals, and administrative capabilities, such as structure, processes, rules, and resources. The process further involves defining the acceptable levels of business risks, evaluating the vulnerabilities of the business, understanding stakeholder expectations regarding risk, considering alternative mitigation strategies, and formulating a comprehensive risk management plan, both strategically and operationally.

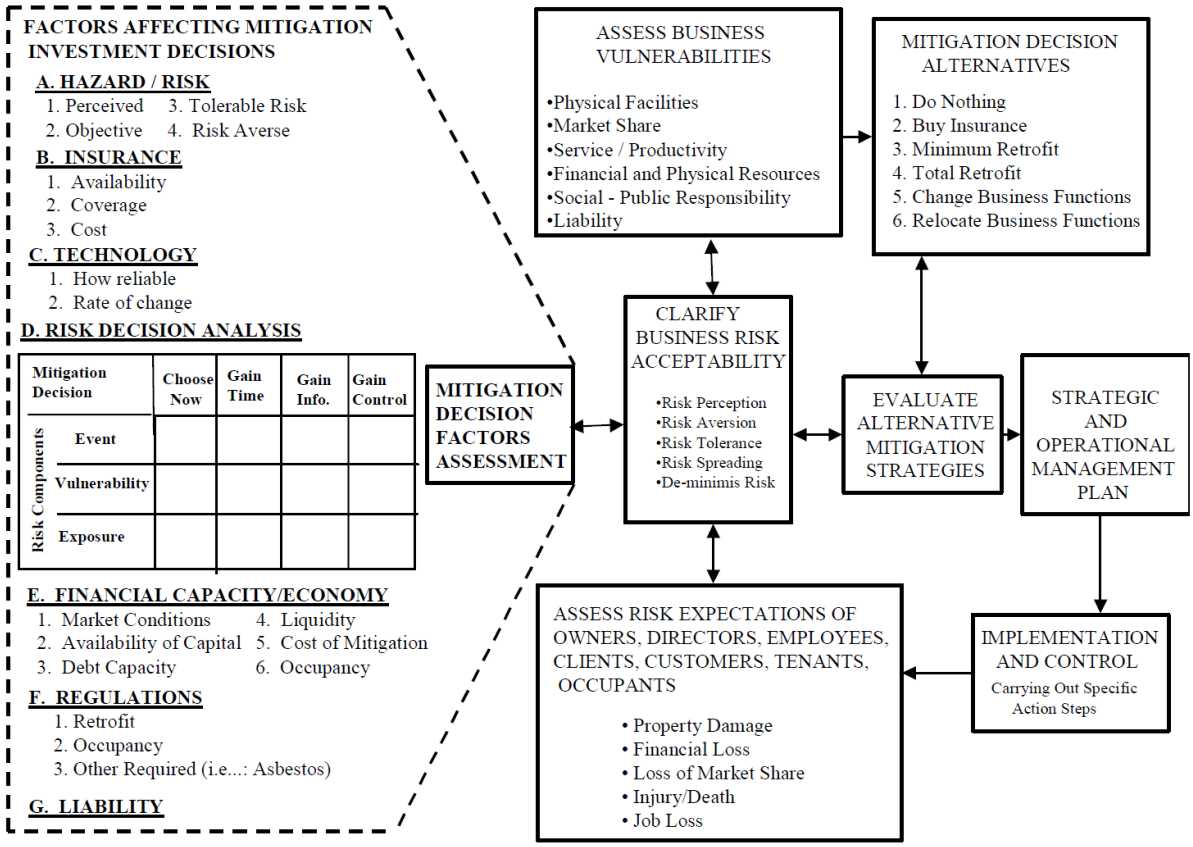


Figure 3.1. Petak's organizational risk management model

Source: Petak (2002)

Kantur & İşeri-Say (2012) propose an integrated framework for organizational resilience, as illustrated in Figure 3.2. This model encompasses several factors - perceptual stance, contextual integrity, strategic capacity, and strategic acting - that together guide an organization toward resilience. The four "R"s of organizational resilience - robustness, redundancy, resourcefulness, and rapidity, as illustrated in Kantur & İşeri-Say's model – should enable the organization to attain evolvability by encompassing recovery, adaptation/continuity, and renewal aspects.

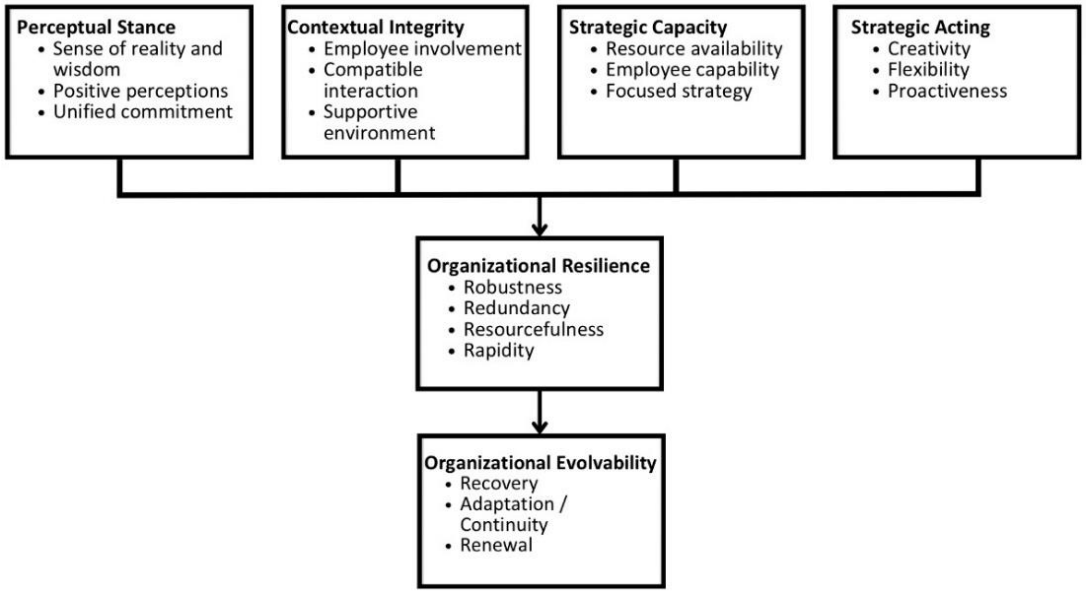


Figure 3.2. An integrated framework for organizational resilience

Source: Kantur & İşeri-Say (2012)

Some scholars address organizational resilience from a wide perspective. For instance, Seville et al. (2006) suggest that organizations are interdependent, meaning that efficient management of resilience for an organization necessitates extending its focus beyond its individual operations and considering the resilience of other organizations on which it relies. Sahebjamnia, Torabi & Mansouri (2015, 2018) stress the importance of using a wider proactive approach such as the use of Integrated Business Continuity and Disaster Recovery Planning (IBCDRP) model to build organizational resilience. They suggest that organizations using IBCDRP can become much more resilient since the implementation of such planning allows critical functions of the organization to run within the predetermined maximum downtime after disruptions. Their model illustrates the connection between the different concepts in the field of disaster risk management.

For operationalizing resilience, Palzur (2024) has illustrated how many studies in recent years, with specific reference to COVID-19, have used models or indices that include several indicators to operationalize the concept of resilience. Edwards (2015) introduces a 6-level layered resilience structure as a framework for simulating and formulating disaster resilience policies. This framework includes person, family, local, private sector, local government, central government and international organizations as the six levels where each layer includes points of influence for achieving resilience. Mpekiaris et al. (2020) include several phases for an organization to achieve resilience. These phases are response to prevent, mitigate or avoid

the impact of a negative incident and restoration, which includes both recovery and resumption which lead leads to the resumption of business processes and normal operations. They include in their operational definition of resilience variables such as having flood protection infrastructure effectiveness, ability to handle hazardous materials, coping with extended power loss and extended water failure, and ask how disruptions will affect the equipment, raw materials, inventory and operations of the company.

Others focus their operational definitions on specific aspects of the organization. For instance, Hale & Moberg (2005) focus on disaster management planning in supply chains and Natarajarathinam, Capar & Narayanan (2009) address the issue of supply chain crisis management. Sheffi & Rice (2005) emphasize the crucial role of supply chains in organizational resilience, highlighting five aspects of flexibility within a company's supply chain. These include diversifying suppliers, ensuring adaptability in the conversion process, strategizing distribution channels, implementing effective control systems for prompt corrective actions, and fostering a corporate culture capable of addressing disruptions. The authors stress the importance of situational awareness during disruptions, advocating for empowered employees who can take initiative and respond swiftly.

Like Sheffi & Rice, who take a practical approach, others as well focus on the different tools and methodologies available to achieve operational resilience. For instance, McManus et al. (2008) have introduced a resilience management process to provide practical tools for achieving improved organizational resilience. They concluded from a 10-case study research that resilience "is a function of an organization's overall situation awareness, management of keystone vulnerabilities, and adaptive capacity in a complex, dynamic, and interconnected environment" and accordingly designed a process for improving organizational resilience.

Lee, Vargo & Seville (2013) created a survey instrument designed for organizations to assess their strengths, weaknesses, and the efficacy of their resilience strategies and investments. The survey evaluates organizational resilience based on two factors: planning and adaptive capacity. It employs a set of 13 indicators (53 items), which are shown in Table 3.2.

Table 3.2. Indicators to measure organizational resilience

Factor	Indicator
Adaptive Capacity	1. Silo mentality 2. Capability and capacity of internal resources 3. Staff engagement and involvement 4. Information and knowledge 5. Leadership, management, and governance structures 6. Innovation and creativity 7. Devolved and responsive decision making 8. Internal and external situation monitoring and reporting
Planning	9. Planning strategies 10. Participation in exercises 11. Proactive posture 12. Capability and capacity of external resources 13. Recovery priorities

Source: Lee, Vargo & Seville (2013)

Brown et al. (2018) also developed a disaster resilience framework to assess hotels' resilience using this survey instrument. The paper operationalized disaster resilience using a capital-based approach, which is based on the assertion that a hotel's capacity to sustain or recover from a disaster and ensure the safety of staff and guests relies on resources from various areas. This is why an integrated capital approach served Brown et al. as a starting point for discussing multiple resilience aspects crucial to the hotel sector. Their integrative framework includes six types of capitals: economic capital, social capital, human capital, physical capital, natural capital, and cultural capital, all of which are predictors for a hotel's resilience to disasters.

This framework, the DRFH, was later used by Brown et al. (2019) in a survey among hotel staff and managers. 19 predictors are included in the DRFH as a foundation for quantitative assessment of disaster resilience in the hotel industry. These predictors were then broken down into around 40 survey questions to assess the resilience of the hotels in all types of capital (Brown et al. 2019). Figure 3.3 below lists the different predictors used in the DRFH.

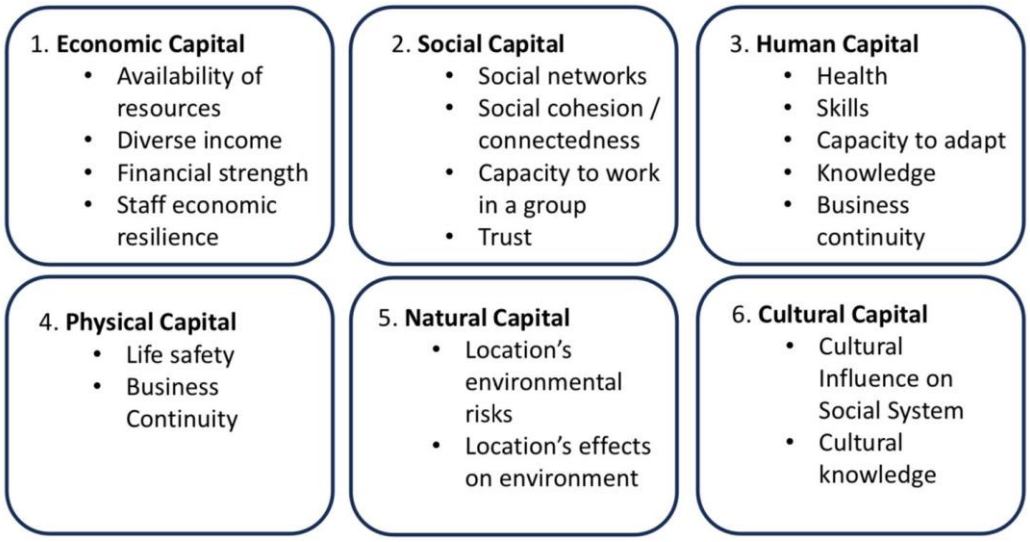


Figure 3.3. Disaster resilience framework for the hotel sector

Source: Brown et al. (2019)

In the hotel industry, one other framework for operationalizing resilience includes the Hotel Resilient Initiative, which was initiated by the UNISDR in 2013 to improve disaster risk management and strengthen resilience in the tourism sector by developing internationally recognized standards for hotels and resorts (UNISDR, 2015a). The initiative was launched in response to the findings of the UNISDR Global Assessment Report 2013, which identified the tourism sector as one of the most vulnerable to disasters (UNISDR, 2015b). It seeks to create globally recognized standards for hotels and resorts to minimize their exposure to risks associated with natural and technological hazards. These standards serve to showcase the hotels' and resorts' level of preparedness and safety to potential clients, insurers, and financiers. The World Bank (2020) has also developed a Resilient Tourism Framework that aims to build knowledge of how and why the tourism sector is vulnerable to disaster and climate risks and raise awareness of disaster and climate risks in the tourism industry.

As the literature review showed, there are scholars who use resilience indices to measure organizational resilience to disasters. The example brought earlier in the chapter was that of Ismiyati & Lestari (2020) who used the Tourism Resilience Index to assess disaster preparedness among hotels and resorts. There are many others who use indices to quantify resilience in the wider literature on resilience (such as Briguglio et al. 2009; Bakkensen et al. 2017; Noy et al., 2020; Pozhidaev, 2021; Diop, Asongu & Nnanna, 2021; Jiang, Wang & Zhao, 2022). Yet these were found less relevant to this study on the hotel industry.

This concluding section has illustrated how the literature employs operational resilience as a metric for assessing organizations' risk management in various crisis scenarios. The subsequent section will introduce the concept of disaster preparedness and provide instances of its operationalization in scholarly works.

3.2.2. The concept of '*preparedness*'

The first issue when addressing the concept of *preparedness*, is preparedness for what? As the definitions vary according to the *what* (disasters, crises, emergencies), it would be useful to reiterate that here the focus is on disaster preparedness when sometimes the literature illustrates that scholars use disasters, crises and emergencies or catastrophes interchangeably. Once the essence is the same, the issue of terminology is less of an issue. Dahlhamer & D'Souza (1997) bring a generalized definition of preparedness to include activities with the capacity to preserve lives, minimize property damage, and mitigate the adverse consequences of disaster events, including prolonged disruptions to business operations. Essentially, preparedness plays a pivotal role in enhancing the control individuals, organizations, and communities exert over the ensuing disaster response.

Concentrating on strategic preparedness, Haimes (2012a) proposes that preparedness entails a collection of policies, plans, and accompanying infrastructure proactively implemented before a natural or human-made disaster. The goal is to minimize adverse consequences, such as response and recovery time or costs, and reduce the likelihood of consequences to an acceptable level. Perry & Lindell (2003), who focus on community preparedness, see preparedness as the readiness of political jurisdiction to interpret environmental threats constructively, minimizing adverse impacts on individual health, safety, and the integrity of systems and physical structures. Community emergency preparedness encompasses planning, training, exercising, and acquiring the necessary equipment and resources to be ready for the emergency.

While preparedness is generally seen as efforts to enhance both response capabilities and coping skills, there are two main approaches to the use of term preparedness to disasters. One sees preparedness as being part of a wider strategy to address emergency, disaster, or crisis management (Pearson & Mitroff, 2000; Drabek, 2007; Lin Moe & Pathranarakul, 2006; Faulkner, 2001) while the second focuses solely on preparedness as a framing concept, which

includes the other aspects as well (Castillo, 2004). This all depends on the definition and the context used.

The literature on the definition of disaster preparedness can be confusing sometimes. Castillo (2004) describes the disaster preparedness model at Boeing, which aims to protect businesses from potential threats that could disrupt operations. The model comprises of three components: preparedness, response, and recovery, meaning that preparedness is just the first component of the model, yet the title of the model is disaster preparedness. Here, preparedness involves training and disaster drills to handle events effectively and periodical evaluations to identify weaknesses and enhance effectiveness. This point exemplifies the importance of looking into the composites of the models, and not only look at their titles.

If we look at preparedness as part of a wider strategy to address disasters, some scholars perceive preparedness as the pre-disaster initiatives taken by organizations to withstand and recover from anticipated disasters (Dahlhamer & Reshaur, 1996; Tierney & Dahlhamer, 1995) where there are also other stages to address. Gillespie & Streeter (1987) see preparedness as a time-ordered phase in the disaster management continuum, occurring after mitigation and before the actual impact of a disaster event. It signifies a state of readiness for response, involving intentional and anticipatory actions. Preparedness implies understanding appropriate behaviors, emphasizing the importance of training and practice, and encompassing the capability to achieve specified objectives. Murray & Watson (2019) use prevention, mitigation, and preparedness all as elements of natural disaster risk management.

Schneiderbauer & Ehrlich (2004) depict the disaster management cycle which has a distinct pre-disaster preparation phase and a post-disaster response phase. They suggest that disaster preparedness and emergency actions focus more on the short-term, while recovery, development and mitigation of future risk address the long-term. Lin Moe & Pathranarakul (2006), which proposed a disaster and emergency management model, presented an integrated approach with a proactive and a reactive strategy. They include in their proactive strategy mitigation, preparedness, and disaster warning tools.

Acknowledging that disasters are phased event where community needs and functioning modes change over time as the disaster event unfolds, Quarantelli & Tierney (1979), lays the groundwork for understanding how emergency preparedness strategies can and need to adapt over time. In a more recent context, Puryear & Gnugnoli (2023) explore the key aspects of emergency preparedness within the fields of health and medicine. They outline a

comprehensive three-stage approach that encompasses planning, response, and recovery. Other scholars, like AlBattat & Mat Som (2019) address the issue of disaster and emergency planning and preparedness, through which organizations design ways to prevent, reduce, mitigate, and allow better preparedness to disasters. They point out that understanding disaster risk and vulnerability is required to develop the necessary reduction and mitigation measures.

Other scholars address preparedness within the issue of effective crisis management. For instance, Faulkner & Vikulov (2001) and Ritchie (2004) include six stages for effective crisis management for the hotel industry: the pre-event phase which focuses on planning and prevention; the prodromal phase when the need to activate the preparedness plan occurs; the emergency phase when the actual hazard becomes a crisis; the intermediate phase where additional emergency measures are adopted to mitigate the consequences of the event; the rehabilitation phase where disaster relief and disaster recovery take place and finally the resolving phase, where the preparedness plan that was implemented is reevaluated and refined and improved for future use.

It should be noted that other emergency or disaster management models do not use the term "preparedness". For instance, Evans & Elphick (2005) address the crisis management process and mention the '4 Rs' of a four-stage process which includes reduction, readiness, response, and recovery. From Drabek's (2007) four-stage emergency management model, which includes mitigation, preparedness, response, and recovery, it seems that for the purpose of having a catchy 4 "R"s, preparedness was exchanged for *readiness* and mitigation was exchanged with *reduction*. Drabek points to the need to prepare disaster vulnerability analyses and according to the results, take appropriate action.

Traditionally, preparedness models have been seen as the creation of emergency plans, a sort of one-time goal. Quarantelli & Tierney (1979) suggest looking at preparedness differently, as an ongoing and dynamic process rather than a fixed outcome. This broader view includes a variety of activities aimed not only at outlining emergency actions but also at preventing disasters, reducing their likelihood, and mitigating their adverse impacts on communities. Within this framework, preparedness involves several steps: hazard assessment, policy formulation, coordination of emergency plans, and participation in diverse preparedness activities such as drills, training, and public awareness campaigns.

AlBattat & Mat Som (2019) describe the disaster preparedness cycle within the hotel industry as a series of connected activities that continuously improve response readiness. Instead of seeing preparedness as a one-time task, they view it as a system where different functions are consistently prioritized to optimize the allocated resources. This preparedness cycle includes planning, organizing equipment, training, conducting exercises, and concluding with evaluation or improvement. Additionally, Lindstedt (2012) introduces a model to measure a unit's degree of preparedness to recover from a disaster. The author emphasizes that preparedness is not just a final goal; rather, it is a crucial approach to enhancing a business's ability to bounce back after an emergency. The process requires identifying the resources, procedures, and competencies (RPCs) that make recoverability. These three concepts need to be in place for preparedness to exist. Lindstedt asserts that "recovery preparedness is not the same as readiness, resilience, survivability, or any other all-embracing concept."

When examining how disaster preparedness is defined in the literature, it becomes clear that a variety of approaches are relevant to this study. It should be noted that Lorenzoni et al. (2022) highlight a lack of standardized approaches and consensus concerning the components and assessment tools for disaster preparedness. Their scoping study reveals the side range of concepts and tools applied in assessing government-level disaster preparedness. These often focus on specific contexts like legal aspects, logistics, and emergency plans. They also emphasize the inconsistent terminology in the field, referencing the widely recognized United Nations definition of preparedness: "The knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions." (UNISDR, 2009).

Perhaps one way to explain this lack of standardization is through what Quarantelli & Tierney (1979) argued decades ago that the characteristics such as frequency, predictability, controllability, speed of onset, and length of forewarning associated with disaster agents (e.g., hurricanes, floods, explosions) make disaster preparedness rules or practices location specific. This requires each community to tailor its disaster preparedness planning by considering its own unique set of hazards. This view has also been highlighted by Ritchie & Jiang (2021) who argue that the hospitality sectors, encompassing accommodation, food and beverage, casinos,

etc., each possess distinctive characteristics that should be considered when evaluating risk, crisis, and disaster management.

Nevertheless, there have been attempts to find a generalized operational definition of preparedness for disasters. Gillespie & Streeter (1987) operationalize preparedness as the mean score of seven items: having an emergency plan, plan update, past training, past simulations, future training, future field exercise and understanding of the Integrated Emergency Management System (IEMS) concept. Gillespie et al. (1993) gauged preparedness using a 28-item index, comprising 7 physical items, 6 planning items, 7 training items, 4 financial items, and 4 community items. Physical preparedness evaluates the emphasis on the physical safety of buildings in organizational plans; planning preparedness evaluates the focus on internal disaster planning within organizations; training preparedness assesses the prioritization of disaster training for staff and volunteers; financial preparedness evaluates the emphasis on raising and allocating funds for disasters; and community preparedness assesses the importance placed on disaster education and community involvement to mitigate the impact on life, injury, and property damage.

Murray & Watson (2019) used four indicators to measure natural disaster preparedness: emergency procedures documented, emergency procedures implemented, business continuity plan implemented and utilities redundancy. In the study, emergency plans encompassed evacuation arrangements, training schedules, and communication measures. The inclusion of evacuation arrangements was deemed essential for regulatory compliance. Implementation, evaluated separately, involved dissemination, training, drills, and testing. Evacuation plan drills were the minimum for implementation. Business continuity plan implementation included data backup, alternative locations, and key personnel arrangements. Responses were quantified, with adoption scored as 1 and partial implementation as 0.5, accounting for plans in progress, notably for business continuity and utilities redundancy.

Wu (2024) outlines eight key dimensions for natural disaster preparedness guidelines in the context of regional business engagement. These guidelines empower community groups and businesses to actively participate in planning, management, and public-private partnership actions related to local disaster preparedness issues. Wu includes hazard knowledge, management, direction, and coordination; formal and informal response plans and agreements; supportive resources; life-safety protection; property protection; emergency

coping and restoration of key functions; and initiation of recovery as the dimensions where each dimension includes a set of activities to be implemented.

The operationalization of preparedness conducted by Mpekiaris et al. (2020) is also of interest here as the survey they conducted for Greek companies required creating indicators for natural disaster preparedness. Operationalizing preparedness included 18 questions divided into two categories: (1) the environmental business surroundings (like being in high seismic or flood-prone areas) and the legal compliance of the companies (like holding the necessary permits), along with (2) the measures taken within the companies during routine operations (such as insurance policy, safety systems and having secondary production sites/locations). Table 3.3 lists the 18 elements of natural disaster preparedness as they appear in the Appendix of Mpekiaris et al. (2020):

Table 3.3. Mpekiaris et al.'s operationalization of natural disaster preparedness

Stage	Questions
Surroundings and legal compliance	Is your company in a high seismic activity area?
	Were there any prior flood events in the vicinity of your company?
	Is there any flood protection infrastructure in the vicinity?
	Do your operational facilities operate inside an urban planning area?
	Is the land use in compliance with legislative framework in force?
	Are there any industries handling hazardous or flammable materials (i.e. refineries, gas stations, chemical plants etc.) in the vicinity?
	Was there a construction permit issued before construction of your company's facilities?
	Have your company's facilities been built according to the issued construction permit (are facilities legally built)?
	Have any construction discrepancies occurred?
	Does your company have a legal operation permit?
	Do you provide a safe and healthy working environment for your employees in accordance with legal requirements?
Measures taken within companies	Is there an insurance contract covering the firm against catastrophic and emergency situations?
	Are there any safety systems in place?
	Are there any heavy machinery and/or sensitive equipment on site?
	Are there any emergency exits?
	Are there any backup copies of important documents stored in a safe location?
	Is there a secondary production site/location - available on demand - to host business operations in case of damage at the primary facility?
	Are there any business continuity and/or restoration plans in place for your company's operations in case of a catastrophic event?

Source: Mpekiaris et al. (2020)

Like Mpekiaris et al. (2020), Wu, Xia & Bao (2021) also address preparedness, though they specifically focus on hotel emergency preparedness. Emergencies denote multi-crises and disasters such as natural disasters, epidemics, terror attacks, along with emergencies resulting from internal factors in the responsibility of the hotels themselves. As mentioned in the literature review, their study defines emergency management preparedness using a Prevention, Preparedness, Response and Recovery (or PPRR) cycle.

This framework defines several strategies and actions in the pre-disaster/crisis (formal planning, early warning systems, disaster/crisis plan, safety training programs, community engagement and disaster insurance), during the disaster/crisis (rescue/evacuation procedures, emergency supplies, multi-language evacuation maps, communication strategies, monitoring strategies, disaster drills), and post-disaster/crisis (records, protection plan, damage assessment, business continuity management, recovery plan) stages, for the operationalization of emergency management. Table 3.4 lists the 17 elements of emergency management preparedness as they appear in Wu, Xia & Bao, divided into the three stages of a disaster/crisis:

Table 3.4. Emergency management preparedness actions and strategies

Stage	Strategies/ Actions
Pre-disaster/crisis	**Formal planning**: Do your hotel have a formal written emergency management plan? **Early warning system**: Does your hotel have early warning system? **Disaster/crisis plan**: Has the plan been revised annually? **Safety training programs**: Does your hotel have regular safety training program? **Community engagement**: Does your hotel participate in community-based disaster preparedness activities? **Disaster insurance**: Does your hotel purchase any insurance against disaster/crisis?
Disaster/crisis	**Rescue/evacuation procedures**: Does your hotel have specific evacuation procedures against disasters? **Emergency supplies**: Does your hotel have emergency supplies stored in case of disasters? Are the materials sufficient to sustain at least 72 hours after a disaster? **Multi-language evacuation maps**: Does your hotel provide multi-language evacuation maps? **Communication strategies**: Does your hotel have a list of people who are competent in different languages? **Monitoring strategies**: Does your hotel have a formal document in which emergency authorities are set for certain people? **Disaster drills**: Does your hotel have disaster drills?

Stage	Strategies/ Actions
Post-disaster/crisis	**Records**: Does your hotel have special provisions for protecting accurate documentation of organizational assets and equipment in the event of a disaster? **Protection plan**: Does your hotel have a plan in place to protect the assets in the event of a disaster/crisis? **Damage assessment**: Does your hotel have procedures for damage assessment after a disaster/crisis? **Business continuity management**: Does your hotel have business continuity planning after a disaster/crisis? **Recovery plan**: Does your hotel have recovery plans for the main disasters or crisis?

Source: Wu, Xia & Bao (2021)

One other operational framework for managing risks in the tourism sector was constructed by the Asia-Pacific Economic Cooperation (APEC) International Centre for Sustainable Tourism. Their APEC International Centre for Sustainable Tourism guide focuses on tourism risk management, which provides detailed advice on how to manage risk in the tourism industry. Like many other frameworks, this framework for crisis management for tourism operators and destinations also includes four stages: prevention/mitigation, preparedness, response, and recovery. Preparedness here refers to developing plans and programs, establishing systems and procedures, and conducting training and testing. The goal is to ensure that, in the event of a crisis, resources (both personnel and equipment) can be efficiently mobilized and deployed. This is aimed at minimizing the impact of the crisis and facilitating the return to regular tourism operations (Robertson, Kean & Moore, 2006).

Another operation definition of disaster risk management has been offered by UNEP (2008), which has developed a practical guide for decision-makers on disaster risk management specifically for coastal tourism destinations responding to climate change. The guide outlines a range of options that tourism destinations should consider for mainstreaming risk reduction in post-disaster recovery.

This chapter has presented numerous studies on disaster preparedness, emphasizing the various definitions of preparedness and resilience in the context of natural hazard and disaster risk management. The dependent variable utilized in the study will be defined in the next chapter, along with a description of the methodology and explanatory variables.

Part II. Comparative study on the risk management of natural hazards in Greece and Israel

Chapter 4. Methodological considerations

Following the theoretical framework of Chapter 2 and literature review brought in Chapter 3, Chapter 4 will acquaint the readers with the research undertaken by the author of this dissertation, from introducing the research approach and design, the hypotheses of the study and the data collection methods.

4.1. Research approach and design

This dissertation follows the postpositivist worldview, as it aims to identify and assess the causes that influence outcomes by using observations to test theories (Creswell, 2014). The author of this dissertation uses a quantitative research approach, taking hotels as the sample units for scrutiny. As the purpose of this study is to find the determinants of risk management of natural hazards among hotels, it was possible to conduct a qualitative study focusing on several case studies. Such a study would utilize interviews and the collection of detailed information from each participating hotel to directly compare the competing rival hypotheses and assess causal inference between the variables (Yin, 2018). Yin explains that the benefits of case study analysis include the ability to cope with the situation where there are more variables of interest than data points, as the theoretical chapter illustrated is the case here.

At first, there was a thought to adopt a mixed research method, integrating a quantitative survey with in-depth interviews among a selection of several hotel managers. However, given the nature of the study, initial indications suggested that hotels would not be willing to expose sensitive information regarding their preparedness to natural hazards, as sharing this information, if found not very flattering, might affect their business, as suggested in the literature on the subject as well (Wieczorek-Kosmala, Błach & Groczyńska, 2014; Jain, & Raithatha, 2022).

First, finding out that the hotel is not prepared for natural hazards would require investments that the hotel might not currently be willing to undertake, despite the implications of such a decision. This relates to Heinle & Smith (2017), who found in their study that disclosing information on systematic risks affects the cost of capital of firms. Second, corporations are always fearful that sensitive information shared with others, including

academic institutions, would leak and the public would use this information when choosing service providers, investment possibilities, and in the hotel industry, choose a more secure hotel.

These two facts suggested that the hotels which would tend to agree to an in-depth evaluation, would be those who have no problem in the first place disclosing information about their disaster risk management strategies. Hence, creating a bias in the selection process of a possible qualitative or mixed-method study of the dependent variable. This situation is to be avoided in case study research (King, Keohane & Verba, 1994). Given these considerations, the preferred research approach was conducting only a quantitative anonymous survey among hotels which will be elaborated below.

The utilization of the quantitative method in this study enables statistical inference, providing the capacity to derive general conclusions about hotels based on data collected from the sample. With a sufficiently large sample size, the study can create inferential statistics to test hypotheses, predict outcomes, and suggest generalizations extending beyond the observed sample. Hence, through the use of statistics, the research can contribute to enhancing the broader theoretical comprehension of the field, offering insights that extend beyond the specific context of the study. The statistical techniques and models used in the study will be outlined in Chapter 5.

Types of hazards

Having to choose on which types of hazards (as discussed in Chapter 1) to focus, there were two points in mind taken into consideration, as explained below:

1) The types of natural hazards that will be part of this study are earthquakes, tsunamis, wildfires, and pandemics. While floods and landslides and weather-related hazards such as extreme heat, droughts, storms, extreme winds, and heavy snow were included in the survey that was circulated among hotels, there were methodological problems addressing these hazards in the analysis. For instance, while all weather-related hazards were grouped together in the survey (to reduce the size and complexity of the questionnaire), this complicated the integration of the hazards. Mapping very different types of hazards would require a silo approach and having the hazards grouped together in the survey did not allow comparison among them.

To complicate things further, the hotels included in the survey did not indicate their precise location (this was requested by the Israeli Hotel Association in Israel which circulated the questionnaire among the hotels). They only indicated the name of settlement, regional council, or island they are on - therefore, methodologically it was very problematic to include hazards, which require precise location to understand the impact of the hazards, in the econometric analysis.

2) It should be noted that the study also includes security crises as a source of extreme events or disasters for hotels. While security crises are not naturally occurring phenomena, given the fact that the countries included in this study do face several security issues as described later that can potentially deteriorate to disasters, it was found to be a useful addition to comparing how hotels perceive and prepare for natural hazards versus hazards arising from acute security issues.

Dependent variables

Preparedness was chosen as the dependent variable. The literature on corporate risk management of natural hazards, which was surveyed in the previous chapter, demonstrates the use of both resilience and preparedness concepts to operationalize risk management.

Resilience is acknowledged as a more comprehensive and multidimensional concept, encompassing various organizational layers and facets. There was a dilemma whether to follow the Brown et al. (2018) capital-based approach for disaster resilience, just as Ivkov et al. (2019) did, or to use the preparedness framework, as proposed by Mpekiaris et al. (2020) or Wu, Xia & Bao (2021). Despite the comprehensive nature of the resilience approach, several terminological and methodological considerations, which will be discussed below, led to the selection of preparedness as the variable of choice for this dissertation, focusing on specific actions necessary to address different stages of a disaster.

There were several reasons to use the framework suggested by Wu, Xia & Bao (2021). First and foremost, resilience, as a concept usually consists of addressing the ability of an organization to bounce back and at times, takes into consideration the concept of vulnerability. Lee, Vargo & Seville (2013) state that organizational resilience hinges on effective leadership, a comprehensive understanding of the operational context, the capability to adapt to swift changes, and adept management of vulnerabilities. The characteristics or indicators of a resilient organization relate to the organization's

susceptibility to a specific threat (Bakkensen et al., 2017), therefore an assessment of the organization's vulnerability will also be required. If we revisit the objective of this study - to explore how corporations manage natural hazards - opting for resilience as the operational variable would encompass broader concepts beyond the natural hazard itself.

Second, there are also three methodological considerations for adopting the framework suggested by Wu, Xia & Bao rather than that of Brown et al. (2019) or Mpekiaris et al. (2020). These considerations are:

1) **Keeping the survey short and raising its completion rate**: In comparison to Brown et al. (2019), Wu, Xia & Bao utilized approximately half the number of questions in their survey to define their dependent variable. This can have considerable effects on a survey's completion rate. Given that operationalizing resilience involves examining various components of the organization beyond a mere list of activities and strategies as done for preparedness, it is logical that measuring resilience necessitates a more extensive survey. Wu, Xia & Bao are comparable in this regard with the number of questions brought by Mpekiaris et al. (2020) for operationalizing preparedness. However, if we discuss the issue of enhancing the survey completion rate, it should be mentioned that several of the questions included in the Mpekiaris et al. study would probably deter hotels from completing the survey as answering no could potentially mean that they are violating the law – something no one rationally would admit in an online survey.
2) **Simplifying the survey**: Conducting a survey on the preparedness of hotels to several different types of natural hazards individually required some thought on how to simplify the questionnaire without creating repetition for each type of hazard. Repetition would most likely affect the number of individuals who would complete the survey. Following the use of dichotomous, yes or no questions, as done by Wu, Xia & Bao, allows creating a matrix of questions in the survey, where the respondents would mark the box for 'yes' or leave empty for 'no'. Having multiple-choice questions with a five-point Likert scale for each question, as used by Brown et al. (2019), would not allow integrating all the hazards into a simple accessible table, but rather would require repeating the survey for each type of hazard separately, and possibly decrease the completion rate of the survey. The methodology brought by Mpekiaris et al. did not differentiate between different types of disaster events but rather searched for a general preparedness level.

3) **Questions focusing on the scope of this study:** While Mpekiaris et al. did use yes or no questions for operationalizing preparedness and it could have been a good academic idea to adopt their methodology to conduct a more in-depth analysis on a specific sector in Greece, however, several of their questions were not very relevant to hotels or to the natural hazards included in this study (for instance floods are not taken into consideration).

It was possible to create a tailor-made survey for this study while integrating certain aspects and questions from other studies and create a new operational definition for the dependent variable however, as there are so many definitions and utilizations of the concepts of resilience and/or preparedness, the preferred approach was to choose an existing definition, if it meets the needs of the study. When no significant changes are required, one advantage of using an existing survey is the ability to compare results across different studies and settings. Expanding the sample of hotels responding to an existing survey fosters greater synergy and scientific exchange in the field. For the reasons presented above, the study adopted preparedness, as used by Wu, Xia & Bao, as the operational definition of risk management of natural hazards.

Dependent variables

Preparedness was chosen as the dependent variable. The literature on corporate risk management of natural hazards, which was surveyed in the previous chapter, demonstrates the use of both resilience and preparedness concepts to operationalize risk management.

Independent variables

The preceding chapters, encompassing theoretical and literature reviews, have clarified how extensive and diverse the academic discourse surrounding corporate risk management is. They underscore the existence of theories and rationales across the various levels of analysis. The choice of independent variables for this study follows the results of previous research, notably taking the variables which were found to explain much of the variation in corporate behavior as illustrated in Table 3.1. The phrasing of the hypotheses follows the examples given by Creswell (2014).

The independent variables have been clustered into three groups: variables external to the hotel, such as national circumstances (country), public/government assistance, the

hazardousness of the geographical location of the hotel; organizational-level variables, such as hotel characteristics; and lastly, risk perception, which is usually considered part of the individual-level of analysis. Table 4.1 categorizes the independent variables of the study into three distinct levels of analysis.

Table 4.1. Categorization of independent variables across levels of analysis

Level of analysis	Variables included in the study
External to the hotel	Hazardousness of the geographical location of the hotel; national circumstances (country), having received public/government assistance
Organizational	Size; ownership type; having an employee in charge of emergency and disaster preparedness; age and undergoing retrofit; previous disaster experience
Individual-level of analysis	Risk perception

The author posits nine hypotheses out of which each one refers to a particular variable. The justification of the hypotheses will be presented below.

Hypothesis 1 (H1): *Hotels situated in areas that are prone to higher levels of hazard magnitude or severity are expected to have higher levels of preparedness.*

Hazard severity can be ranked from low to high (Smith & Petley, 2009). The earthquake, tsunami and wildfire hazards of the different locations have been quantified and mapped for the purpose of this study. While it would have been appropriate to explain how each hazard was quantified under this hypothesis, the section detailing each hazard is quite lengthy. To ensure a smoother and more readable presentation of the hypotheses, the hazard maps and methods of quantifying hazards for each hotel location will be presented after hypothesis 9.

Hypothesis 2 (H2): *Hotels in different countries will NOT have different levels of preparedness.*

According to this hypothesis, it is suggested that country circumstances influence the degree of preparedness among hotels to natural hazards. However, to the best of our knowledge, none of the countries included in this study have legislative requirements for

hotels to prepare for disasters. General guidelines and recommendations in case of natural hazards in the hospitality sector were also not found. Both in Israel and in Greece, hotels are required to have fire safety certificates periodically renewed for them to operate (State Comptroller of Israel, 2023; EP, 2008).

The different countries have different frameworks for civil protection for action and response in the event of specific emergency events (Mavroulis et al. 2022). The Israeli Ministry of Tourism has adopted an all-hazards approach according to which emergencies are an inclusive phenomenon and therefore one must prepare for them in an integrative manner, based on the specific conditions - not of the source of the emergency incident but rather of the system or the community prepared for it. Nevertheless, there was no clear indication that this framework was translated to activities of the hospitality sector (State Comptroller of Israel, 2023). Considering the information provided, specific findings based on the country where the hotel is located are not anticipated.

Hypothesis 3 (H3): *Hotels, which have received public assistance for strengthening emergency disaster preparedness either direct funding, training of employees, or assistance for raising awareness, will present higher levels of preparedness to natural hazards.*

The GAO (2023) outlines that a strategic approach to utilizing assistance to minimize the impact of disasters on communities and alleviate costs for taxpayers involves enhancing disaster mitigation and planning initiatives, commonly referred to as building disaster resilience. In line with this perspective, the hypothesis posits that resource allocation is essential for preparedness measures, and receiving assistance in acquiring these resources will ultimately result in the execution of preparedness activities and practices.

Operationally, in this study, respondents were asked to indicate whether the hotel had received public assistance for strengthening emergency disaster preparedness. The three types of assistance included in the survey are: funding, training, and raising awareness. It was decided to index these three types of assistance under the assumption that hotels which received more than one type of assistance would be better prepared for hazards, regardless of the assistance's volume. A hotel could receive a score between 0 and 3, where 0 would indicate the hotel did not receive any type of public assistance, and 3 would indicate the hotel received all three types of public assistance as listed above.

Hypothesis 4 (H4): *Larger hotels do more to prepare for the effects of natural hazards than do smaller hotels.*

As Sadiq (2010) explained, there exists a positive correlation between the size of an organization and its involvement in mitigation and preparedness activities. In the survey of this study, hotels were asked to indicate which out of the seven categories of size (number of rooms) they belonged to: 1-15, 16-30, 31-50, 51-100, 101-200, 201-300, and 301 or above. While this information might be useful for various applications, in the statistical analysis having seven categories for one variable complicates the model, therefore in was decided to reduce the number of categories to four: 1-50, 51-100, 101-200, and 201 or above. This is similar to the division of hotel size done by Bilić, Pivčević, & Čevra (2017), who used three groupings: up to 50 units, 51-200 and more than 200 units.

Hypothesis 5 (H5): *Hotels that are stand-alone businesses in a single location are less inclined to participate in mitigation and preparedness activities compared to those that are part of a local chain or part of an international chain of hotels.*

As Quarantelli et al. (1979) explained, firms with multiple sites are more likely to engage in disaster preparedness since they tend to have corporate mandates, policy directives, and perhaps more economic resources that allow or require them to engage in preparedness activities. In this study, hotels were asked to indicate if they are family-run hotels, corporate owned single hotels, part of a local chain of hotels or part of an international chain of hotels. For a comprehensive understanding of the difference between the terms, see Ivanova & Rahimi (2016).

Hypothesis 6 (H6): *Hotels which have an employee who is specifically designated to address emergency disaster preparedness will illustrate higher levels of preparedness.*

Emergency management directors play a crucial role in developing plans and procedures to address natural disasters and emergencies. They take a lead in coordinating responses with various stakeholders, including public safety officials, elected officials, nonprofit organizations, and government agencies. The suggestion that assigning a dedicated employee

to emergency management can improve an organization's preparedness is an acknowledged principle in emergency and/or risk management (Sadiq & Graham, 2014; Renschler et al. 2016). It aligns with the idea that assigning responsibility for emergency preparedness to a specific individual or team can lead to more focused efforts, better coordination, and improved overall preparedness (U.S. Bureau of Labor Statistics, 2023). Hotels in the survey were asked to indicate if they have an employee who is specifically designated to address emergency disaster preparedness.

Hypothesis 7 (H7): *Newer hotel buildings or retrofitted hotels would be more prepared for several types of natural hazards than older hotels (mostly earthquakes and tsunamis).*

Hotels were asked to indicate in which decade or year the hotel was built and whether the hotel has been retrofitted or renovated to address the risks of natural hazards. In the theoretical review, a study by Banerjee & Gillespie (1994) suggested that the age of the firm indicates the experiences and capacity of the organization to deal with risks as longer operational histories may enhance disaster preparedness. This variable, whether addressing the physical dimensions or longer organizational experience, was not seen in the literature as an explanatory variable affecting preparedness activities.

Nonetheless, this hypothesis suggests that the physical attributes of buildings are important factors in preparedness since newer buildings tend to withstand natural hazards better than older buildings. This is largely due to advancements in construction technologies and adherence to modern building codes and standards (Rowan, 2022). Updated building codes incorporate lessons learned from past natural disasters and advancements in engineering and construction practices, so buildings that adhere to these buildings codes also incorporate updated engineering practices, improved materials, and a better understanding of the impact of natural disasters on structures (Xu et al., 2021). The adherence to building codes is mostly relevant to earthquake and tsunami hazards.

The respondents of the survey were asked to indicate when the hotel was built (year or decade). As the variable represents the age of the hotel, for those respondents who indicated a decade and not a specific year of establishment, the mid-decade year was taken as a representative year for the purpose of calculating the age of the hotel. The question regarding the retrofit of the hotel to address natural hazards, was a dichotomous "yes" or "no" question.

These two variables were included separately in the regression; both represent the physical condition of the hotel.

Hypothesis 8 (H8): *Hotels, which have previously experienced natural disaster, would be more prepared to address these natural hazards in the future.*

The literature review illustrated how previous disaster experience can play an important role among managers with regard to mitigating the effects of disasters. Hoffmann & Muttarak (2017) concluded in their study, which focuses on the Philippines and Thailand, that prior disaster experience is a key driver of disaster preparedness among individuals. Findings from the 2021 Small Business Credit survey in the U.S. suggested that firms "that had previously been affected by a similar natural disaster were more likely than firms affected for the first time to report having taken steps to address their natural disaster risk" (Funderburk & Misera, 2022). Based on this reasoning, the survey participants were asked to report whether their hotel had encountered a previous disaster (yes or no question) and specify the type of hazard they had faced.

Hypothesis 9 (H9): *Hotels that perceive the risks of natural hazards as high will be more likely to engage in preparedness activities.*

As Smith & Petley (2009) explain, individuals determine the degree of risk based on their own experiences regardless of the objective conditions. Individuals can have biases regarding the risks and their consequences, which can influence how their organization prepares for disasters (Omer & Alon, 1994). In this study, respondents were requested to answer a question regarding which types of hazards they think the hotel faces. This question was also part of the methodology suggested by Wu, Xia & Bao (2021). Another question regarding the respondents' opinion on the impacts of different types of hazards on the hotel was also asked as Wu, Xia & Bao did, however, here it was not used to operationalize risk perception.

4.2. Hazard mapping and quantifying

To address the first hypothesis, which focuses on the physical hazards hotels face due to their locations, the following section will explain how these hazards were integrated into the study's methodology.

After choosing the types of natural hazards which would be addressed in the study, due to the spatial character of natural hazards, it was necessary to collect geographical data on the hazardousness of geographical locations, meaning mapping the differentiation of each individual natural hazards per location. Such maps provide visual depictions of hazard information including information about the occurrence, location, severity, economic impact, and social impact of natural hazards (ADB, 2017).

By using geographical information systems (GIS), the vision of this study was to use layers of individual hazards on one map to see the exposure of the hazard in each location and then aggregate the risks into an all-hazard exposure index. This would allow the reader to rank locations according to their overall "riskiness". This vision was faced with a realistic problem of comparing one hazard to another. It is relatively simple to compare the hazard of earthquakes among hotels by using seismic hazard maps, as these maps provide information about the likelihood and intensity of earthquakes occurring in different regions.

However, comparing the risks associated with earthquakes with the risks associated with flooding or other natural hazards depends on the components of risk (hazard, vulnerability, and exposure) for each hotel, using the same measurement. This would involve exposure and vulnerability assessment and the use of risk modeling, as explained above, which are all beyond the scope of this dissertation. Even such tools as the Climate Mapping for Resilience and Adaptation (CMRA) Assessment tool of the U.S. Federal Government (2022) generates individual maps for each hazard, such as droughts, extreme heat, wildfire, and flooding.

There are different risk assessment tools available these days that integrate the different hazards into a united composite. For instance, the National Center for Disaster Preparedness (NCDP, 2024) at the Columbia Climate School has created the US Natural Hazards Index (the current version is known as NHI v2.0), which allows the visualization of natural hazard data for fourteen hazard types in the United States and Puerto Rico and presents a multiple hazard index. This index represents the aggregate hazard from fourteen individual hazards. These types of maps were not found to exist for Greece or Israel to allow to utilize in this study an all-hazard approach.

The Natural Hazard Data Practical Guide (ADB, 2017) effectively addresses the issue of measuring natural hazards. This measurement requires the identification of information concerning the intensity, frequency, and location of the hazards. Intensity refers to the observed or potential severity of a specific natural hazard; frequency relates to how often a hazard of a particular intensity is expected or has occurred in a specific location; and location pertains to the affected geographical area. Given that natural hazards inherently have spatial dimensions, maps are frequently employed to visually represent hazard information. In this study as well, it was important to create maps conveying the different levels of each natural hazard to allow a comparison between the hotels included in the study.

The ADB guide explains the two main approaches to understanding natural hazards. First, the deterministic analysis focuses on specific scenarios, conveying the geographic extent and intensity of a hazard, often used for slow-onset events like drought. In contrast, the second approach is the probabilistic analysis, which assesses the likelihood of hazard intensity at a location by considering numerous potential source events, commonly used in seismic and cyclone modeling, with results presented in hazard maps. The form of maps used for the analysis in this study will be presented below according to the type of hazard.

4.2.1. Earthquakes

Assessing earthquake hazard involves utilizing various measures to characterize the magnitude of seismic events. Scientists consider magnitude, representing the energy released at the seismic source, and intensity, reflecting the specific shaking experienced in the affected area (ADB, 2017). There are different maps which depict earthquake risks such as seismic hazard maps, fault maps, shake maps, peak ground acceleration maps, tsunami inundation maps for areas near coastlines, earthquake scenario maps, and liquefaction and/or landslide potential maps (Silva, Yepes-Estrada & Weatherill, 2017). To reach a clear understanding of earthquake risks, all the factors need to be integrated into a clear picture.

In hazard assessment, earthquakes are frequently discussed using peak ground acceleration (PGA), representing the maximum expected acceleration at a specific site for a defined event or return period. Seismologically, ground acceleration signifies the Earth's motion speed increase during seismic events (ADB, 2017). PGA maps are commonly employed when a more precise, localized evaluation of earthquake hazards is needed, offering details on the maximum ground acceleration experienced at specific locations during seismic events.

These maps are especially valuable in earthquake engineering, aiding in the assessment of potential impacts on structures and infrastructure within a specific area.

Another type of parameter for assessing earthquake hazard, instead of or in conjunction with the PGA, is the spectral acceleration (SA), which is an intensity measure commonly used for analysis of buildings and provides valuable information for seismic design and engineering. It measures the "maximum force experienced by a mass on top of a rod having a particular natural vibration period" (USGS, 2019). It is a measure of ground motion that considers the sustained shaking energy at a particular period, where the seismic hazard is described by spectral-acceleration values at periods of 0.2, 0.5, 1.0 and 2.0 seconds. According to a publication by the Government of Canada (2021), in the past, national building codes used to utilize the PGA as the main parameter for assessing earthquake hazard, however, newer building codes have adopted the SA as it is a better measure of potential damage.

Bradley (2011) wrote that the SA is widely employed as the predominant measure of intensity in both seismic design and the choice of ground motion records for evaluating seismic response and performance of structures and buildings.

Engineers use the response spectra, which are the result of SA at different frequencies, as tools of earthquake engineering for analyzing the performance of structures and equipment during earthquakes. As seismic response spectra are used to understand how high structures respond to seismic forces at varying frequencies, the SA and its uses would seem as a good way to measure the earthquake hazard of high-rise hotels (above 10 stories). However, because we have no information here on the number of floors each hotel has, the study adopts the PGA, which is still used for foundation design, as the preferred parameter.

Corporations use seismic hazard maps, such as the National Seismic Hazard Maps provided by the U.S. Geological Survey (USGS, 2022) or the hazard.EFEHR web platform, managed by the European Facilities for Earthquake Hazard and Risk (EFEHR), to assess earthquake risks. These maps incorporate scientific knowledge regarding earthquake sources, crustal deformation, and past seismic events to estimate the probability of encountering earthquake shaking at different levels of intensity. The return intervals utilized in these maps typically vary from 475 to 2475 years, contingent on the specific seismic hazard model and the magnitude of shaking intensity under examination. Frequently, regulatory bodies or building codes stipulate a return period to be employed for seismic design in a particular area. For instance, in the United States, the Federal Emergency Management Agency (FEMA)

frequently advocates for the utilization of a 475-year return period in seismic hazard assessments (Tsompanakis, 2014). The same 475-year return period is also recommended in the majority of national codes across European countries for designing standard structures, adjusting hazard values with importance factors as needed (Pitilakis et al., 2023). Consequently, this study also embraces the 475-year return period.

If we zoom into the context of this study, which focuses on the Eastern Mediterranean, utilizing the EFEHR is useful as it offers seismic hazard models and earthquake hazard and risk maps across Europe. The outcomes of the European Seismic Hazard Model 2020 (ESHM20) serve as a significant benchmark for seismic hazard at a European scale and have been formally acknowledged as an "approved representation of the seismic hazard in Europe." Pitilakis, Riga & Apostolaki (2022) have recently also used the ESHM20 to propose a new seismic hazard zonation map for Greece. The ESHM20 map created by Danciu et al. (2021) is shown in Figure 4.1 below.

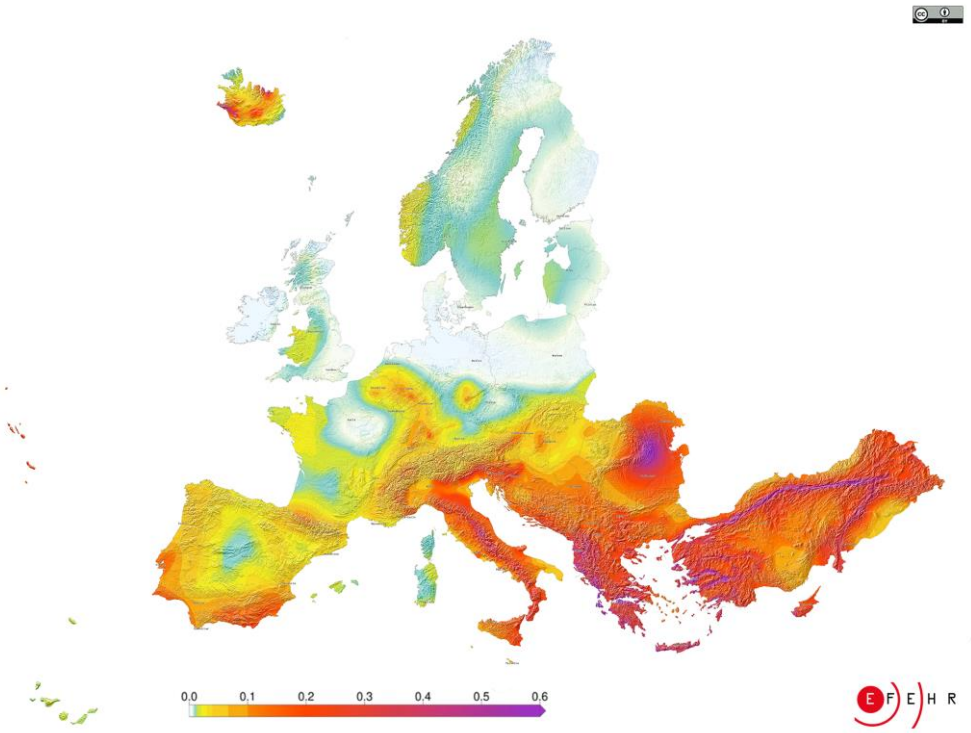


Figure 4.1. 2020 European Seismic Hazard Model (ESHM20)

Source: Danciu et al. (2021)

Figure 4.1 represents the spatial distribution of the PGA mean values for a 10 % probability of exceedance (POE) in 50 years, corresponding to a mean annual frequency of exceedance of about 0.002107, and to a mean return period of 475 years (1/0.002107 ~ 475 years) (Danciu et al., 2021).

In the context of this study, while the ESHM20 includes Greece, as illustrated in Figure 4.1, it does not include the Middle East and Israel. The relevant map for Israel is the 2014 Earthquake Model of the Middle East (EMME14) presented by Giardini et al. (2018) and available on the EFEHR platform as well.

It should be noted that the GSHAP Global Seismic Hazard Map, which was published in 1999 (Giardini et al. 1999), provides a global perspective on seismic hazard, covering a wide range of countries and regions including Israel and Greece. However, its resolution and detail for specific regions is considered lower than the EMME14 and ESHM20. For this reason, the regional maps of Europe and the Middle East were utilized in the study.

Figure 4.2 presents an ArcGIS output map taken from the ESHM20 of the mean values of PGA for Greece using a POE of 0.2103% in 1 years (476 years). The hotels surveyed in this study were asked to state where the hotel is situated (city, town, regional council, island, etc.). The coordinates of these locations, which correspond to the WGS84 standard, were inserted into ArcGIS application and through the generation of the maps, it was possible to find the PGA values which denote the earthquake hazard levels relevant to the hotels' location. The locations of the hotels included in this study appear on the map along with their specific PGA value.

It should be mentioned that where an island or regional council was cited as the hotel's location, the coordinates used were those that Google Maps chose as the coordinates for that geographical location. While these coordinates may not correctly reflect the location of the hotel, without any other way to choose a more precise location, this choice of action seemed relatively objective and consistent. In any case, all coordinates were checked to see that they reflect a relatively central point in the city, village, island or regional council.

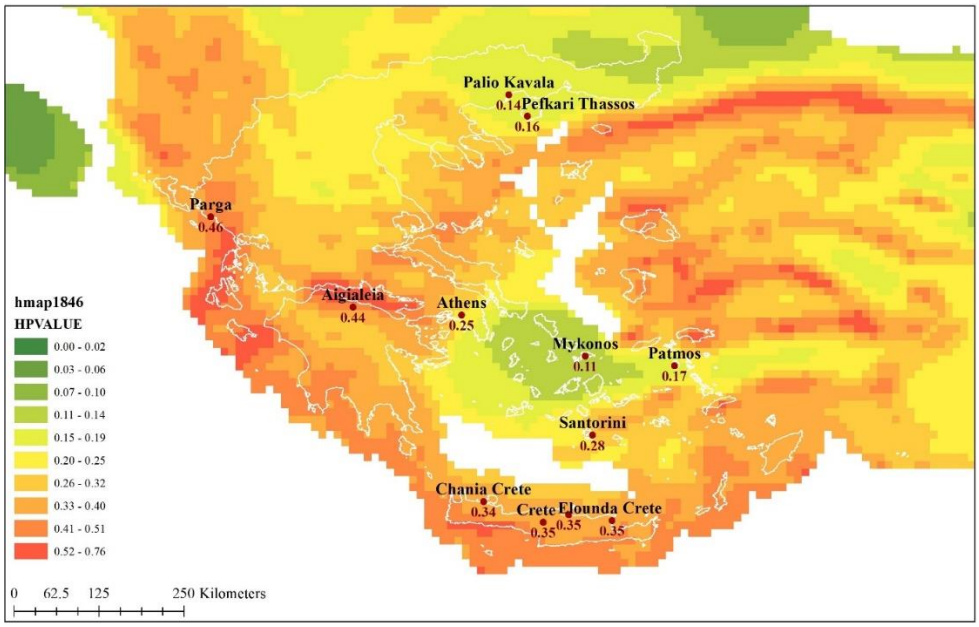


Figure 4.2. Earthquake hazard map for Greece using the ESHM20

Source: ArcGIS extraction of information in the ESHM20 according to Danciu et al. 2021

Figure 4.3 presents the EMME14 map for Israel. The map represents the mean values of PGA for Israel using a POE of 10% in 50 years (475 years). Given the density of information, only a selection of locations of the hotels included in this study are named on the map along with their specific PGA value.

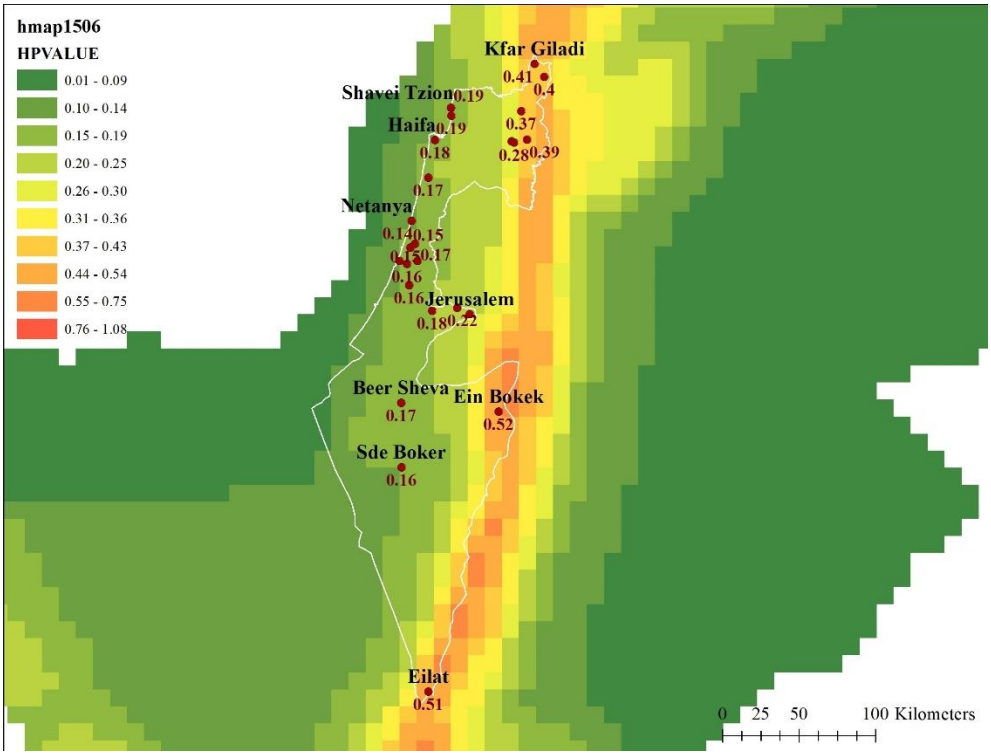


Figure 4.3. Earthquake hazard map for Israel using the EMME2014

Source: Giardini et al. (2018)

The earthquake hazard levels according to the EMME14 and ESHM20 for each location are included in Table 4.2. These correspond to the maps presented in Figures 4.2 and 4.3 and these are the hazard levels that later were included in the regression analysis of the study.

Table 4.2. Hotel locations included in the study and their earthquake hazard level

Serial No.	Location	PGA Value
1	Shavei Tzion	0.19
2	Zikhron Ya'akov	0.17
3	Jerusalem	0.24
4	Kinneret	0.28
5	Netanya	0.14
6	Haifa	0.18
7	Tiberias	0.39
8	Tel Aviv	0.12
9	Ein Bokek	0.52
10	Eilat	0.51
11	Raanana	0.15
12	Petah Tikva	0.17
13	Herzliya	0.15
14	Kiryat Anavim	0.22
15	Sde Boker	0.16
16	Mate Yehuda	0.18
17	Western Galilee	0.19
18	Be'er Ya'akov	0.16
19	Safed	0.37
20	Kfar Giladi	0.41
21	Ramat Gan	0.16
22	Lavi	0.28
23	Beer Sheva	0.17
24	Upper Galilee	0.40
25	Mykonos	0.11
26	Athens	0.25
27	Parga	0.46
28	Santorini	0.28
29	Aigialeia	0.44
30	Crete	0.35
31	Chania, Crete	0.34
32	Heraklion, Crete	0.35
33	Elounda, Crete	0.35
34	Patmos	0.17
35	Palio Kavala	0.14
36	Pefkari Thassos	0.16

Source: Own elaboration.

4.2.2. Tsunamis

As described by Batzakis et al. (2020), tsunamis are extreme waves initiated by various natural hazards, including earthquakes, submarine or coastal landslides, and volcanic activity. These hazards possess the capacity to significantly disrupt the water mass, imparting it with substantial energy and giving rise to colossal waves, which can create devastating damage due to two factors: the run-up and the inundation zone. The run-up denotes the greatest vertical separation between mean sea level and the furthest inland extent of the flood zone during a tsunami, signifying a temporary sea-level surge. The inundation zone refers to the furthest horizontal reach of flood flows in the coastal area.

Batzakis et al. also mention that Greece is among the countries most susceptible to tsunamis, due to its positioning within the broader geodynamic setting of the Eastern Mediterranean Sea. The regions in Greece most prone to tsunamis are identified as the eastern and western sections of the Hellenic Arc, along with the fault zones in the Aegean Sea and the Gulf of Corinth. Batzakis et al. offer a simplified depiction of the geotectonic configuration of the Eastern Mediterranean Sea based on the works of Papadopoulos (2000) and Tsanakas et al. (2019). This map is illustrated in Figure 4.4.

Figure 4.4. Geotectonic configuration of the Eastern Mediterranean with focus on Greece

Source: Batzakis et al. (2020), after Papadopoulos (2000) and Tsanakas et al. (2019)

The Euro-Mediterranean Tsunami Catalogue (EMTC) (Maramai, Brizuela & Graziani, 2014) includes tsunami events that have occurred within the Euro-Mediterranean area which can assist in understanding tsunami hazard and creating tsunami risk assessments. The catalogue presents a reliability scale suggested by Tinti, Maramai & Graziani (2004) to describe the tsunami hazard or potential, where 4 is the highest level, depicting a definite tsunami area, 3 - probable tsunami, 2 - questionable tsunami, 1 - improbable tsunami, 0 - very improbable tsunami and "no" - for no tsunami hazard. Subsequently, a 6-degree Sieberg-Ambraseys scale was assigned for each event included in the catalogue for addressing tsunami intensity. The catalogue includes information regarding Greece and Israel, based on previous studies. For instance, the information on Israel is based on the work conducted by Salamon et al. (2011), who have constructed a list of tsunamis reported for the Levant Coast from the second millennium B.C. to the present.

The EMTC database enables the visualization of key information for each tsunami event, including the geographical coordinates and primary parameters of the source event, the maximum intensity, a general description of the tsunami, and the associated bibliographic sources (Maramai, Graziani & Brizuela, 2019). The EMTC shows a geographical distribution of tsunamis as reported and does not reflect any future cases or the possibility of having tsunamis in areas other than those mentioned. Therefore, this catalogue by itself is not sufficient to understand the extent of the tsunami hazard to the shores of Greece and Israel. Other tools which allow understanding the tsunami hazard and probability for tsunami events in the Mediterranean Basin were necessary.

The 2018 NEAM Tsunami Hazard Model (NEAMTHM18) is a probabilistic model assessing the tsunami risk originating from earthquakes, encompassing the shorelines of the North-eastern Atlantic, the Mediterranean, and interconnected seas (NEAM) (Basili et al. 2021). The interactive map allows extracting the relevant data for this study using the hazard map (rather than the probability map).

Figures 4.5 and 4.6 illustrate the mean values of maximum inundation height (MIH) from tsunamis for a 500-year average return period (ARP) for Greece and Israel respectively. In other words, the maps depict the expected height of water inundation caused by a tsunami that has a 0.2% (1 in 500) chance of occurring in any given year (Basili et al. 2018). Since the maps' points of interest (PoIs) circles do not cover all coordinates, the closest PoIs to the hotel location coordinates were taken as proxies.

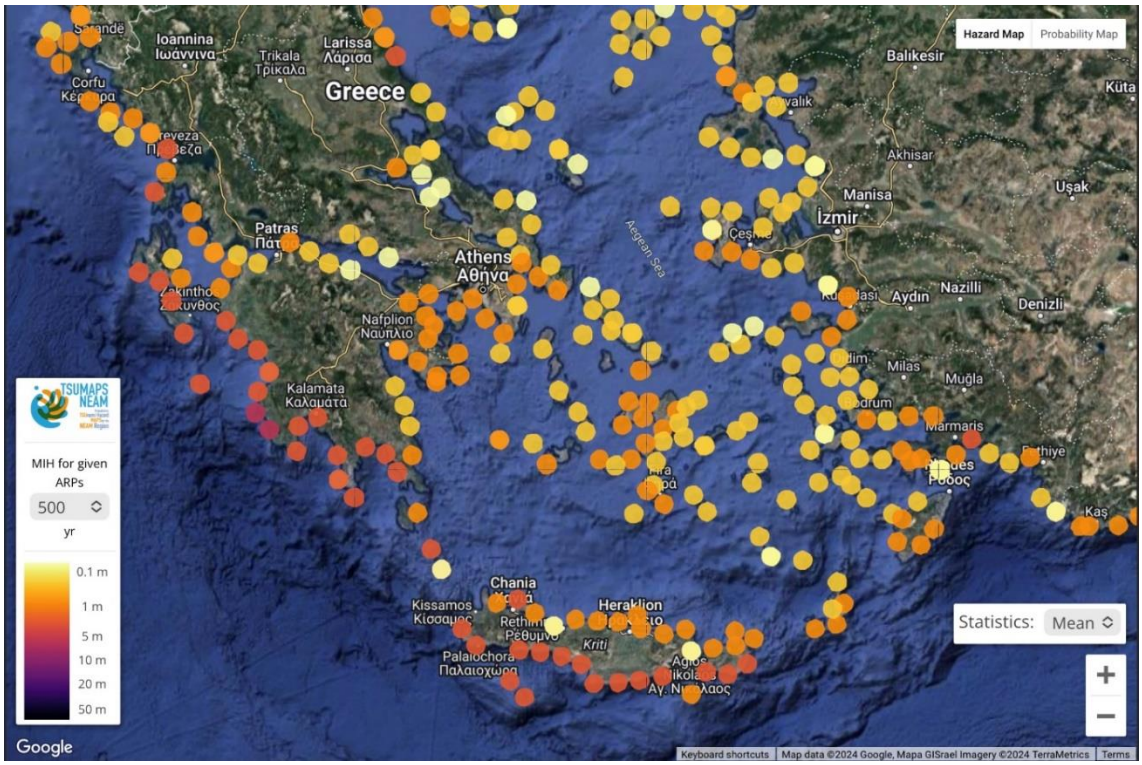


Figure 4.5. NEAM Tsunami Hazard Model 2018 hazard map for the coasts of Greece

Source: Basili et al. (2018)

Figure 4.6. NEAM Tsunami Hazard Model 2018 hazard map for the coasts of Israel

Source: Basili et al. (2018)

The hotels in this study were asked in the survey to indicate if they are located up to 500 meters inland distance from the shoreline. This question helps distinguish between hotels that are at risk from tsunamis and those that are safe from such hazards due to their inland location. While extreme tsunamis have the potential to impact assets that are more than 500 meters inland, there was a need to decide on a general cut-off distance (Najihah et al., 2014). Different locations have different attributes that influence the effects of tsunamis on the built environment such as land elevation, land slope, and land use (Fathiyah, Arhatin & Siregar, 2024; Honesti et al., 2019). Therefore, there was a need to choose a distance that would, on the one hand, address the impacts of tsunamis on hotels and include all the relevant hotels in the proximity of the coastline, on the other hand. Table 4.3 includes all the hotel locations which have the potential to face tsunamis and the specific tsunami hazard values, as they appear in the NEAMTHM18.

Table 4.3. Hotel locations included in the study and their tsunami hazard level

Serial No.	Location	Appr. Mean MIH (m), 500 ARP
1	Shavei Tzion	0.6985
2	Netanya	0.67705
3	Haifa	0.5878
4	Tel Aviv	0.7004
5	Eilat	-
6	Herzliya	0.7004
7	Mykonos	0.13649
8	Parga	0.60732
9	Santorini	0.35701
10	Aigialeia	0.22153
11	Crete	0.67048
12	Chania, Crete	0.70207
13	Heraklion, Crete	0.51525
14	Elounda, Crete	0.64900
15	Patmos	0.20656
16	Palio Kavala	0.11154
17	Pefkari Thassos	0.11210

Source: Own elaboration.

As one can see from Table 4.3, the city of Eilat has no MIH value. This is because the Red Sea is not included in the NEAMTHM18. To find some information regarding Eilat, several studies were reviewed. The review suggests there have been numerous studies and reports

undertaken to assess and model the tsunami risk along the Gulf of Eilat-Aqaba (Finzi et al. 2017; Frucht, 2019; Frucht et al. 2019; Salamon et al., 2021). These evaluations involve simulating various tsunami scenarios, appraising hazards and potential damage, and delineating evacuation zones and early warning protocols. Salamon et al. (2021) explain that the Gulf of Eilat-Aqaba at the northeastern end of the Red Sea exhibits a unique geological and seismotectonic setting. According to their study, the area's geology, tectonic, bathymetry, and earthquake and tsunami history create the potential for earthquake and submarine-landslide tsunami generation.

While the different studies address the possibility of tsunamis hitting Eilat, they do not provide a similar value to that of the NEAMTHM18 or something comparable. Therefore, due to the different methodologies of the sources, it was decided not to use the information on Eilat and omit the single hotel in Eilat which met the criteria to be included in this sample in the first place.

In addition, while several hotels in the city of Netanya also indicated that they are located on the coastline, they too were omitted from the tsunami hazard sample. This is because most of the hotels in Netanya are situated on the Netanya Promenades, which is a raised ridge of sandstone cliffs about 25 to 45 meters above sea level, making the tsunami hazard less relevant to them. They can potentially face a partial or complete collapse of the coastal cliff or experience a landslide due to earthquakes and extreme erosion of the coastline, but these hazards are beyond the hazards studied in this study.

4.2.3. Wildfires

Within the realm of wildfire hazard assessment, there are different indices used to measure wildfire hazard or danger. Here too, like with earthquakes, maps are used to visualize hazard information. Trucchia et al. (2023) differentiate between hazard maps for wildfires, which are essentially static assessments of wildfires and between danger maps which are dynamic. The hazard map featured in their research combines both the susceptibility and intensity of wildfires.

Wildfire susceptibility is characterized as the static probability of wildfires in a specific area, influenced by the terrain's intrinsic characteristics, mostly its fuel content. Wildfire intensity is described as the rate of heat energy emitted by the fire, connected to flame length and, more broadly, the overall behavior of the fire during a specific wildfire event.

If we look at what indicators are used to assess wildfire hazard it is important to mention the European Commission's technical report on the basic criteria to assess wildfire risk at the pan-European level (San-Miguel-Ayanz et al., 2018). The report suggested that wildfire risk assessment should include two issues: wildfire danger and vulnerability, as illustrated in Figure 4.7.

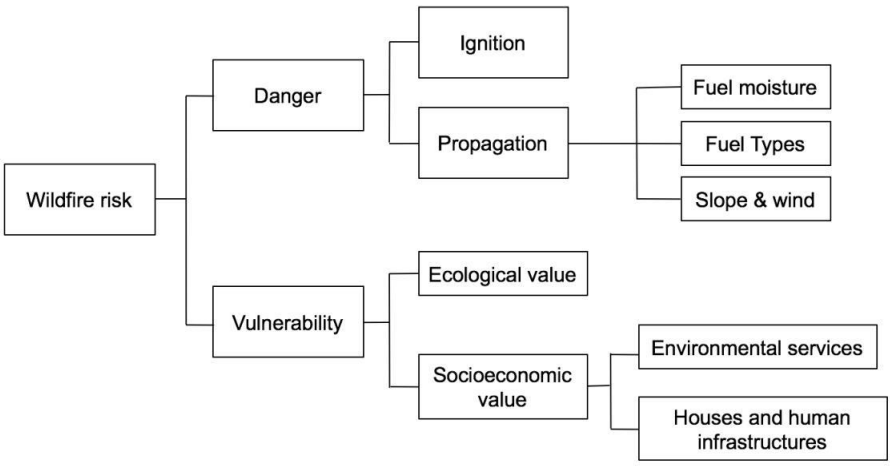


Figure 4.7. Components of wildfire risk assessment

Source: San-Miguel-Ayanz et al. (2018)

Evaluating wildfire risk in a specific area involves considering factors like the presence of combustible vegetation and potential ignition sources, whether from lightning strikes or human activities. Once a fire ignites, numerous elements come into play to influence its progression. For instance, the type and arrangement of vegetation, along with its moisture content, play a crucial role in determining the duration and intensity of the fire event. Meteorological conditions play a significant role in shaping the susceptibility of vegetation fuel to fire. Weather patterns exert control over the moisture content of the vegetation.

Additionally, the moisture levels within diverse fuel types, coupled with meteorological parameters like wind speed, collectively influence the susceptibility to ignition, potential fire spread, and the severity of a fire (Costa et al., 2020). Furthermore, topography and wind conditions exert significant influence on the direction and speed of the fire spread (C3S, 2022b). These factors are illustrated in the top part of Figure 4.7 under wildfire danger. As explained earlier in the chapter, this study focuses only on the hazard aspect of the natural phenomena. Addressing vulnerability, which is the second component of wildfire risk assessment, is not included in this study.

When looking at how countries assess wildfire hazards, in general one can note that countries have customized approaches to assess wildfire risk or to rate fire risk/danger. Some examples include the European Fire Potential Index and structural risk index, the US National Fire Danger Rating System, the Canadian Forest Fire Danger Rating System (CFFDRS), and the Australian McArthur Forest Fire Danger Index (FFDI) (San-Miguel-Ayanz et al., 2003; Shmuel & Heifetz, 2023; Pinto et al. 2018). Some scholars and institutions use indices related to burnt area as an indicator of susceptible areas for wildfires. Guk, Bar-Massada and Levin (2023) mention that for the purpose of retrospectively mapping burnt areas, several indices have been created, including the Normalized Burn Index (NBR), the Burned Area Index (BAI), and the Relative Difference Aerosol-Free Vegetation Index (RdAFRI). These spectral indices can be valuable tools for assessing fire severity and monitoring areas impacted by fire, particularly when using remote sensing data (Key & Benson, 2006). To explain the spatial and temporal patterns in wildfires in Israel, Levin & Heimowitz (2012) created several spatial and climatic databases which include percentage vegetation cover, land use and land cover information and weather conditions. This last point will be elaborated on later.

Pinto et al. (2018) assert that the Canadian Forest Fire Weather Index (CFFWIS), a component of the Canadian Forest Fire Danger Rating System (CFFDRS), is a highly reliable and widely utilized fire rating methodology used globally. The CFFWIS is composed of six components, outlined and visually depicted in Figure 4.8 below: (1) Fine Fuel Moisture Code (FFMC) - providing a numeric rating for the moisture content of litter and other cured fine fuels; (2) Duff Moisture Code (DMC) - offering a numeric rating for the average moisture content of loosely compacted organic layers of moderate depth; (3) Drought Code (DC) - assigning a numeric rating for the average moisture content of deep, compact organic layers; (4) Initial Spread Index (ISI) - determining a numeric rating for the expected rate of fire spread; (5) Buildup Index (BUI) - providing a numeric rating for the total amount of fuel available for combustion; and (6) Fire Weather Index (FWI) - establishing a numeric rating for fire intensity, derived from the ISI and BUI (Government of Canada, 2023).

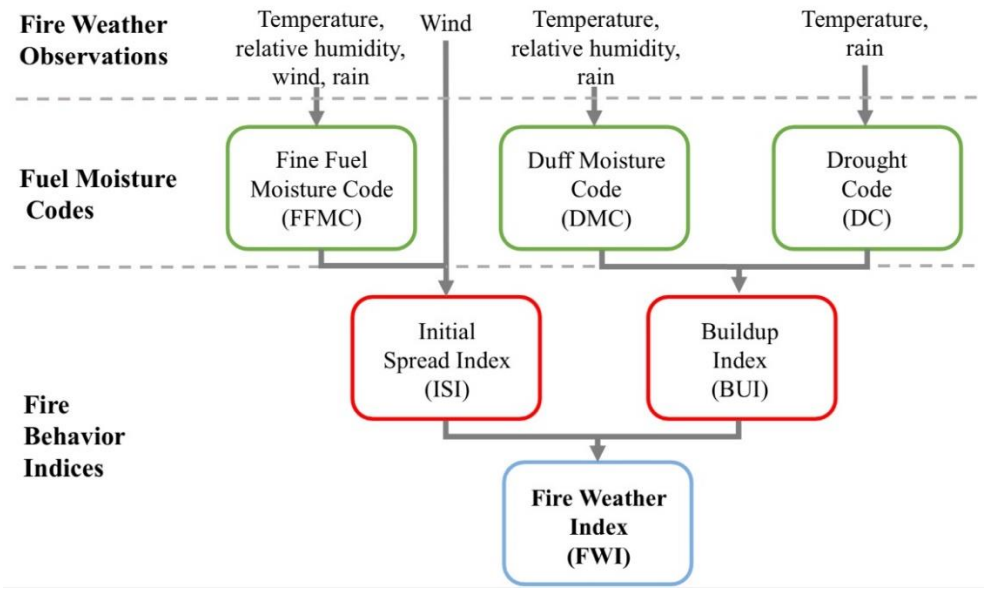


Figure 4.8. Structure and components of the Canadian Forest Fire Weather Index System

Source: Government of Canada, 2023.

The Fire Weather Index (FWI)

The globally utilized Fire Weather Index (FWI) is a model-driven indicator designed to assess the risk of fires. Figure 4.8 visualizes the three sub-indices within the FWI-system that make up the consolidated Fire Weather Index (FWI). One can see that the FWI measures the potential fire intensity by factoring in the rate of fire spread, fuel consumption, and various environmental elements such as temperature, relative humidity, wind speed, precipitation, drought conditions, fuel availability, vegetation characteristics, and topography (C3S, 2022b).

Initially calibrated for describing fires in Canada's boreal forests, the FWI has demonstrated effectiveness in diverse regions. According to Viegas et al. (1999), the FWI is well-suited as a general index for meteorological fire danger in Mediterranean European eco-systems. Carvalho et al. (2008) found that meteorological variables and FWI System components are good predictors for forest fires in Portugal. Another more recent study on Portugal found that high daily severity rating, which is a part of the Canadian Forest Fire Weather Index (FWI) System (CFFWIS), is strongly related to the total burnt area (BA) in Portugal (Calheiros et al. 2022).

Today, the FWI operates within the Fire Danger Forecast module of the European Forest Fire Information System (EFFIS), which is a component of the EU Copernicus program's emergency management services and considered a primary source of information on wildfires across Europe, Middle East and North Africa (Pinto et al., 2018). The FWI has been widely

adopted by many European countries and serves as the preferred method and best-harmonized approach for evaluating wildfire risk (San Miguel et al., 2017; San-Miguel-Ayanz et al., 2018). The FWI has also been incorporated into the Fire Risk Map (FRM) product disseminated by the Satellite Application Facility for Land Surface Analysis (LSA SAF), a part of EUMETSAT.

Sirca et al. (2018) conducted a study assessing eight fire danger indices in the fire-prone Mediterranean region of Sardinia Island, Italy. Among the indices considered, the study's overall findings revealed that two indices, namely the Integrated Fire Index (IFI) and the Fire Weather Index (FWI), effectively estimate observed fire occurrences on the island of Sardinia. The IFI is a fire danger rating index specifically developed and calibrated to accommodate the climate and vegetation characteristics of Mediterranean areas, relying on weather and fuel physical inputs.

Costa et al. mention several studies that have concluded that there is a significant relationship between FWI and forest fires, such as Carvalho et al. (2008), Fréjaville & Curt (2015), Dimitrakopoulos, Bemmerzouk & Mitsopoulos (2011), and Di Giuseppe et al. (2016). The FWI was also found to be a relatively good index in predicting wildfire activity in Sweden relatively to indices such as the Keetch-Byram Drought Index (KBDI), the Fosberg Fire Weather Index (FFWI) and the Nesterov Index, which was used in the former Soviet Union (Eriksson, Johansson & McNamee, 2023). Although their findings endorse the applicability of the FWI in Sweden, they emphasize that weather alone is not the sole factor influencing wildfire danger. They highlight the importance of considering any weather-based wildfire danger index in conjunction with other local factors, including fuel types and topography.

This raises the issue that one of the biggest shortcomings of the FWI as an indicator for wildfire hazard is its focus on weather conditions as it was developed as part of the Canadian Forest Fire Danger Rating System with a focus on pine fuel types (Van Wagner, 1987). With any modifications of the initial model conditions, it can only provide a broad perspective on fuel conditions, focusing specifically on the dead fuel component of the existing material. (Tanskanen & Venäläinen, 2008) It does not address alterations of the ignition or fuel content of the area under consideration. Nevertheless, according to the C3S (2022a), the FWI has been shown "to correlate with fire activity expressed in terms of burnt area". In addition, the FWI was found to perform better than other methods in studies that compared several selected fire danger indices (Laneve, Pampanoni & Shaik, 2020).

While there are certain disadvantages to the use of the traditional FWIs for estimating wildfire risk, as elaborated by Shmuel & Heifetz (2023), currently, this is the most popular tool in use and will be adopted for this study as well, yet it will be integrated with another index to add precision. As the information combined in the FWI is not complete, another indicator - the Wildland-Urban Interface (WUI) - will be used in conjunction with the FWI, as suggested by Ben Zaken in an interview the author conducted with Ben Zaken of the Fire and Rescue Commission in Israel, Israel's contributor to the EFFIS report.[5]

Ben Zaken stressed that there is a need to look at the WUI when evaluating wildfire hazards in Israel. By giving the example of the cities of Beer Sheva and Eilat, which are in the desert and have no vegetation to create wildfires, he illustrated that even though these cities can potentially have extreme weather conditions according to the FWI, there is no fuel content to create wildfires.

As mentioned before, the FWI is not specifically designed to differentiate between areas covered with forests versus desert areas or areas with limited vegetation. Given that, the applicability and performance of the FWI varies in different biomes, especially in fuel-limited environments, thus requiring fuel information for better wildfire assessments (Ntinopoulos et al., 2022). The Peruvian case study (Podschwit et al., 2022) on the applicability of fire danger indices including the FWI on different areas in Peru illustrates this point as well. Therefore, while the FWI provides important information about fire danger in forested areas, its effectiveness may be limited in environments with limited vegetation or in the absence of an ignition source. For this reason, Di Giuseppe (2023) suggests a new fire danger index - fire occurrence probability index (FOPI) - to overcome one of the most important limitations of the FWI with regards to landscape flammability. Utilizing a dynamic fuel mask that incorporates data on fuel content significantly enhances the correlation between the FWI and observed fire activity in fuel-limited environments. However, as there is no available FOPI for the areas of interest in this study, and it is beyond the purpose of this study to create such a FOPI map, the preferred approach is to use the WUI in conjunction with the FWI.

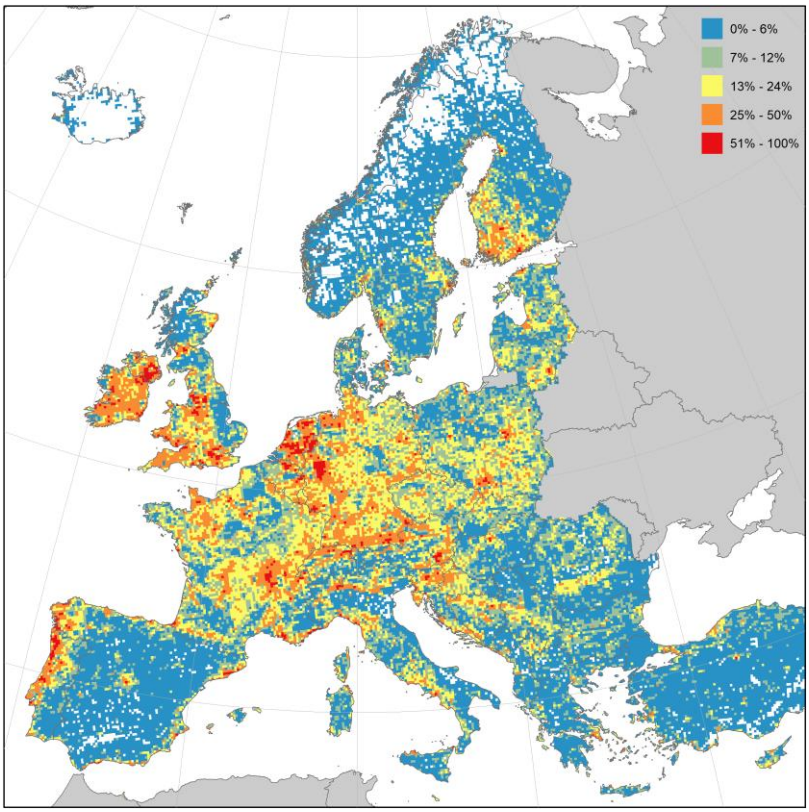
This is in line with the finding of several studies which indicate that the land use and land cover (LULC) and vegetation are important factors to assess wildfire danger as LULC influences the impacts of the meteorological conditions (Calheiros et al., 2022). Following this logic, this

[5] Avi Ben Zaken, Israel's National Fire & Rescue Authority, telephone interview by Galit Palzur, Jan. 29, 2024.

next section will explain the importance of the WUI, its definition and applications for this study.

The Wildland Urban Interface (WUI)

The WUI holds significance in risk management of wildfires, as areas where wildland and urban regions meet are increasingly exposed to growing wildfire risks (Vilar et al., 2016). This is primarily attributed to the impact of accelerating climate change and the flammability of fuel in those areas (Taccaliti et al., 2023) along with accumulated vegetation around vulnerable structures (Thapa, Jenkins & Westerling, 2023). There are different definitions in the literature for WUI, as noted and summarized by Tikotzki, Bar-Massada & Levin (2023) and Taccaliti et al. (2023). The Wildland-Urban Interface (WUI) refers to the spatial zone where human development, encompassing structures and infrastructure, converges or intertwines with natural, undeveloped wildlands. This definition underscores areas of interface where human development and native vegetation closely coexist, heightening the risk of wildfires impacting communities (Schug et al. 2023). An illustration of the WUI can be found in Figure 4.9 below.



Percentage of land area which lies in the WUI (ensemble median, by spatial cell), estimated from the CORINE Land Cover map of 2012.

Figure 4.9. The spatial extension of the Wildland-Urban Interface (WUI) in Europe

Source: Costa et al. (2020)

Costa et al. (2020) elucidate that the majority of fire ignitions are attributable to human activities, a prevalence observed particularly in the WUI. Consequently, emphasizing the WUI becomes crucial in the evaluation of wildfire hazard. Trucchia et al. (2023) deduce that incorporating climate data and information about surrounding vegetation into the dataset is crucial. This enhances the model's accuracy in predicting wildfire hazards. In addition, by using climatic variables such as precipitation, air temperature, and soil moisture, the study confirmed that climate plays a crucial role for estimating susceptibility at the supranational scale of the study area. Neighboring vegetation was found as the second most important variable for assessing wildfire hazard. In the context of the Mediterranean and Israel, in particular, Levin et al. (2016) have found that human factors predominantly influence alterations in vegetation cover in Israel and serve as the primary ignition source for fires in Mediterranean regions and that the type of vegetation plays a crucial role in comprehending the spatial distribution of fire frequency.

Modugno et al. (2016) clarify that various approaches to WUI mapping utilize distinct distance buffers and categorize WUI areas based on a combination of urban and vegetation features in the landscape. They also note the absence of transnational legislation uniformly defining WUI areas across European countries. For mapping WUI areas at the European scale, the harmonized CORINE 2006 (CLC) land use/land cover map stands out as a consistent spatial dataset.

In addition to the CLC, Schug et al. (2023) introduce a global map of the 2020 Wildland-Urban Interface (WUI) at a 10-meter resolution, employing a validated method that relies on remote sensing data for both building distribution and wildland vegetation. Their analysis discerns between two WUI categories: (1) the intermix WUI, characterized by a blend of buildings and wildland vegetation, where the intermix WUI represents regions with over 6.17 buildings per square kilometer and a wildland vegetation coverage of 50% or higher; and (2) the interface WUI, marked by the proximity of buildings to extensive patches of wildland vegetation where the interface WUI is characterized by regions where there are over 6.17 buildings per square kilometer, with less than 50% wildland vegetation, situated within close proximity (less than 2.4 km) of a substantial flammable vegetation threshold area spanning at least 5 km and comprising over 75% of the total area. This definition excludes small urban parks from the wildland vegetation category. The 2.4 km threshold distance to a large vegetation patch, or in short, the buffer distance, aligns with the U.S. Federal Register's

definition (Radeloff et al., 2005) and accounts for the distance embers can travel during a wildfire, therefore it is important to include such buffers in the model (Schug et al. 2023).

The WUI is being used in this study for comparative analysis, allowing for a comparison of wildfire hazard across various settlements housing hotels. The decision to incorporate the WUI into the assessment of wildfire hazard along with the FWI requires determining the appropriate buffer distance for combining wildland and vegetation interfaces into the WUI map utilized in this study. The question is what the buffer distance should be in this study. To answer this question, several studies were reviewed. It is important first to mention that Bar-Massada et al. (2023) stress that there is no one correct definition for the WUI and for the value of the interface WUI extent. It is crucial to recognize that there are significant differences between WUI maps created for large areas and those created for smaller, more local areas, especially in terms of purpose and feasibility. The broad-scale maps which depict large areas, require less-detailed information.

Several studies have utilized a buffer distance of 2.4 km from urban areas for WUI mapping. Li et al. (2022) utilize a threshold of 2.4 km between wildland vegetation and housing for WUI mapping in California. They justify this distance as it corresponds to the statistical reach of firebrands from the fire front. To validate the 2.4 km threshold, they also tested in their study distances of 1.2 km and 4.8 km, demonstrating variations in resultant WUI. Their findings suggest that a ±50% change in the 50% threshold around 2.4 km has negligible impact on validity indicators, thus affirming the appropriateness of the 2.4 km distance both conceptually and operationally.

Li et al.'s findings follow the U.S. approach of a 2.4 km distance and a minimal patch size of 5 km. Bar-Massada et al. (2023) suggest that these parameters align with wildfire issues in the U.S. WUI but alternative parameterizations may be better suited for regions like Europe, where land cover patterns and fire regimes vary. Bar-Massada et al. (2023) suggest that a 600 m buffer provides a more accurate estimate regarding the approximate *median* value of maximum spread distances of showering embers (compared to the 2.4 km buffer which reflects *maximum* travel distances). They mention that Modugno et al. (2016), who created a pan-European map for large forest fires in the WUI areas in Europe, used a buffer of 200 m to urban development and a buffer of 400 m to hazardous fuels. These figures are lower than the 600 m they used in their study.

The dataset of the global map of the 2020 WUI, created by Schug et al. and available at the https://silvis.forest.wisc.edu/globalwui/, which utilizes the 2.4 km buffer distance corresponds with the purposes of this study as the model allows "to provide summary statistics at coarser spatial scales" (Bar-Massada, 2021). Using a larger buffer distance operationally raises the WUI area and allows more potential wildfire-affected areas to be included in the calculations. Given the fact that in this study the precise locations of the hotels are unknown and the goal of the study is to explore corporate risk management decisions, which can be affected not only by direct physical hazards but also by the effects of wildfires on the vicinity of the hotel (i.e. because of a reduction in the number of visitors in the city because of a nearby wildfire), it was decided to adopt the 2.4 km buffer, which as mentioned above has also been used in the Global Wildland-Urban Interface (WUI) 2020.

To sum this section, for the purposes of this study, both the FWI and WUI will be considered conjointly as indicators of wildfire hazard. In WUI regions, which are exposed to increasing wildfire risk, the FWI has been found to be a key indicator of the potential for fire occurrence and spread (Rodriguez-Jimenez et al., 2023). Therefore, integrating both indicators together would give a good indicator for wildfire hazard as needed in this study.

One study which made use of integrating both the FWI and the WUI is that of McNamee et al. (2022) who developed a Wildfire Hazard Index (WHI) specifically for Sweden using three components: the FWI, the WUI and fuel type. The three components were combined using a weighted sum approach. According to the study, the model showed good agreement with past fire occurrences, particularly for larger fires.

It should be mentioned that practitioners around the world also make use of a compilation of datasets and information sources to create wildfire hazard maps that meet the needs of mitigating wildfires. For instance, in the United States, the USDA Forest Service's Fire Modeling Institute developed the Wildfire Hazard Potential (WHP) map. This tool aids in assessing wildfire hazards and prioritizing fuel management needs across extensive landscapes. The information used in the map integrates both spatial datasets of wildfire likelihood and intensity, along with spatial fuels and vegetation data and point locations of past fire occurrences (Fire Lab, 2024).

As mentioned before, to construct the wildfire hazard scale utilized in this study, both the FWI and WUI were used. The FWI layer was obtained from the EFFIS database. The Fire Weather Index (FWI) is a daily index used to estimate fire danger on a certain day. However,

it can also be used to represent a general fire hazard that is not specific to a certain date by calculating an average score for a specific location. The C3S can create indicators such as the average fire danger over a certain period of time (month, fire season, year, etc.). The European Commission technical report (San-Miguel-Ayanz et al., 2018) states that "long-term series of FWI data can be used as an explanatory variable in the assessment of wildfire risk assessment at the pan-European level." After consulting with the Israel Meteorological Service (IMS), it was decided to use the average FWI for the most updated information for the past three years as the indicator for the FWI used in this study. The exact dates taken for the FWI average figures are: 1.1.2020-31.12.2022.

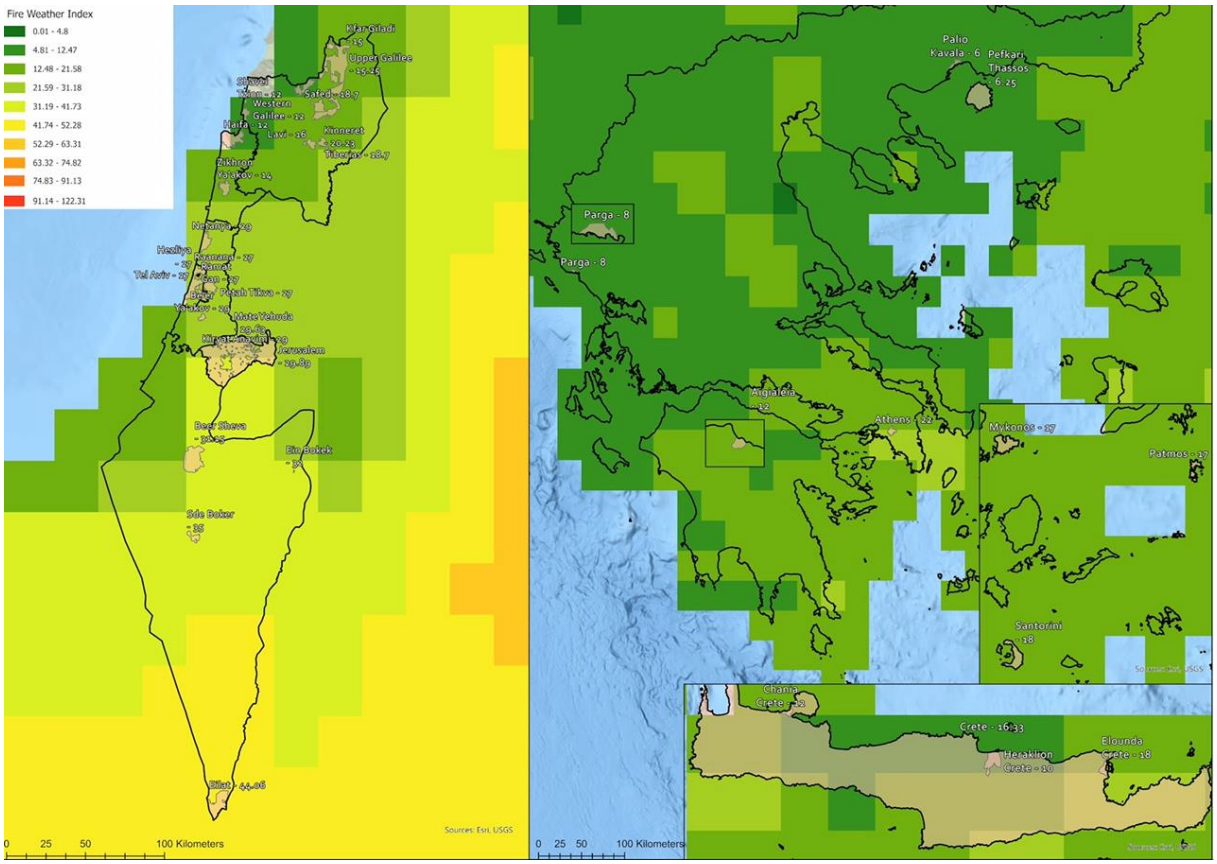


Figure 4.10. The FWI 3-year average layer for Greece and Israel

Source: Copernicus Climate Change Service (C3S)

Looking at Figure 4.10 with Israel and Greece placed side-by-side, one can notice the difference between both countries in terms of the FWI. When looking only at the factors included in the FWI, most of the locations score higher than the locations in Greece, making them, according to the index, more susceptible to wildfires. Next, the study looks at the FWI and WUI together.

The WUI used in this study was obtained from the SILVIS Lab (Spatial Analysis for Conservation and Sustainability) of the University of Wisconsin-Madison at https://silvis.forest.wisc.edu/globalwui/ as presented by Schug et al. (2023). First, the polygons of the hotel settlements were obtained and spatially presented on a GIS map. A 2.4 km buffer was used for settlements but not for islands or regional councils (Mate Yehuda, Western/Upper Galilee), where the WUI reflected the most abundant pixels of interface in the councils' jurisdiction.

The WUI differentiates between four types of wildland-urban interfaces: Forest/Shrub/Wetland dominated WUI (divided into intermix and interface), Grassland-dominated WUI (divided into intermix and interface), Wildland non-WUI (divided into Forest/Shrub/Wetland or Grassland), and Non-wildland non-WUI (divided into Urban or Other). The map does not present the potential for fire creation but the type of interface that exists. For this reason, it was necessary to tie the type of vegetation to fire hazard.

This exercise was quite difficult as there is no consensus regarding the findings. Nevertheless, since it was necessary to find a way to compare the wildfire potential of various types of vegetation, and after closely following the literature review conducted by Taccaliti et al. (2023), for the purpose of this study, it was broadly decided to differentiate between forest and shrubland in the WUI to have the most potential to cause fire spread, and grassland in the WUI, which would have less potential to cause fire spread and lastly, to address what is considered in the SILVIS Lab tool as "non-WUI". Urban settings of the non-WUI category would be considered to have some sort of fire potential, even if low, whereas non-WUI categorized as "other" would be considered to have no vegetation with potential to cause fires. This categorization was checked individually for each location on satellite imagery.

It was important to understand what constituted as "other", as a quarter of the locations in the study had this feature. The finding suggested that "other" mainly consisted of farmland, desert conditions or hilly/mountainous terrain (like in the instances of Shavei Tzion, Lavi and Kfar Giladi - farmland; Sde Boker, Beer Sheva and Eilat - deserts, and Santorini - mountainous volcanic terrain). To summarize this issue, the WUI was integrated into this study in the following form, as illustrated in Table 4.4.

Table 4.4. Constructing a WUI Index for the study

Type of WUI	WUI Index
Forest/Shrub/Wetland-dominated intermix WUI	4
Grassland-dominated intermix WUI	3
Non-WUI: Forest / Shrub / Wetland or Non-WUI: Grassland	2
Non-WUI: Urban	1
Non-WUI: Other	0

For each location, the WUI chosen was the one which was most present in the surrounding buffer. Meaning, for clarification, if a certain polygon is surrounded 80% by grassland pixels and 20% by forestland pixels, the type of vegetation used in this study to characterize the WUI for that polygon would be grassland. As mentioned before, on islands, such as Santorini or Mykonos, where technically there was no ability to create a buffer, it was decided to take the type of vegetation which predominantly characterizes the island.

Next, to integrate the FWI and the WUI together, several mathematical options were tested. It was found that a simple multiplication between the FWI and the WUI Index created for this study as presented above, would suffice to present the wildfire hazard for each location. As the results do not present an actual continuous variable, it was more fitting to group the locations according to the results. This exercise is presented in Table 4.5 below:

Table 4.5. Calculation of the Wildfire Hazard Index

Serial No.	Location	FWI Value	WUI Type	WUI Index	FWI*WUI	Grouping
1.	Shavei Tzion	12	Non-WUI: Other	0	0	1
2.	Ein Bokek	32	Non-WUI: Other	0	0	1
3.	Eilat	44.05	Non-WUI: Other	0	0	1
4.	Sde Boker	35	Non-WUI: Other	0	0	1
5.	Kfar Giladi	15	Non-WUI: Other	0	0	1
6.	Lavi	16	Non-WUI: Other	0	0	1
7.	Beer Sheva	31.14	Non-WUI: Other	0	0	1
8.	Upper Galilee	15.75	Non-WUI: Other	0	0	1
9.	Santorini	18	Non-WUI: Other	0	0	1
10.	Haifa	12	Non-WUI: Urban	1	12	2
11.	Western Galilee	12	Non-WUI: Urban	1	12	2
12.	Pefkari Thassos	6.25	Non-WUI: Forest / Shrub / Wetland	2	12.5	2
13.	Athens	22	Non-WUI: Urban	1	22	2

Serial No.	Location	FWI Value	WUI Type	WUI Index	FWI*WUI	Grouping
14.	Palio Kavala	6	Forest / Shrub / Wetland-dominated intermix WUI	4	24	2
15.	Tel Aviv	27	Non-WUI: Urban	1	27	2
16.	Raanana	27	Non-WUI: Urban	1	27	2
17.	Petah Tikva	27	Non-WUI: Urban	1	27	2
18.	Herzliya	27	Non-WUI: Urban	1	27	2
19.	Ramat Gan	27	Non-WUI: Urban	1	27	2
20.	Zikhron Ya'akov	14	Non-WUI: Forest / Shrub / Wetland	2	28	3
21.	Netanya	29	Non-WUI: Urban	1	29	3
22.	Be'er Ya'akov	29	Non-WUI: Urban	1	29	3
23.	Parga	8	Forest / Shrub / Wetland-dominated intermix WUI	4	32	3
24.	Crete	16.33	Non-WUI: Forest / Shrub / Wetland	2	32.66	3
25.	Patmos	17	Non-WUI: Grassland	2	34	4
26.	Safed	18.70	Non-WUI: Grassland	2	37.40	4
27.	Heraklion Crete	10	Forest / Shrub / Wetland-dominated intermix WUI	4	40	4
28.	Kinneret	20.23	Non-WUI: Grassland	2	40.46	4
29.	Aigialeia	12	Forest / Shrub / Wetland-dominated intermix WUI	4	48	4
30.	Chania Crete	12	Forest / Shrub / Wetland-dominated intermix WUI	4	48	4
31.	Mykonos	17	Grassland-dominated intermix WUI	3	51	5
32.	Tiberias	18.70	Grassland-dominated interface WUI	3	56.11	5
33.	Mate Yehuda	29.63	Non-WUI: Forest / Shrub / Wetland	2	59.26	5
34.	Elounda Crete	18	Forest / Shrub / Wetland-dominated intermix WUI	4	72	5
35.	Jerusalem	29.89	Grassland-dominated interface WUI	3	89.67	5
36.	Kiryat Anavim	29	Forest / Shrub / Wetland-dominated intermix WUI	4	116	5

Source: Own elaboration.

The wildfire hazard index constructed in this study, which is shown on the most-right hand side row in the table above and which will be later used in the econometric analysis, can be visualized in a map as well, as illustrated in Figure 4.11. As one can notice, when integrating both the FWI and WUI together - as opposed to looking at the FWI separately - several locations in Greece are now more prone to wildfires than those in Israel:

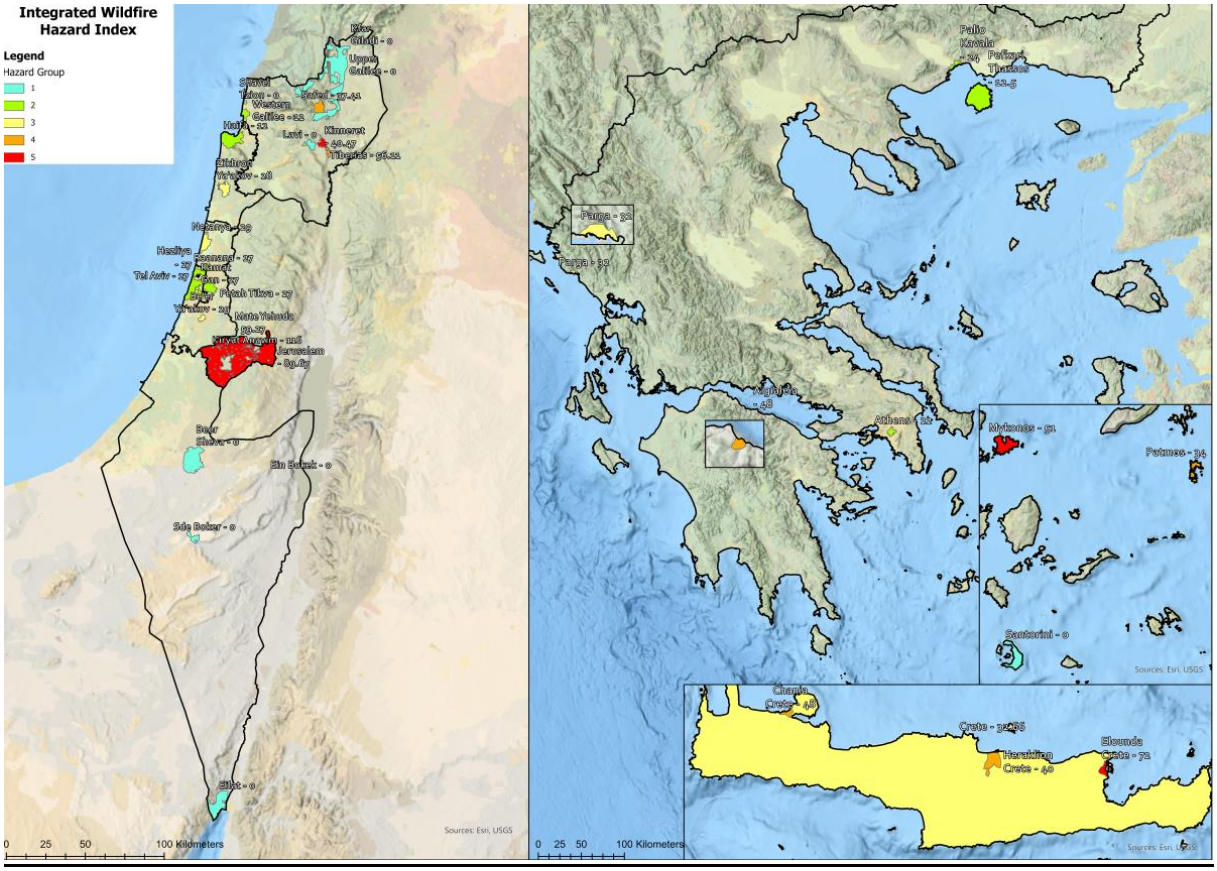


Figure 4.11. Map of integrated Wildfire Hazard Index for Greece and Israel

Source: Own elaboration with the assistance of the GIS Consultant Unit, Faculty of Social Science, University of Haifa. Source of Data: Schug et al. (2023), the dataset at https://silvis.forest.wisc.edu/globalwui/ and the Copernicus Climate Change Service (C3S)

It is worth noting that various studies propose alternative methods for assessing wildfire hazard. It is important to acknowledge their existence even though this study adopted a different approach. For instance, examining historical fire occurrences provides insight into regions more susceptible to wildfires. Within this context, fire occurrence zoning becomes instrumental in evaluating and mitigating wildfire risk across different spatial scales (Pan, Wang & Li, 2016). This approach entails delineating areas based on the frequency and intensity of past fire occurrences, aiding in the comprehension of spatial wildfire patterns, identification

of high-risk zones, and the formulation of effective fire management and policy strategies (Koutsias et al., 2015).

Koutsias et al. (2015) have suggested creating fire occurrence zoning based on documented historical fire records using continuous kernel density surfaces that are based on wildland fire ignition observations. Jing et al. (2023) as well have used mathematical statistics and kernel density analysis to predict and zone forest fire occurrences in Southwestern China with the Light Gradient Boosting Machine (LightGBM) model.

These days the mapping of wildfires and assessing wildfire hazard incorporate more and more the use of remote sensing along with GIS. These methods rely on factors like vegetation type, fuel moisture content, slope, aspect, and proximity to roads (Levin & Heimowitz, 2012). Carmel et al. (2009) suggested using Monte-Carlo simulations of fire spread, utilizing vegetation maps and considering the susceptibility of different vegetation types to burning.

4.2.4. Security Crises

The purpose of this section is to explain how security crises have been incorporated into this study with regards to different hotel locations. It is not the purpose of this section to discuss the reasons for their potential or how they affect corporations in general, or hotels as the specific business type in focus here. In this study, security crises include terrorist attacks, prolonged armed conflict, and refugee crises. Some refer to these types of risks as geopolitical risks. Growing global geopolitical risks pose a widespread concern, impacting various economic sectors, including tourism as heightened geopolitical tensions often deter tourists due to safety and stability concerns, leading to deferred or canceled travel plans (Herman, 2023). Terror attacks, as an example, can cause demand shocks to tourist destinations and utilities, and alter the image profile of destinations (Araña & León, 2008). Consequently, geopolitical risks not only reduce international tourist arrivals, overnight stays, and tourism imports but also diminish tourism spending and other key indicators of tourism development (Lanouar & Goaied, 2019). For these reasons, it is important for hotels to manage the risks associated with geopolitical and security crises.

In Israel, the home front (civilian population) has become a major security concern, because Israel's enemies focus on trying to attack the civilian population in various ways (IDF, 2024a). While the invasion and massacring of civilians in southern Israel by the terrorist organization of Hamas on October 7, 2023, illustrates that military land offenses are a severe threat faced

by Israel (IDF, 2024b), still most of the civilian population in Israel is rather under constant threat due to long-range missiles and rockets from various directions (IDF, 2024a), as illustrated in Figure 4.12. This figure, which is used only for illustrative purposes, visualizes the missile and rocket threat scenarios, as of 2021, originating from various regions: the left map depicts the West Bank's fire range, the center map illustrates the threat range from Lebanon to areas of Israel, and the right map portrays the missile and rocket threats emanating from Gaza.

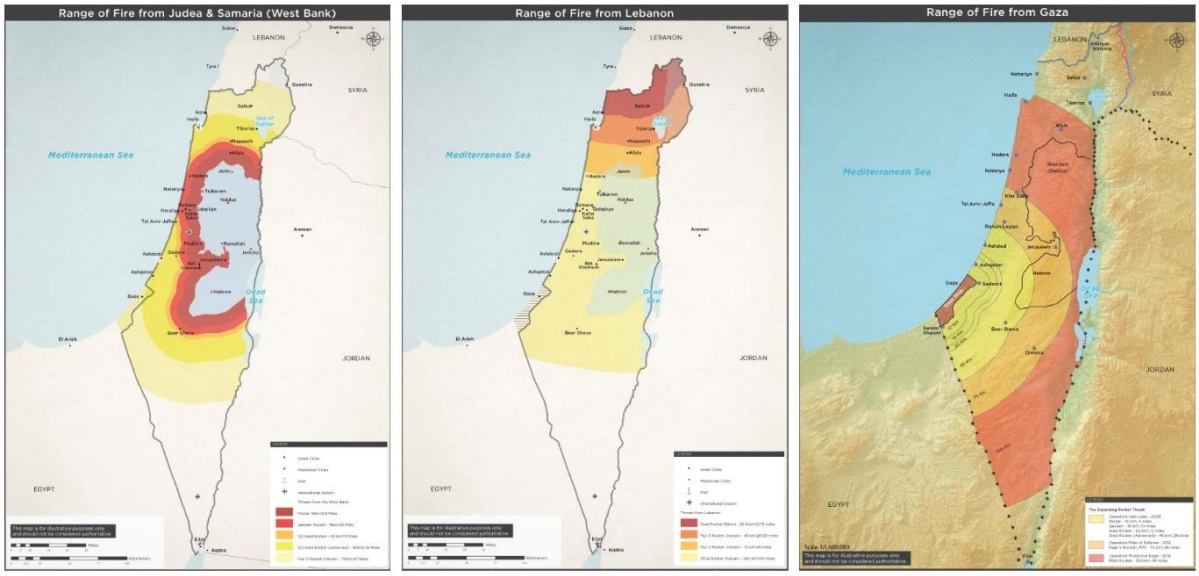


Figure 4.12. Range of fire from the West Bank, Lebanon and Gaza to Israel

Source: IDF Mapping Unit (2021a, 2021b, 2021c)

During the Hamas-Israel Conflict beginning in October 2023, missiles launched by the Houthis in Yemen targeted the southern city of Eilat. Moreover, on April 13, 2024, Iran launched its first direct missile and drone attack on Israel (Timsit & Westfall, 2024) illustrating how geographically, all of Israel faces long-range missile threats. A second direct missile attack on Israel, by Iran, occurred on Oct. 1, 2024. That fact along with the Houthi attacks are, in practice, a source of military threat to Israel, which should be considered alongside the conventional publicly circulated maps shown in Figure 4.12 (Rubin, 2024). Another dimension to take into consideration is the occasional terror attacks in and around Israel, which are a serious security threat along with other internal and regional security scenarios.

All the security threats depicted above illustrate that currently there is no distinction between different areas in Israel regarding levels of security threats. This is especially true when one sees the effects of these geopolitical risks on the tourism industry in Israel.

According to Gocer & Kovacs (2023), who conducted a study on the effects of geopolitical risks on tourism revenues of the Middle East and Asian countries, Israel was found to be the most vulnerable country out of the countries included in the study, with regards to the negative effects of geopolitical risks on tourist arrivals. For these reasons, this study will not differentiate between locations in Israel concerning their security risk levels and the potential for security crises.

With regards to Greece, the issue of security threats and crises is a bit different and include also migration flows as security threats. A study by Lampas (2018) illustrates how Greeks perceive refugee flows as a security threat following the rapid increase in refugee flows mostly from the year 2015 due to the war in Syria. As highlighted by Kolovos (2010) and later by Karatrantos (2021), the migration-refugee crisis in Greece poses a multifaceted security challenge. Beyond its implications for border security, it underscores the risk of potential infiltration by foreign terrorist fighters within mixed migration flows. Moreover, the influx of asylum seekers[6] may contribute to societal polarization, radicalization, and the emergence of right-wing extremism. For this reason, migrant and refugee influxes were included in this study also under security crises.

One question which comes into mind is whether the Greek islands and shores, which were the points of entry for the thousands of migrants and asylum seekers, are considered potentially in a higher state of a security threat than the big cities, like Athens, that later serve as a transit site for those seeking to reach other areas in Europe. Figure 4.13 illustrates a daily snapshot map of the refugee crisis that Greece and the Western Balkan states suffered in during the years 2015-2016. The map depicts how the islands of Greece, such as Lesvos, Chios, Samos and Leros, were the main points of entry to hundreds of thousands of migrants and refugees over the total period of the crisis (ECHO, 2016).

[6] This research uses the terms refugee and asylum seeker interchangeably as used by Palzur (2005). Traditionally, an asylum seeker is someone who has applied for protection as a refugee and is awaiting the determination of his or her status. Whereas refugee is the term used to describe a person who has already been granted protection (UNESCO, 2008).

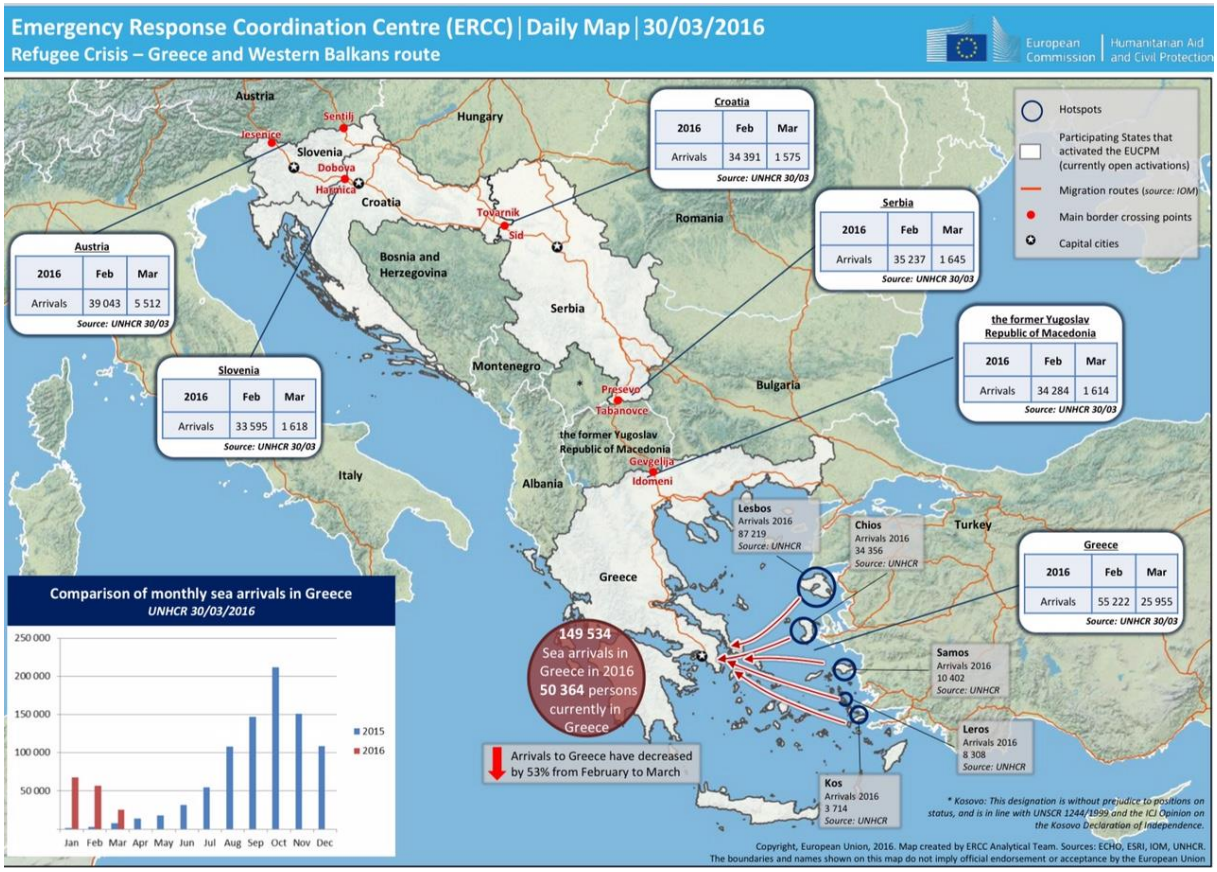
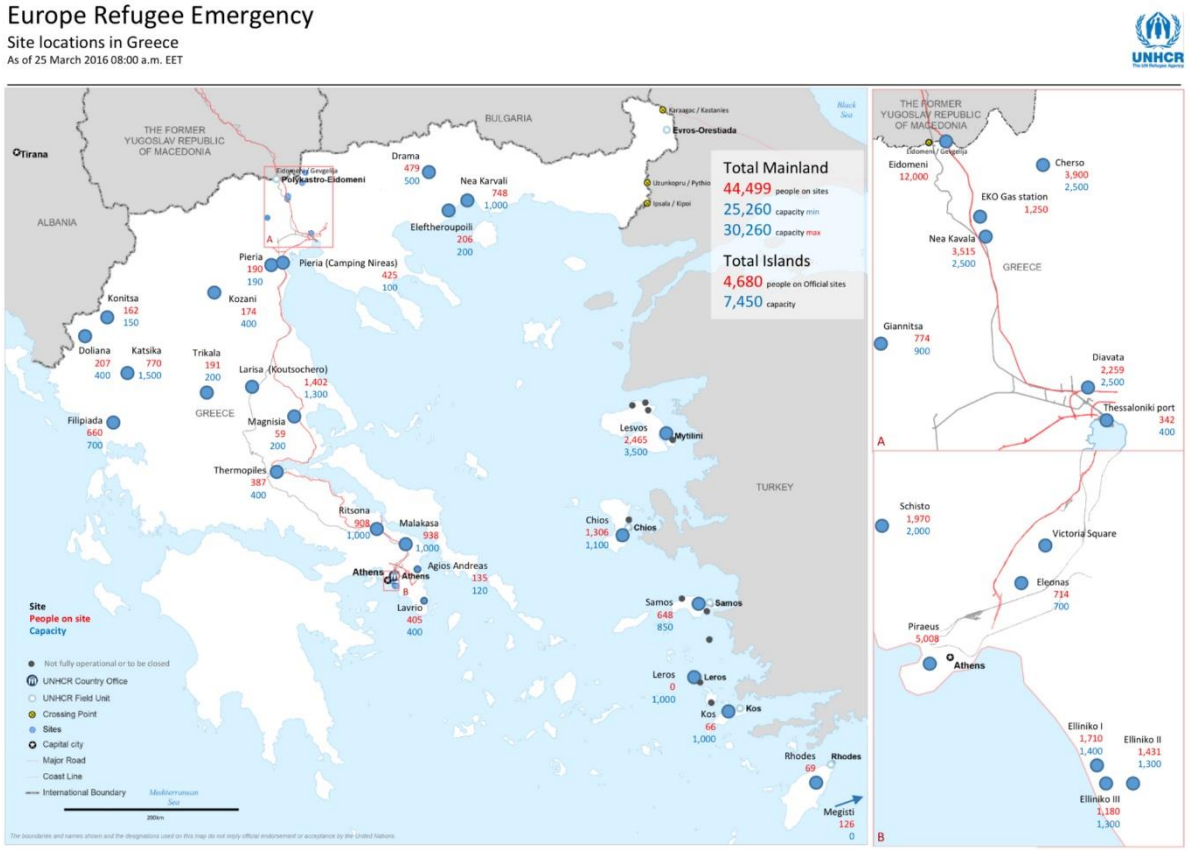


Figure 4.13. Illustration of the refugee crisis in Greece: The ECHO daily map of 30.3.2016
Source: ECHO (2016), © European Union (2016). Reuse authorized. The reuse policy of European Commission documents is regulated by Decision 2011/833/EU (OJ L 330, 14.12.2011, p. 39).

A survey conducted among hoteliers on various Greek islands following the influx of asylum seekers and migrants during the 2016 crisis revealed that a significant majority, approximately 90% on islands like Lesvos and Chios, attributed the decline in reservation rates and increase in cancellations during January-February 2016, compared to the same period in 2015, to the refugee and migrant crisis on the islands (Rouska, 2017). In addition, in the year 2020, thousands of residents on Greek islands protested migrant camps on their islands as these camps have been accompanied by higher violence levels on the islands (MediaCorp NewsAsia, 2020).

For this reason, there is logic to distinguish between points of entry for illegal migrants and asylum seekers in Greece as opposed to the rest of the country with regards to the threats associated with extremely high influxes of migrant flows. However, while Figure 4.13 shows the points of entry, other maps illustrate how the migrant/refugee crisis during 2016 illustrate that the issue was a national problem as these migrants and asylum seekers were transferred to various places across Greece for accommodation to reduce the stress on singular locations.

Figure 4.14, which was taken from the UNHCR shows the locations of temporary accommodation centers across Greece as of March 25, 2016 (for illustrative purposes alone). One can see how these centers were scattered throughout the country.



Based on figures from the Coordination Centre for the Management of the Refugee Crisis as of 25/03/2016 08:00 a.m. Eastern European Time.

Figure 4.14. Illustrative map of refugee site locations in Greece (as of March 25, 2016)

Source: UNHCR (2016)

For this reason and given the fact that it is quite difficult to predict where exactly the next refugee or migration flow will arise on the Greek border with regards to refugees and illegal migrants, no distinction will be made within Greece regarding this type of security crisis.

In terms of terrorism risks, Greece has faced challenges since the end of its military dictatorship in 1974. Domestic terrorist groups and a series of extremist left-wing and right-wing attacks have been ongoing. While Greece has shown a lower threat level of homegrown Islamist radicalization compared to other EU countries, it has become and remains an attractive transit point for jihadists traveling to and from Syria, according to the Counter Extremism Project (2023). When one looks at the Global Terrorism Index (GTI) for the year 2023 that assess and rank countries based on their level of terrorism risks, we can find that

Greece ranks 31 in the impact of terrorism on the country while Israel is ranked 25 (Institute for Economics and Peace, 2023a).

The Institute for Economics and Peace report (2023a) explains that in 2022, Greece experienced 35 terror attacks, making it the second most affected country in Europe after Turkey. Notably, despite having the highest number of attacks, Greece has not reported any terrorism-related deaths since 2013. None of the attacks in Greece during that year were claimed by any specific group, all attributed to unidentified far left or anarchist factions. Many of these incidents targeted police, prisons, government institutions, and political figures.

The description above illustrates how both Israel and Greece are faces with security risks. There is difficulty attributing these risks to specific locations within each country. For this reason, no distinctions will be made within each country. However, for comparative purposes, which will be addressed in the econometric analysis, it is important to consider examining if a certain country faces greater security risks than the other.

The Global Terrorism Index (GTI) focuses on terrorism, so it is more appropriate to consider indices like the Global Peace Index (GPI) also created by the Institute for Economics and Peace (2023b), or the Security Threats Index (The Global Economy, 2023) for a broader analysis. The GPI evaluates peace trends by considering societal safety, ongoing conflicts, and militarization levels, providing rankings for countries based on these factors. Similarly, the Security Threats Index assesses various security risks, including bombings, attacks, rebel movements, coups, terrorism, organized crime, and homicides, to gauge the threat level to a nation. The higher the value of the indicator, the more there are threats in that country.

According to the 2023 ranking of the GPI, Israel ranked 143 while Greece ranked 60, making Greece comparatively ranked higher than Israel in the state of peace. Interestingly, the Security Threats Index for 2023 reveals a different picture when Greece is ranked to have with more security threats than Israel: Greece received a score of 3.3 out of 10 and ranking 133, while Israel received a score of 2.6 out of 10, ranking 142 (The Global Economy, 2023). It is important to note that these rankings were determined before the Hamas-Israel Conflict of 2023 began. Additionally, the survey conducted in this study was administered prior to the Hamas attack on Israel, so the indices reflect the levels of security risks as they were perceived at the time of the survey.

In this study, due to the varied interpretations of security crises and the differing rankings of countries on various indices, it was decided that no definitive determination will be made

regarding which country is more susceptible to security crises as of August 2023. The econometric analysis will differentiate between the two countries in terms of the security variable without making assumptions about which country may be more prepared due to heightened security risks.

4.2.5. Pandemics

Pandemics are large-scale outbreaks of infectious diseases with significant global impacts on health, economies, and societies. Factors such as increased global travel, urbanization, and changes in land use have heightened the likelihood of pandemics, necessitating enhanced preparedness efforts (Madhav et al., 2017). Porta (2014) differentiates between epidemics and pandemics, where the former is characterized by the occurrence of illnesses exceeding normal levels within a community or region, while the later extends over a broad geographic area, crossing international borders and affecting a significant population.

Unlike epidemics, which are defined by their regional impact, pandemics, like COVID-19, are distinguished by their widespread geographic scope, crossing international boundaries (Porta, 2014). Pandemics arise from the rapid transmission of new viruses among individuals with limited or no immunity. These events are triggered by novel pathogens that swiftly spread from one human host to another, impacting a large population worldwide (Kelly, 2011).

To demonstrate the potential effects of pandemics one can take the COVID-19 pandemic as an example, which has been viewed by Peleg et al. (2021) as both qualitatively and quantitatively different from other disaster types given its global scope and the number of people affected. The COVID-19 pandemic caused disruptions and had notable impacts on supply and demand, trade and investments, prices, exchange rates, economic growth, international cooperation, financial stability, and other pandemic-related financial risks (ILO, 2020; Kemp, Portillo & Santoro, 2023). Alcántara-Ayala et al. (2021) refer to the COVID-19 pandemic in essence as a global disaster, which transcended ecological regions, national borders, economies, and societies. Given the fact that pandemics transcend borders, for the purposes of this study, the hazards associated with pandemics will be equal in all locations. Hence, location will not be a relevant variable when checking which factors explain why some hotels are better prepared for pandemics than others.

Of course, how each location or country addresses the risks associated with pandemics will influence their vulnerability and eventually how well they face the pandemic risks. But like in the case of the other hazards presented above, here too, the issue of vulnerability will not be included in the study. The Global Health Security Index (GHS Index), which measures countries' capacities to prepare for epidemics and pandemics would be a good indicator for the risks arising from pandemics. The index assesses countries' health security and capabilities across six categories and 37 indicators, providing insights into their preparedness for health security threats (Bell & Nuzzo, 2021). However, while acknowledging the existence of such indices, the study will not differentiate between locations with regards to pandemic hazards.

The next section of this chapter will discuss the data collection method, followed by the sampling strategy and information about the questionnaire.

4.3. Data collection

To explain the variation in disaster preparedness practices among hotels, as stated in the purpose of this study, there was a need to collect data relating to the different explanatory variables and the dependent variable. To the best of my knowledge, this information, especially regarding the levels of disaster preparedness, has never been collected / published with regards to hotels in Cyprus, Greece, and Israel. Therefore, the first stage of the study was to create and distribute a survey among hotels that would allow the collection of data that was not accumulated before.

In this study, the main approach to gather information involved utilizing a structured questionnaire, comprising a series of questions aimed at quantifying preparedness and capturing other details essential to the research. The decision to employ a survey as the research method is grounded in its efficacy for obtaining standardized responses from a broad and varied sample, as employed in the quantitative method (Franklin, 2008). The use of a structured questionnaire ensures uniformity in data collection, facilitating easier analysis and comparison of responses. Furthermore, it provides the flexibility to investigate specific variables aligned with the research objectives (Cheung, 2014).

4.3.1. Sampling strategy

This study uses hotels as the units of analysis for corporate risk management of natural hazards. There are several different definitions for *hotels*; most of these definitions include

these characteristics: a commercial establishment that offers temporary lodging accommodations and a range of guest services to travelers and/or tourists in exchange for money (Medlik, 2003). These services may include rooms, dining options, and various amenities, catering to the diverse needs of guests. Hotels can vary widely in size, function, and cost, providing a spectrum of experiences from budget lodgings to luxury resorts within the hospitality industry (Tourism Notes). Wilson-Mah (2020) lists different classifications of hotels according to size, location, level of service, market and function, ownership and affiliation, amenities, industry standards, and brand standards.

The sample of hotels included in this study have been selected in different ways for each country. The selection process will be described below according to the country addressed:

1. **Hotels in Israel**: The hotels in Israel which were included in the study consisted of hotels which are registered at the Israel Hotel Association (IHA). The IHA, which was willing to cooperate with this study, circulated the survey among 445 hotels listed, as of May 2023, in the Association, using the email addresses that they have of the hotel managers. The survey was sent by an IHA email address; responses to the survey were collected through the SurveyMonkey platform.
2. **Hotels in Greece**: For the Greek sample of hotels, at first a similar approach was attempted with the intention of cooperating with the Hellenic Chamber of Hotels or the Hellenic Hoteliers Federation, as suggested by contacts at the Ministry of Tourism of Greece and at the Greek Tourism Confederation who were kind enough to try and help. However, all attempts to contact the Hellenic Chamber of Hotels and the Hellenic Hoteliers Federation through email, phone, or connections failed. As a result, there was a need to create a list of hotels with contact information for the purpose of the study.

   The Greek Travel Pages (GTP) were used as the main information source for the dataset. Given the large number of hotels in Greece and the interface of the GTP website, which includes a search engine for hotels with different filter options (i.e., destination, accommodation type, ranking, facilities), it was decided to first select the locations of the hotels and take all the hotels in that location with contact information that could be found for the sample. The specific locations of hotels in Greece for this study were selected to reflect different levels of natural hazards. Hence to make sure that there is a certain degree of variation among hotels with regard to the levels of

natural hazards they face. Two filters were applied in the search engine: destination (location) and accommodation type (hotel).

Not all the hotels included on the GTP website listed their contact information. For those which did, the email addresses used for the circulation of the survey were the ones which appeared on the website. For those which did not list their email addresses on GTP, their websites were searched for an email address. When the email on the GTP website did not correspond to the email on the hotel's website, the hotel was asked via telephone to supply a valid email address for the purpose of this survey. The email of the person in charge of emergency management was requested. Hotels which did not have an email address on their website but had contact forms received the survey request through the contact form. Hotels which did not have email addresses nor contact forms on their websites were also contacted by telephone to receive a valid email address explaining the request. Some did not answer. There were several other hotels which were added to the Greek sample despite not being listed in the GTP website. They were found coincidentally when cross-referencing other hotels on the search engine.

As many of the hotels in Greece are part of a local or international chain, several of the largest chains were contacted through their headquarters, one of which replied that they have no intention to cooperate with the survey. One other chain hotel office explained they lack the time and resources to complete the survey. Since their hotels were also contacted directly, there is a possibility that some of their hotels answered the survey regardless, without the guidance from chain management. Eventually, the survey was circulated directly among 312 hotels in Greece.

3. **Hotels in Cyprus**: Similarly to the situation in Greece, attempts were made to contact the Cyprus Hotel Association for their support and/or assistance through emails and phone calls, however to no avail. Like with the Greek sample, it was necessary to assemble a list of Cypriot hotels and contact information. In this case, the Cyprus Hotels website, which has a directory of hotels in Cyprus was used. The website includes different information on most of hotels in Cyprus; with the use of the location filter, it was easy to compile a list of 85 hotels specifically for several locations. Here too, where no email address was available, the same process used for Greek hotels was used to obtain a way to send the questionnaire.

4.3.2. Research tool

The last section raised the importance of having a survey which on the one hand should be detailed enough to include all the variables in question, but on the other hand, not too long and complicated to dissuade respondents from completing it. Having this point in mind, SurveyMonkey was the chosen platform for conducting the survey. The main reason for choosing this platform over others is the ability to create simple and visually appealing matrix questions which were necessary to avoid repetition of questions. To illustrate this point, Table 4.6 presents question no. 13 as it appeared in the study's English version of the questionnaire. The complete questionnaire appears in Annex II of this study.

Table 4.6. Sample question taken from the survey to illustrate the use of the matrix format*

13. Please tick box if the questions below apply for the specific type of hazard listed.
For example, in the first row, if the formal written emergency management plan refers to earthquakes, tick the box for "yes" or leave empty for "no". Do the same for the other types of hazards (floods and/or landslides, wildfires, etc.)

	Earthquakes	Floods and/or Landslides	Wildfires	Weather Related Extreme Events	Tsunamis	Pandemics	Security Crises
Does the hotel have a formal written emergency management plan?	☐	☐	☐	☐	☐	☐	☐
Has the plan been revised annually?	☐	☐	☐	☐	☐	☐	☐
Does the hotel have early warning systems?	☐	☐	☐	☐	☐	☐	☐

* The Complete Survey appears in Annex II

The questionnaire consisted of 26 questions on 6 pages. The survey questionnaire was reviewed by several survey experts, one of which works at the National Statistics Authority of Israel, to assure its validity. Then, the questionnaire was pilot tested by two senior hotel managers in two large hotels, one of which belongs to a chain. As a result of this process, several amendments were made to the questionnaire to make it more understandable and to encompass different practices that hotels perform to address crisis situations.

The survey was distributed electronically to hotels via email addresses. Online surveys are especially advantageous when studying a population that is geographically dispersed (Van Selm & Jankowski, 2006), as is the case in this study. Respondents in Greece (and Cyprus)

received the questionnaire in Greek as a default, with the ability to answer also in English and the respondents in Israel received the questionnaire in Hebrew as a default, with the ability also to answer in English. Overall, out of the 75 completed responses, 55 hotels answered the survey in Hebrew, 3 hotels answered the English version, and 17 hotels answered the Greek version.

Chapter 5. Research results and their practical implications

Chapter 5, which analyzes the empirical data and presents the results, includes three parts. The first illustrates the data with descriptive statistics, offering an exploration of the characteristics of the variables included in the study among the hotels in the study's sample. The second section involves econometric and statistical analyses aimed at examining the relationships and dynamics between the variables. Finally, the third section synthesizes the empirical findings and draws the study's conclusions. Later, the limitations of the study will also be addressed.

The survey was sent to 445 hotels in Israel and 312 hotels in Greece (757 in total) between May 26 and July 10, 2023. A total of 111 hotels (86 hotels in Israel and 25 hotels in Greece) answered the survey, reflecting a response rate of 14.6%. Given the length of the survey, its complexity, and the season when the survey was distributed (high season), this response rate is consistent with the response rate target of this study. While not all respondents completed the survey, it was possible to complete the econometric analysis on the sample and derive conclusions, with a lower confidence level and higher margin of error.

The respondents (both incomplete and complete) spent an average of 11 minutes on the survey, while those who completed the survey spent 19min:15 sec on the survey. This reflects a substantial time commitment for respondents. Perhaps, the survey length may have discouraged full participation and could have impacted respondents' willingness to complete all questions. The survey statistics appear in Table 5.1 below.

Table 5.1. Survey statistics

	Greece	Israel	Total
Circulated Questionnaires	312	445	757
Partially Complete + Complete Questionnaires	25	86	111
Completed Questionnaires (no. of observations included in the study)	18	57	75
Time spent to complete Questionnaire	8min:53sec	22min:16sec	19min:15sec
Completed / Started	72%	66.3%	67.6%
Completed / Circulated	5.8%	12.8%	10%
Started / Circulated	8%	19.3%	14.7%

Source: Own elaboration.

One can notice that in Table 5.1 there is no information on the number of viewers for the survey. This is because the survey was circulated through web links with no information gathered on those entering the survey (to allow privacy and to raise respondent rates). Hence, there is no way to know if those who received the email even opened the survey, disregarded it or considered it as spam.

5.1. Data description

In this section, the survey results will be presented with the use of descriptive statistics. Usually, the common components included in descriptive statistics are measures of central tendency: mean, median, and mode; measures of dispersion: variance, standard deviation, and range; frequency distributions, measures of shape, bivariate/multivariate analysis: scatter plots, cross-tabulations, correlation coefficients, and percentiles and quartiles (Hoeks et al, 2013; Kaliyadan & Kulkarni, 2019).

Descriptive statistics offer valuable insights into the characteristics and distribution of the variables under investigation, however, because most of the independent variables in this study are noncontinuous nominal / categorial variables and ordinal variables, other than presenting the frequency distribution, most of these descriptive statistics components are problematic to present or meaningless (Sirkin, 2006). Therefore, the descriptive statistics presented below for the independent variables consist of presenting the frequency of the different categories in the survey results, for the purpose of visualizing the grouping and sorting of variables and for understanding the characteristics of the hotels included in the survey.

This chapter provides an analysis of descriptive statistics and regression based on the responses from 75 hotels that completed the entire survey (N=75). Notably, respondents who did not finish the survey tended to stop at the section concerning the dependent variable. Answering these questions necessitated an understanding of the hotels' preparedness measures, which not all respondents possessed. Thus, it is understandable that this is where some participants chose to discontinue the survey. Consequently, all 111 respondents (N=111) provided data for the independent variables but as these questionnaires were incomplete, the data included in the statistical analysis (descriptive and inferential) will be based only on a sample of 75 hotels.

If we follow the list of independent variables (predictors) according to their appearance in the hypotheses, we can start with descriptive statistics regarding variable 1, the hazard faced by the hotel. The hazard levels for earthquakes, tsunamis and wildfires, for the locations of the hotels in this study, were presented in sub-chapter 4.2 above, therefore there is no additional analysis to include here. The hazard variable is not relevant for security risks and pandemics, as explained as well in sub-chapter 4.2.

Hypothesis 2 refers to the country where the hotel is located. In the sample of 75 hotels, there were 57 hotels in Israel and 18 hotels in Greece. Given the interest in conducting here a comparative analysis between the circumstances and preparedness levels of hotels in two different countries, most of the graphs presented in the descriptive analysis below will present the frequency of answers with a sub-division according to the country of the hotels. For instance, Table 5.2 below addresses the frequency of answers with regards to the third variable on receiving public assistance as the hotels were asked in which fields the hotel has received public assistance for strengthening emergency disaster preparedness?

Table 5.2 shows that most of the hotels examined (71%) did not receive any of the three types of public assistance options and that only one hotel out of 75 received all three types: funding, training for employees and raising awareness measures. In terms of funding, 7% of the sample received such assistance; 21% of hotels received training for emergencies and disasters for their employees; and 24% of the hotels stated they received assistance for raising awareness.

Table 5.2. Types of public assistance and public assistance index among hotels (N=75)

Type of Public Assistance	In Israel	In Greece	Total	Percentage
Funding	2	3	5	7%
Training for employees	11	5	16	21%
Raising awareness	11	7	18	24%
Public Assistance Index	In Israel	In Greece	Total	Percentage
Score of 0	45	8	53	71%
Score of 1	1	5	6	8%
Score of 2	10	5	15	20%
Score of 3	1	0	1	1%

Source: Own elaboration.

The size of the hotels (variable 4) included in the sample is presented in Figure 5.1. Roughly half of the sample are medium-sized, in the 51 to 200 rooms range. One other interesting observation is that the Greek hotels in the sample are proportionately smaller than the Israeli

hotels. Thirteen out of the eighteen hotels (72%) of the Greek sample have up to 100 rooms whereas only 37% of the Israeli sample have up to 100 rooms.

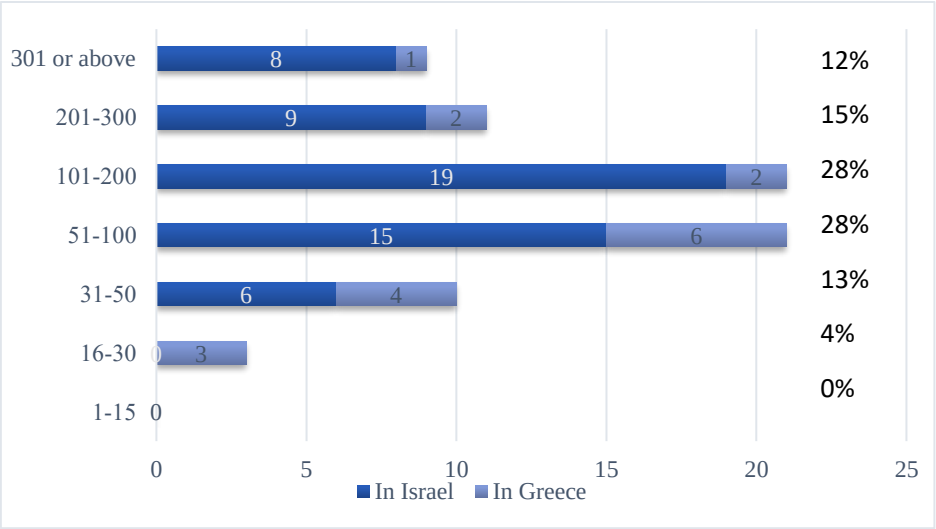


Figure 5.1. Size of hotels in the sample (N=75), country breakdown
Source: Own elaboration

When addressing ownership patterns among the sample (variable 5), the majority (52%) of the hotels were a part of a local chain, 15% were family-run hotels, 21% were corporate owned single hotel, and 12% were part of an international chain of hotels. Figure 5.2 illustrates this information, also allowing a country comparison.

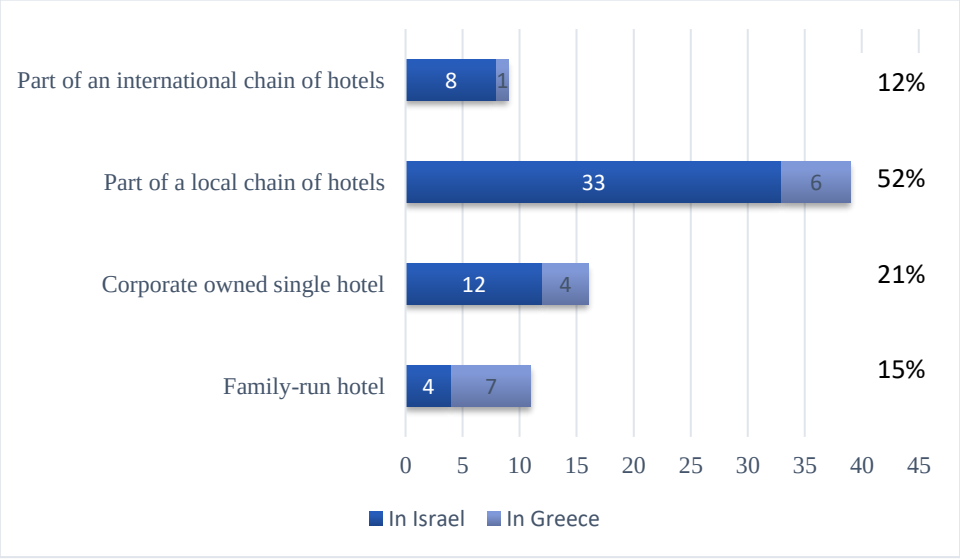


Figure 5.2. Ownership patterns of the hotels in the sample (N=75)
Source: Own elaboration

The hotels were asked whether they have an employee who is responsible for emergency disaster preparedness or similar functions like risk management or business continuity (variable 6). Figure 5.3 shows how most of the hotels in both countries have a designated employee for emergency disaster preparedness. A total of 49 hotels indicated they have such an employee.

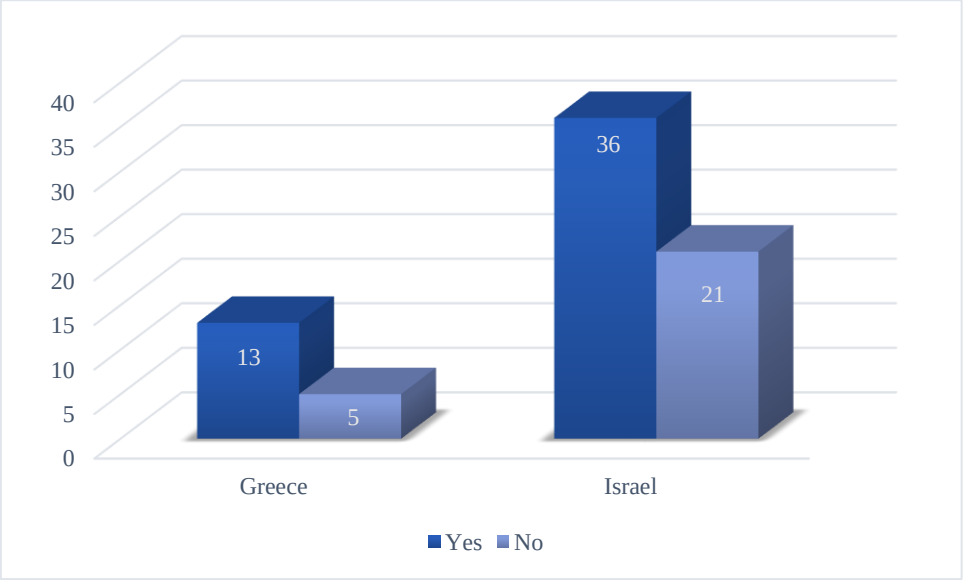


Figure 5.3. Presence of employee in charge of emergency disaster preparedness (N=75)
Source: Own elaboration

In addition to the question regarding the presence of such an employee, the respondents were asked to indicate whether the person responsible at the hotel for emergency disaster preparedness was also the person who answered the survey. The purpose of this question was to see whether the survey was answered by the most competent person in the field at the hotel. It is logical to assume that having the person in charge of emergency disaster preparedness answer the survey makes the responses more credible. There were 35 respondents who said that the person in charge of emergency disaster preparedness answered the survey on behalf of the hotel. If we return to the issue of the incomplete surveys (36 in total), here it becomes evident that many hotels simply lack a representative capable of answering questions about emergency disaster preparedness. This might further explain why respondents did not complete the section related to the hotel's preparedness measures.

The variable regarding the physical condition of the hotel (variable 7) involved two aspects: the age of the building or property and whether the hotel had been retrofitted or renovated to address the risks of natural hazards. In Table 5.3, in the left columns one can see how many

hotels were built in each country during which decades. The age of the hotel included in the regression analysis was the age of the hotel in years, when the exact year of establishment (of the building) was given, or the mid-year of the decade, when the hotel indicated in the survey only in which decade it was built. The sample includes 14 hotels between the ages of 1–10 years, 6 hotels between the ages of 11–20 years, 8 between the ages of 21–30 years, 17 hotels between the ages of 31–40 years, 13 hotels between the ages of 41-50 years and 17 hotels at the age of 51 or older. This distribution demonstrates a sufficient degree of variance in hotel age and provides a good representation of hotels - from new hotels that have just begun their operations to long-standing establishments that have been around for decades.

On the right-hand side of Table 5.3 appear the figures regarding retrofitting. Out of the hotels built in each decade, the number of hotels which have undergone retrofitting is indicated. For example, out of the two hotels built between 1910-1919 in Israel, only one has been retrofitted to address natural hazards.

Table 5.3. Age of hotels in the sample and whether they were retrofitted (N=75)

	No. of Hotels Built			Retrofitted Hotels	
Year	In Greece	In Israel		In Greece	In Israel
1910-1919	0	2		0	1
1920-1929	0	0		0	0
1930-1939	0	0		0	0
1940-1949	0	0		0	0
1950-1959	1	2		1	1
1960-1969	3	6		3	1
1970-1979	2	7		2	2
1980-1989	8	11		5	1
1990-1999	3	8		3	1
2000-2009	0	6		0	1
2010-2019	1	12		1	3
2020-2023	0	3		0	1
Total	18	57		15	12
			Percentage	83%	21%

Source: Own elaboration

Out of the total sample, 15 hotels in Greece (83%) and 12 hotels in Israel (21%) have been retrofitted throughout the years to address natural hazards.

The eighth variable included in this study addresses previous disaster experience. For each type of hazard, the respondents were asked to indicate whether their hotel experienced a previous disastrous event. To make sure that the respondents understood what a disaster is,

the survey literally defined a disaster as “an extreme event that does not allow the hotel to continue business as usual; there have been casualties, loss of life, great damage to assets and/or significant loss of income.” Table 5.4 indicates the number of hotels, divided according to country, which answered that they previously experienced a disaster for different types of hazards. To illustrate the results of this survey question, one can take earthquakes as an example. There were 5 hotels in Greece and 6 hotels in Israel that stated that they previously experienced a disaster resulting from an earthquake. There was also one hotel in Greece that claimed to experience a disaster resulting from a tsunami.

Table 5.4. Previous disaster experience (N=75*)

Type of Hazard	In Greece	In Israel	Total	Percentage
Earthquake	5	6	11	15%
Tsunamis (N=21)	1	0	1	5%
Wildfires	1	3	4	5%
Security Crises	1	17	18	24%
Pandemics	10	33	43	57%

*There are 21 hotels in the sample which fit the criteria to face the tsunami hazard

Source: Own elaboration

These results raise some interesting questions because some of them do not intuitionally correspond to the disasters we know did or did not occur in different areas. For instance, the earthquakes in the last century in Israel are not known to have caused significant damage or injuries (except for the earthquake of July 11, 1927). Hence, there was a need to look into each of the hotels separately. Out of the 6 hotels in Israel which claimed to have experienced a previous disastrous earthquake, three are in Eilat, two are in Jerusalem, and one is in Tel Aviv. The Gulf of Aqaba did experience a 7.2 earthquake on November 22, 1995, which caused damage in Eilat to roads and buildings and cut off electricity and water supplies temporarily (IDF, 2024c). Regarding Jerusalem and Tel Aviv, while both cities have felt minor to moderate tremors from occasional earthquakes along the Dead Sea Fault system, there is no evidence of major destructive earthquakes in their vicinity (Geological Survey of Israel, 2024). While hotels could have experienced cracks that required structural maintenance and incurring costs, there is no other explanation for how the hotels answered the survey question.

To assess the accuracy of other survey responses, several other hotels were picked randomly. For instance, the hotel that claimed to have experienced a disaster resulting from a tsunami is in Aigialeia, Greece and was built in the 1960s. The shores of Aigialeia did

experience the tsunami of February 7, 1963, which resulted in damage and injuries (Papathoma & Dominey-Howes, 2003) and Karkani et al. (2022) mention that on January 1, 1996, an intense wave was observed near Aigio. These occurrences make it possible that the hotel experienced a tsunami that meets the criteria for being a disaster.

Another area where the results seemed surprising concerns the pandemic. The COVID-19 pandemic caused havoc in the tourism sector, with the halt of flights and reduced number of travelers. With the need for social distancing and measures to reduce COVID-19 transmission, many hotels were forced to change their business strategies, adopt innovations to enable low-touch, clean experiences, some had to close (Ntalakos et al. 2022). The results of the survey show that only 57% of hotels in the sample had a disastrous experience resulting from COVID-19. This figure would be 58% if we exclude one hotel out of the 75, which indicated that it opened after COVID-19, in 2022, meaning that it could not have experienced COVID-19.

The final explanatory variable presented in this study focuses on risk perception. Respondents were asked to indicate the main extreme-event hazards facing the hotel by ticking the box if a certain type of hazard could have a devastating effect on the hotel. The results of this question are shown in Table 5.5.[7]

Table 5.5. Risk perception among the hotels: number of hotels indicating which type of hazards can cause extreme events for their property (N=75*)

Type of Hazard	In Greece	In Israel	Total	Percentage
Earthquake	12	42	54	72%
Tsunamis (N=21)	2	7	9	43%
Wildfires	9	7	16	21%
Security Crises	3	43	46	61%
Pandemics	9	23	32	43%

* There are 21 hotels in the sample which fit the criteria to face the tsunami hazard

Source: Own elaboration

The results indicate that there is wide understanding that earthquakes pose as a serious hazard in both Greece and Israel as 72% consider earthquakes as dangerous. Roughly 75% of the hotels in Israel see security crises as a type of hazard that can cause extreme implications for their property. If we divide the data into a country analysis, in Greece 66%, 20%, 50%, 17% and 50% respondents considered earthquakes, tsunamis, wildfires, security crises, and

[7] The original survey also includes floods and/or landslides and weather-related extreme events and possible types of extreme events.

pandemics respectively, as sources of disastrous extreme events. In Israel the figures are 74%, 64%, 12%, 75% and 40% respectively for earthquakes, tsunamis, wildfires, security crises, and pandemics. Again, it should be noted that the figures for tsunamis are from the sample of 21 hotels which met the criteria - 11 in Israel and 10 in Greece. One other note is that while these numbers are of great interest, the figures for earthquakes, tsunamis and wildfires should be taken into consideration only in conjunction with the actual physical hazard levels that are present in the hotels' locations. This will be examined in the regression analysis in the next section of this chapter.

This last part of the descriptive statistics section will introduce the results of the preparedness levels of the 75 hotels in the sample to different types of hazards. It is important to note again that while the initial data may suggest that the hotels are generally unprepared for various types of hazards, this conclusion might be misleading, specifically regarding earthquakes, tsunamis and wildfires. The intensity of hazards varies significantly depending on each hotel's location. Therefore, although the graphs might indicate a lack of preparedness in many hotels, this may not be the case. To accurately assess the hotels' preparedness, it is essential to consider the correlation between their location and preparedness levels. This analysis will be detailed later in the chapter. Figure 5.4 shows the preparedness levels of the hotels to the earthquake hazard. This figure will be followed by figures for tsunami preparedness (Figure 5.5), wildfire preparedness (Figure 5.6), security crises preparedness (Figure 5.7), and pandemics preparedness (Figure 5.8).

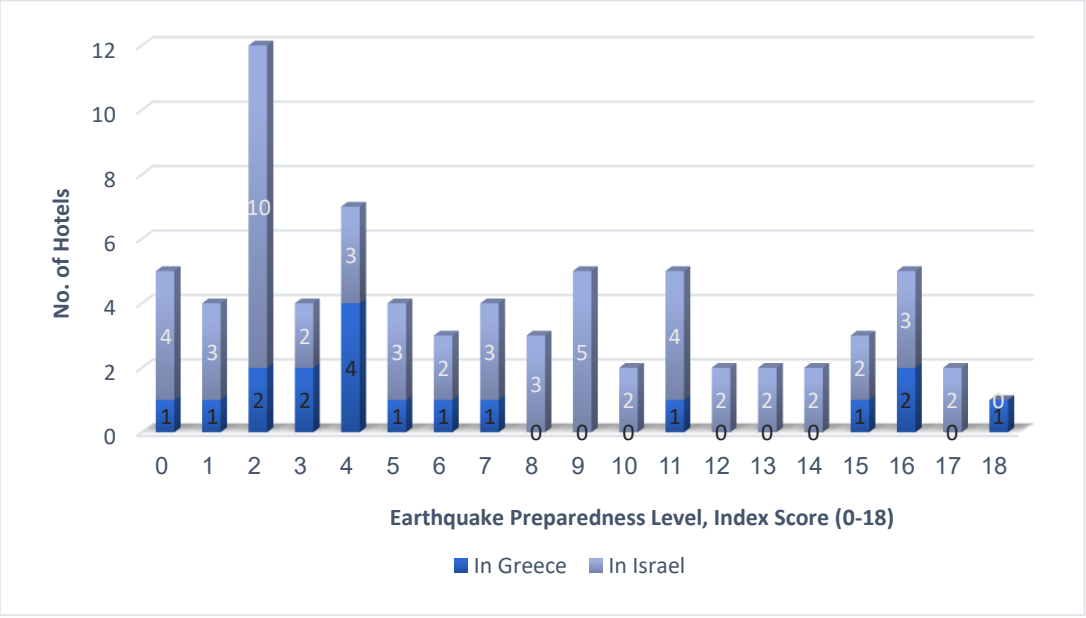


Figure 5.4. Preparedness levels of hotels in sample to earthquake hazard (N=75)

Figure 5.4 shows considerable variability in earthquake preparedness levels among the hotels, ranging from very low scores (0-3) to very high scores (16-18). This suggests that preparedness is quite uneven across the hotels in both countries. In Israel, the distribution appears more spread across different levels, ranging from 0 to 18, while Greece has relatively fewer hotels at higher preparedness levels.

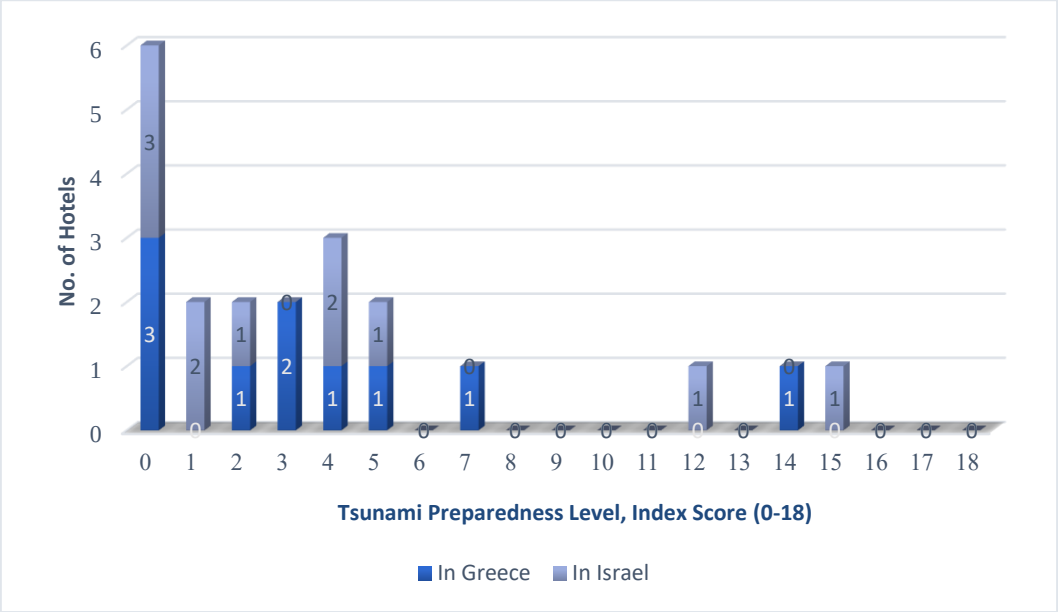


Figure 5.5. Preparedness levels of hotels in sample to the tsunami hazard (N=21)

With regards to the tsunamis, Figure 5.5 shows that most hotels in the sample have very low preparedness levels for tsunamis. The most frequent preparedness level is Level 1, with 6 hotels (3 in Greece and 3 in Israel). Out of the 21 hotels, 17 have a score of 5 or lower. The situation regarding wildfires is similar, with most of the hotels demonstrating a preparedness index score of 4 or lower, as illustrated in Figure 5.6.

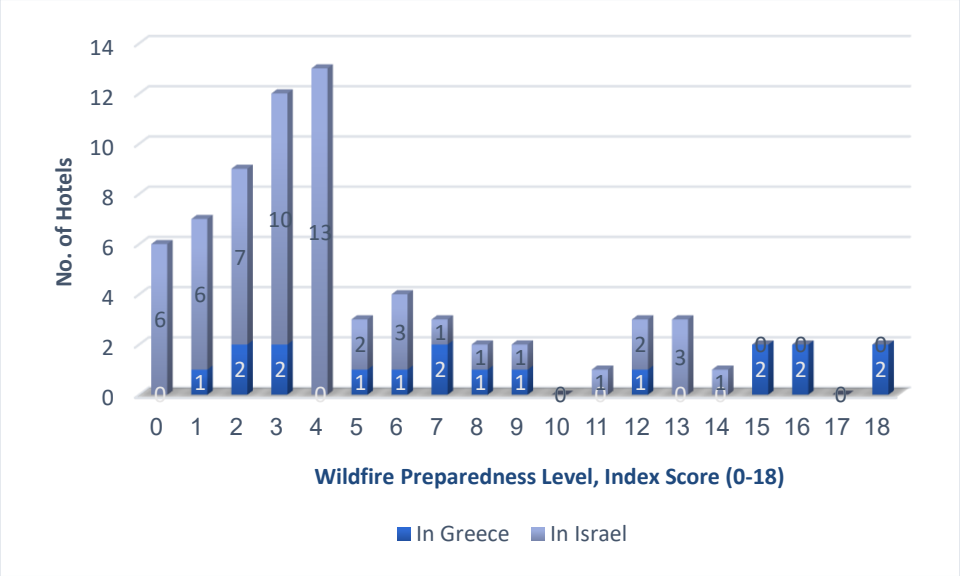


Figure 5.6. Preparedness levels of hotels in sample to wildfires hazard (N=75)

The preparedness levels for security crises, as shown in Figure 5.7, are highly varied among the hotels, ranging from 0 to 18. There is no clear clustering in one specific area, suggesting a diverse range of preparedness approaches across the two countries. One can notice that hotels in Israel appear to have a much broader distribution, with many hotels spread across low, medium, and high preparedness levels. Whereas in Greece most hotels are concentrated in the lower preparedness levels (0-4), with few hotels showing higher levels of preparedness.

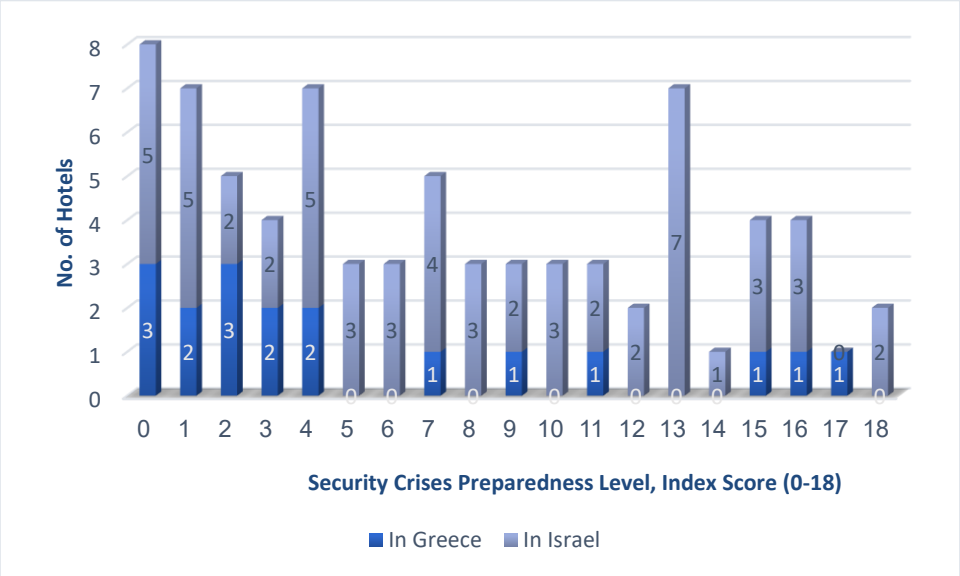


Figure 5.7. Preparedness levels of hotels in sample to the security crises hazard (N=75)

The preparedness levels of hotels in the sample to pandemics seem to follow a similar pattern with tsunamis and wildfires, with most of the sample (53 hotels) clustered around the lower levels of preparedness, 0-4 in the index score.

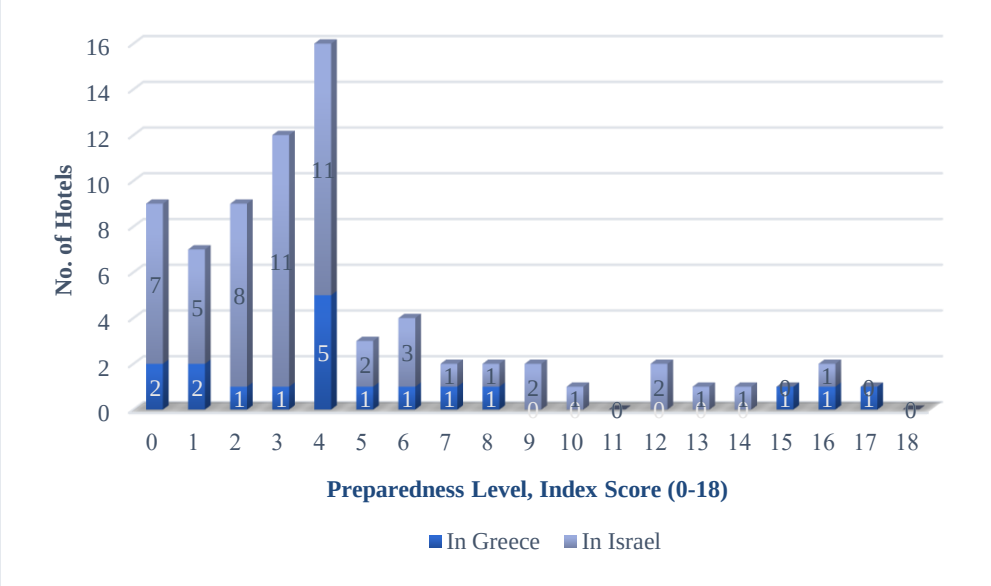


Figure 5.8. Preparedness levels of hotels in sample to the pandemics hazard (N=75)

Since there is no need to check the correlation between the locations of the hotels with the security and pandemic hazards (as explained earlier in the chapter), one can already understand that the hotels included in the survey are not prepared for the next pandemic. To compare the preparedness levels of the hotels included in the study across hazard types, Table 5.6 summarizes the mean, mode, and median values of the preparedness levels.

Table 5.6. Preparedness levels across hazard types: mean, mode, and median scores

Type of Hazard	Mean	Mode	Median	Size of Sample
Earthquake	7.11	2	6	75
Tsunamis	3.9	0	3	21
Wildfires	5.4	4	4	75
Security Crises	7.27	0	7	75
Pandemics	4.49	4	4	75

The mean, mode and median analysis of hotel preparedness levels across the five hazard types reveals significant variation in both average preparedness and score distributions, as seen in Figures 5.4–5.8. Hotels in the sample exhibited the highest preparedness levels for security crises and earthquakes, with means of 7.27 and 7.11, respectively. However, in both cases, the mode of preparedness was low (0 for security crises and 2 for earthquakes),

indicating that while some hotels were highly prepared, a sizeable percentage of hotels showed only minimal preparedness levels. With a mean of 5.4 and a consistent mode and median of 4, hotels demonstrated moderate levels of preparedness for the wildfire hazard. This suggests that while preparedness for this hazard is more evenly distributed, it still leaves room for improvement. The study also found hotels least prepared for pandemics and tsunamis. The mean preparedness for pandemics was 4.49, while for tsunamis it was 3.9, with both hazards recording low medians and modes of 4 and 0, respectively.

When comparing the preparedness levels for the two hazard types that are not location-dependent, hotels show higher preparedness for security crises than for pandemics. However, many hotels, particularly in Greece, remain inadequately prepared for security threats. The statistical analysis in the next section of this chapter will explore the reasons behind these findings.

To finish this part of the study focusing on descriptive statistics, it would be useful to address the point mentioned above regarding the level of preparedness to hazards given the location of the hotel. As mentioned above; to accurately assess the hotels' preparedness, it is essential to consider the relationship between their location and preparedness levels. A useful tool to visualize these relationships is the use of plots. The levels of hazard for earthquakes and tsunamis used in this study are continuous, therefore the use of plots for visualization purposes is best for them. Figure 5.9 and Figure 5.10 illustrate the preparedness levels for hotels with relation to their earthquake hazard level and tsunami hazard level, respectively.

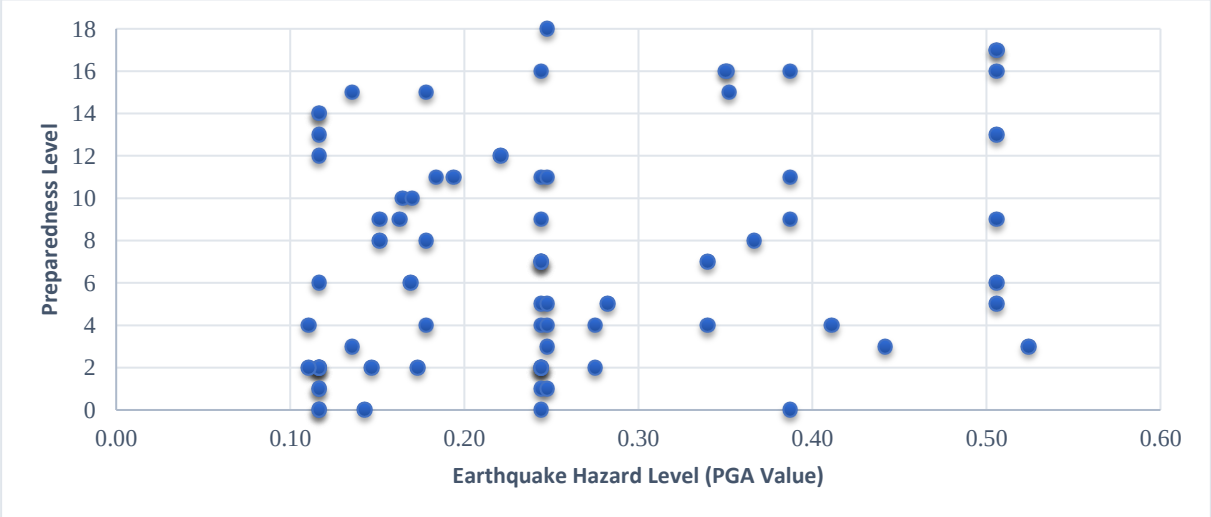


Figure 5.9. Scatter plot - earthquake preparedness level / earthquake hazard level (N=75)

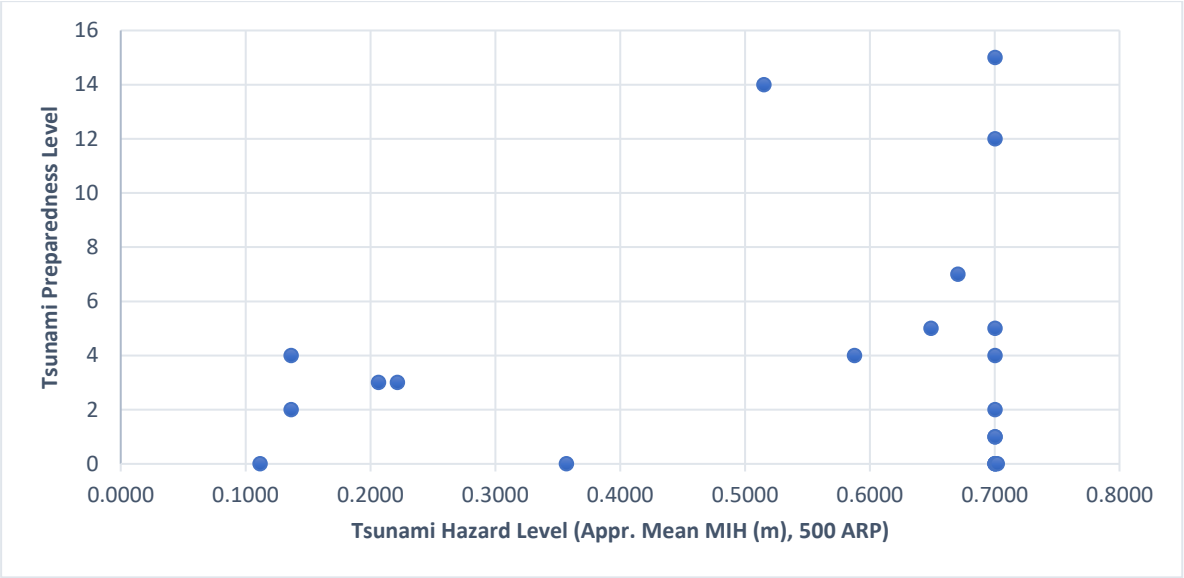


Figure 5.10. Scatter plot - tsunami preparedness level / tsunami hazard level (N=21)

For the earthquake hazard, there seems to be a cluster of hotels with low preparedness levels (0-4) at lower PGA values (around 0.10), indicating that many hotels in relatively lower hazard areas have not invested much in earthquake preparedness. This may suggest that hotels in areas with lower hazard levels understand they are in low earthquake hazard zones, thus making them less required to be prepared. This issue of risk perception will be checked in the statistical analysis later in the chapter.

Nevertheless, the scatter plots above suggest that there isn't a noticeable or consistent relationship between hotels' preparedness levels for earthquakes or tsunamis and the hazard levels associated with their locations. The 14 hotels in Jerusalem, which have an earthquake hazard level (PGA value) of 0.24 show significant variation in their preparedness levels. Another example would be the six hotels in Tel Aviv and Herzliya which are included in the tsunami sample, where the hazard level is 0.7004, should have shown a similar level of preparedness. However, that is not the case. The preparedness levels vary considerably.

Although the ordinal nature of the wildfire preparedness index limits the utility of a scatter plot, it was included to illustrate that many hotels in high-risk wildfire areas (with a score of 5 on the wildfire hazard index) have very low preparedness levels. These hotels are clustered in the lower right corner of Figure 5.11. Specifically, the study identifies 18 out of 75 hotels with the highest wildfire hazard score of 5, all of which have preparedness levels of 6 or below.

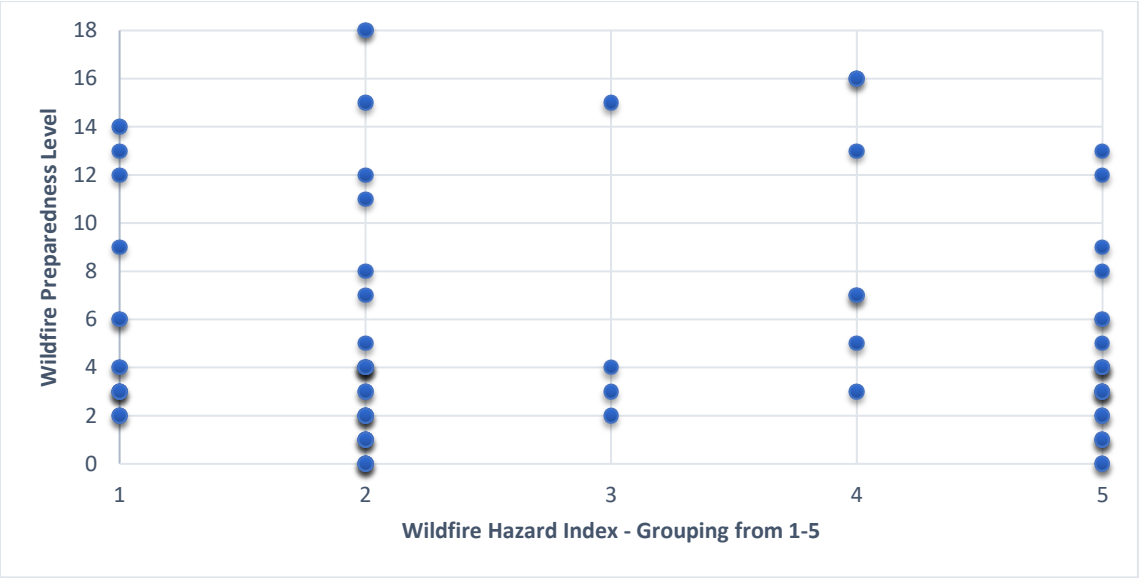


Figure 5.11. Scatter plot - wildfire preparedness level / wildfire hazard level (N=75)

Having provided a thorough descriptive analysis of explanatory and dependent variables across the five types of hazards included in the study, the next part of the chapter will focus on the statistical analysis. The descriptive findings reveal significant variability in preparedness that warrants understanding the relationships between the different variables. The following sections present the results of this analysis, offering insights into the factors that significantly influence hotel preparedness for different extreme events.

5.2. Identified relationships and dynamics

This next section moves from descriptive statistics to understanding the relationship between the predictors and the dependent variable. Following the introduction of the hypotheses and their operationalization in this study and the descriptive statistics illustrated above, one can notice that most of the variables in this study are categorical and/or binary predictors. The wildfire index used in this study is an ordinal scale. The ownership type variable (e.g., corporate-owned, family-run) is categorical, and other variables such as size are ordered categories (e.g., small, medium, large according to the number of rooms). Some of the variables are binary, which include "yes" or "no" responses, such as whether the hotel has an employee designated for crisis management. The variable regarding receiving assistance is constructed by summing relevant factors, making it an ordinal or count-like in nature.

Given these characteristics of the different variables one can understand that the most suitable statistical model for analyzing the preparedness of hotels to the different types of

hazards is an ordered logit regression, which is designed to handle both ordinal dependent variables and categorical predictors (Williams, 2016). An ordered logit model (OLM) accommodates ordinal outcomes by modeling the likelihood of being at or above certain levels of preparedness, without assuming a continuous distribution and an equal distance between preparedness levels.

It should be noted that while linear regressions and logistic regressions were conducted as well as part of the statistical analysis to thoroughly analyze different models, they were found to be inappropriate for the type of information included in the study. Since the dependent variable - the preparedness level of hotels - is measured on an ordered and ordinal scale, ranging from 0 to 18, a linear regression model which assumes a continuous dependent variable, is inappropriate for this type of ordinal data. In addition, while multinomial logistic regressions are useful for categorical outcomes with multiple levels, they ignore the ordinal nature of the dependent variable.

Since different statistical models give different outputs, it is important to outline the outputs of the OLM. OLM's purpose here is to examine how the different variables influence the preparedness level of hotels. The ordered logit regression in this study provides probabilistic insights into the preparedness levels of the hotels included in the study by estimating the likelihood of a hotel being at or above specific levels of preparedness in response to different hazards. For each variable, the model calculates the odds that a hotel falls into a category at or beyond a certain level, given the answers it provided in the survey regarding its characteristics (Fu, 1998). This is useful for interpreting incremental changes in preparedness given the ordinal nature of the data. The cumulative approach of OLMs offers insight into whether factors increase the likelihood of reaching moderate or high preparedness levels rather than only distinguishing between a "prepared" or "unprepared" hotel.

To understand the regression results, it would be useful first to show how the variables were named in the analysis. The variables were tagged as follows: hazard = HAZARD; country = COUNTRY; receiving public assistance = ASSIST; SIZE received several categorical variables: X01.50, X51.100, X101.200. Hotels with over 201 rooms were in the default category, excluded from the regression. Ownership (OWN) was also divided into categorical variables: family.run.hotel, Corporate.owned.hotel, Part.of.a.local.chain.of.hotels. Here, *hotels part of an international chain* is the default category. Having a dedicated employee for emergency

and disaster preparedness = EMPL; Age of the hotel = AGE; being retrofitted = RETROFIT; previous disaster experience = EXP; and risk perception = PERCEP. The dependent variable, level of preparedness was labelled PREP.

The ordered logit regressions used in this study can be illustrated using the following mathematical equation when the focus is on expressing the odds of a hotel being in a category *at or beyond* a certain level of preparedness:

$$\log\left(\frac{P(\text{PREP} \geq j)}{1 - P(\text{PREP} \geq j)}\right) = -\tau_{j-1} + (\beta_1 \cdot \text{HAZARD} + \beta_2 \cdot \text{COUNTRY} + \beta_3 \cdot \text{ASSIST} + \ldots + \beta_{14} \cdot \text{PERCEP})$$

Where:

$\log\left(\frac{P(\text{PREP} \geq j)}{1 - P(\text{PREP} \geq j)}\right)$ refers to the log-odds of the probability that a hotel's preparedness level is at or above a specific category, *j*;
j refers to the ordinal category of PREP (ranging between 0-18);
$-\tau_{j-1}$ *is the* cut-off value associated with the (*j*−1)th category of PREP;
β_0 ,β_1, …, β_{14} are the regression coefficients for each independent variable;
X01.50, X51.100, X101.200 are the categorical variables representing SIZE;
Family.run.hotel, Corporate.owned.hotel, Part.of.a.local.chain.of.hotels are the categorial variables representing OWN.

It should be noted that due to technical difficulties, for two regressions, some of the predictors were omitted, slightly altering the original equation. This will be elaborated where relevant below.

As Williams (2016) explains, ordered logit regressions provide coefficients and odds ratios for each independent variable, showing how variations in the explanatory variables (such as going from no assistance to receiving different levels of assistance) impact the odds of achieving a higher level of preparedness. While coefficients show the direction and relative strength of each explanatory variable's relationship with preparedness, the odds ratios (OR) translate these coefficients into the multiplicative effect on the odds, allowing us to see, for example, how much more likely a hotel is to be highly prepared if it has a dedicated crisis management employee or is in a high-risk hazard area. An OR of 1 represents a threshold, indicating no association between the predictor and the dependent variable's outcome. Values greater than 1 suggest a positive association, meaning the variable increases the likelihood of the outcome, while values less than 1 indicate a negative association, reducing the likelihood of the outcome.

By assessing the significance of each variable, the model also allows us to identify which variables are most influential in determining a hotel's level of preparedness. This allows the study to highlight factors like public assistance, hotel size, or ownership type as key drivers of preparedness to different types of hazards. Therefore, the results of the ordered logit regression will focus on the following statistics: coefficients, odds ratios, and p-values. In addition, McFadden's pseudo-R^2 / adjusted pseudo-R^2, and confusion matrices were created to add another layer of statistical assessment.

The confusion matrix provides a clear visualization of how well the model predicts each category of the ordered dependent variable and allows error analysis (Hua, Choi & Shi, 2021). It should be noted that the fact that ordered logit models focus on ordinal trends rather than exact level predictions, this makes achieving precise predictions for ordinal outcomes a bit more difficult. Nevertheless, the confusion matrices were found to be beneficial for evaluating model performance, as will be explained below.

The following tables present the results of the ordered logit regressions conducted in R software for statistical computing, for the five hazard types: earthquakes, tsunamis, wildfires, security threats and pandemics. For each hazard type, the results will be interpreted before moving on to the next hazard type. Confusion matrices were created for all five types of hazards. Following the regression analyses, a synthesis of all the results will be brought, with a different perspective - focusing on the variables, rather than on the hazard types.

According to the results of the ordered logit regression presented in Table 5.7 for earthquakes, the HAZARD variable, with a coefficient of 6.0685 and p-value < 0.05, has a very strong and significant positive relationship with the preparedness variable. Just to understand the meaning of the odds ratio - each unit increase in the hazard variable increases the odds of preparedness by 432 times. Another strong and statistically significant predictor for earthquake preparedness is having an employee (EMPL) in charge of emergency and disaster management, as the coefficient is 2.4097 and p-value < 0.05. The odds ratio result indicates that hotels with designated preparedness employees are roughly 11 times more likely to be prepared than those without a designated employee.

Table 5.6. Results of the ordered logit regression for the earthquake hazard

Earthquake	Coef.	Std. Err.	T Value	P Value	Odds Ratios
HAZARD	6.0685	2.1435	2.8311	0.0046	432.038
COUNTRY	-0.0817	0.6628	-0.1233	0.9019	0.922
ASSIST	0.9055	0.2882	3.1426	0.0017	2.473
X01.50	-0.9404	0.8393	-1.1205	0.2625	0.391
X51.100	0.1797	0.7864	0.2286	0.8192	1.197
X101.200	0.9277	0.7244	1.2807	0.2003	2.529
Family.run.hotel	0.5997	0.9830	0.6100	0.5419	1.822
Corporate.owned.single.hotel	-0.1084	0.8338	-0.1301	0.8965	0.897
Part.of.a.local.chain.of.hotels	-0.3623	0.7573	-0.4784	0.6324	0.696
EMPL	2.4097	0.6420	3.7535	0.0002	11.131
AGE	-0.0227	0.0111	-2.0396	0.0414	0.978
RETROFIT	-0.3653	0.5851	-0.6244	0.5324	0.694
EXP	-0.5035	0.6866	-0.7333	0.4634	0.604
PERCEP	0.2480	0.5188	0.4780	0.6327	1.281

McFadden's R^2: 0.142 adj. R^2: 0.137

While not as strong as the HAZARD or EMPL variables, obtaining assistance (ASSIST) also shows a significant positive effect on the preparedness of hotels to earthquakes (coefficient = 0.9055, p-value < 0.05). The odds ratio here suggests that hotels which have received assistance are 2.47 times more likely to be prepared for earthquakes than hotels that have not received assistance. The other variables have not been found to have a statistically significant relationship with the preparedness levels of hotels for earthquakes. This means that the country where the hotel is situated (Greece or Israel), the size of the hotel, ownership patterns, the age of the hotel, whether it was retrofitted, previous disaster experience, and risk perception are not good predictors for earthquake preparedness among the 75 hotels included in the study.

Looking at the overall fit of the model, the McFadden's R^2 of 0.142 for the earthquake hazard suggests the model explains 14.2% of the variance in earthquake preparedness. When adjusting McFadden's R^2 to account for the number of variables in the model (adjusted pseudo-R^2), the value is slightly lower, 0.137. These results suggest that while the model has some predictive power, it does not capture all relevant variables influencing earthquake preparedness.[8]

[8] For ordered logit regression, McFadden's R^2 scores ranging from 0.2 to 0.4 usually suggest a good model fit. Scores between 0.1 and 0.2 often point to a model with decent explanatory power, especially in fields like social sciences and behavioral studies where outcomes are influenced by diverse, often unmeasured

If we turn to the tsunami hazard, first, it should be mentioned that during the regression analysis in R software, error messages were generated for the ownership and size variables. Despite efforts to diagnose the issue, the exact source of the errors could not be identified. As a result, these variables were unfortunately excluded from the final analysis. Table 5.8 illustrates the results for the rest of the variables included in the study.

Table 5.8. Results of the ordered logit regression for the tsunami hazard

Tsunami	Coef.	Std. Err.	T Value	P Value	Odds Ratios
HAZARD	5.5183	3.8470	1.4344	0.1770	249.2059
COUNTRY	2.5612	2.1198	1.2082	0.2502	12.9513
ASSIST	1.7294	0.7035	2.4583	0.0301	5.6374
EMPL	1.9100	1.1258	1.6966	0.1155	6.7533
AGE	-0.0116	0.0318	-0.3659	0.7208	0.9884
RETROFIT	-1.6530	1.7802	-0.9285	0.3714	0.1915
EXP	3.3962	2.7984	1.2137	0.2482	29.8516
PERCEP	1.1390	1.1644	0.9782	0.3473	3.1237

McFadden's R^2: 0.221 adj. R^2: 0.198

In this case, the McFadden's R^2 value of 0.221 indicates that the tsunami hazard model explains approximately 22.1% of the variance in preparedness levels relative to the null model, which assumes no predictors, suggesting a moderate-to-good fit. The regression results show that only ASSIST (public assistance) has a statistically significant impact on preparedness for tsunamis (p-value = 0.0301), with an odds ratio of 5.64. This suggests that hotels that receive public assistance (such as funding, training, or awareness programs) are substantially more likely to reach higher levels of preparedness for tsunamis. HAZARD and COUNTRY have positive coefficients, indicating a potential positive association with preparedness. However, the p-values (0.1770 and 0.2502, respectively) indicate that these associations are not statistically significant. EMPL and EXP and PERCEP also have positive but non-significant associations with preparedness. AGE and RETROFIT are not significant predictors, with p-values above 0.05, indicating that neither the age of the hotel nor the presence of retrofitting measures significantly impacts tsunami preparedness.

factors. It's important to note that these values are different from what's considered acceptable in linear regression models, where higher R^2 values (0.7-0.9) are expected, or for other disciplines of science (McFadden, 1974; Ugba & Gertheiss, 2023).

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Errors were also generated during the wildfire hazard regression analysis in R software for the experience and perception variables. Therefore, these two variables were emitted from the study, as one can see in Table 5.9. The results for the wildfire hazard show three statistically significant predictors for wildfire preparedness among hotels. First, COUNTRY with a coefficient of 2.733 and p-value of 0.0007 indicated that the country in which a hotel is located significantly influences its level of wildfire preparedness. In this case, with an odds ratio of 15.38, hotels in Greece are much more likely to be better prepared for wildfires than the hotels in Israel.

Table 5.9. Results of the ordered logit regression for the wildfire hazard

Wildfires	Coef.	Std. Err.	T Value	P Value	Odds Ratios
HAZARD	0.1484	0.1504	0.9863	0.3279	1.1599
COUNTRY	2.7332	0.7654	3.5709	0.0007	15.3828
ASSIST	0.3506	0.2533	1.3839	0.1714	1.4199
X01.50	-2.7566	0.8615	-3.1997	0.0022	0.0635
X51.100	-1.2830	0.7055	-1.8187	0.0739	0.2772
X101.200	0.3135	0.6450	0.4860	0.6287	1.3682
Family.run.hotel	0.9132	1.0043	0.9092	0.3668	2.4922
Corporate.owned.single.hotel	0.2387	0.8501	0.2808	0.7798	1.2696
Part.of.a.local.chain.of.hotels	0.6693	0.7768	0.8616	0.3923	1.9529
EMPL	1.9523	0.6002	3.2529	0.0019	7.0448
AGE	-0.0103	0.0102	-1.0063	0.3182	0.9898
RETROFIT	0.7934	0.6091	1.3027	0.1976	2.2109

McFadden's R^2: 0.168 adj. R^2: 0.163

The results also show that small hotels (1-50 rooms) have a significant negative association with preparedness for wildfires. The odds ratio of 0.0635 suggests that small hotels are much less likely to reach higher levels of preparedness compared to larger establishments, potentially due to limited resources or fewer dedicated staff for crisis management. With a negative coefficient and p-value of 0.0738, the results for hotels with 51-100 rooms suggest that medium-sized hotels may also face challenges in reaching optimal preparedness levels. One other significant variable is EMPL suggesting, like in the case of earthquakes, having a designated preparedness employee significantly increases wildfire preparedness, with an odds ratio of 7.0448.

The remaining variables, including HAZARD, ASSIST, X101.200 (Larger Hotels), ownership types, AGE, and RETROFIT, did not show statistically significant effects on wildfire preparedness in this model. In addition, it is important to mention that the McFadden's R^2 of

0.168 indicates a moderate level of fit for the wildfire hazard model. The relatively minor difference between McFadden's R^2 and the adjusted R^2 of 0.163 suggests that most of the variables included the model contribute to explaining the variance in wildfire preparedness.

For the security crises hazard, Table 5.10 presents the results of the ordered logit regression. The security hazard model demonstrated a modest explanatory power, with a McFadden's R^2 of 0.101 and an adjusted R^2 of 0.096, indicating that approximately 10% of the variance in security preparedness levels is explained by the explanatory variables. Despite this, several variables are statistically significant

Receiving public assistance (ASSIST) significantly impacts preparedness for security crises (p-value = 0.0085), with an odds ratio of 2.03. This suggests that hotels receiving public support are twice as likely to reach higher levels of preparedness. In addition, the presence of a designated preparedness employee (EMPL) is a significant positive predictor (p-value = 0.0031), with an odds ratio of 5.61. This indicates that hotels with a dedicated role for crisis management or disaster preparedness are over five times more likely to be well-prepared for security crises. With a p-value of 0.0829, PERCEP has a marginally significant positive association with preparedness.

The remaining variables (COUNTRY, hotel size, ownership types, AGE, RETROFIT, and EXP), do not have statistically significant effects on preparedness of hotels in Greece and Israel that were included in the study for security crises. To sum the results of the ordered logit regression for the security crises hazard, while several of the explanatory variables show significant prediction capabilities, the relatively low McFadden's R^2 highlights the need for additional predictors to better explain the preparedness of hotels to security threats.

Table 5.10. Results of the ordered logit regression for the security crises hazard

Security	Coef.	Std. Err.	T Value	P Value	Odds Ratios
COUNTRY	-0.4350	0.7228	-0.6017	0.5496	0.6473
ASSIST	0.7098	0.2610	2.7189	0.0085	2.0335
X01.50	-0.8280	0.7390	-1.1205	0.2669	0.4369
X51.100	0.0795	0.6716	0.1184	0.9061	1.0828
X101.200	0.8622	0.6283	1.3722	0.1750	2.3683
Family.run.hotel	0.3674	0.9074	0.4049	0.6870	1.4440
Corporate.owned.single.hotel	0.2303	0.7821	0.2944	0.7694	1.2590
Part.of.a.local.chain.of.hotels	0.1445	0.7151	0.2020	0.8406	1.1554
EMPL	1.7239	0.5598	3.0796	0.0031	5.6062
AGE	-0.0114	0.0106	-1.0793	0.2847	0.9886
RETROFIT	-0.0713	0.5645	-0.1263	0.8999	0.9312
EXP	-0.6533	0.5459	-1.1968	0.2360	0.5203
PERCEP	1.0042	0.5696	1.7631	0.0829	2.7296

McFadden's R^2: 0.101 adj. R^2: 0.096

The results of the ordered logit regression for the last type of hazard, pandemics, are brought in Table 5.11.

Table 5.11. Results of the ordered logit regression for the pandemic hazard

Pandemics	Coef.	Std. Err.	T Value	P Value	Odds Ratios
COUNTRY	0.5853	0.7332	0.7983	0.4278	1.7955
ASSIST	0.5322	0.2531	2.1022	0.0397	1.7026
X01.50	-1.1739	0.8202	-1.4313	0.1574	0.3092
X51.100	0.1905	0.6743	0.2825	0.7785	1.2099
X101.200	0.6980	0.6189	1.1278	0.2638	2.0097
Family.run.hotel	-0.0280	0.9635	-0.0291	0.9769	0.9724
Corporate.owned.single.hotel	0.5056	0.8043	0.6286	0.5320	1.6579
Part.of.a.local.chain.of.hotels	-0.5985	0.7336	-0.8159	0.4177	0.5496
EMPL	1.4601	0.5684	2.5688	0.0127	4.3064
AGE	-0.0234	0.0111	-2.1172	0.0383	0.9768
RETROFIT	0.6865	0.5997	1.1447	0.2568	1.9867
EXP	0.4088	0.5534	0.7388	0.4629	1.5051
PERCEP	0.8203	0.5465	1.5011	0.1385	2.2713

McFadden's R^2: 0.115 adj. R^2: 0.109

The table shows three significant explanatory variables: ASSIST, EMPL, and AGE. Public assistance significantly (p-value = 0.0397) impacts preparedness of hotels for pandemics, with an odds ratio of 1.70. This suggests that hotels receiving external support, such as funding or training, are more likely to achieve higher levels of preparedness for pandemics. In addition, the presence of a designated preparedness employee is a significant predictor (p-value =

0.0127) and so is the age of the hotels (p-value = 0.0383). Age has a small but significant negative effect on preparedness, with an odds ratio of 0.98. This suggests that newer hotels are slightly more likely to be prepared than their older counterparts.

The remaining variables, COUNTRY, hotel size, ownership types, RETROFIT, EXP, and PERCEP do not show statistically significant effects on the preparedness of the hotels included in the study for pandemics. The pandemic hazard model demonstrated a McFadden's R^2 of 0.115 and an adjusted R^2 of 0.109, indicating that the model explains approximately 11.5% of the variance in preparedness levels relative to the null model. This is a modest level of explanatory power that generally highlights the need for additional variables or alternative modeling approaches to better explain the preparedness of hotels for pandemics.

To add another layer of statistical analysis to this study, confusion matrices were used in this study to evaluate the predictive accuracy of the OLM for the preparedness index, which ranges from 0 to 18. Table 5.12 depicts the results of the confusion matrices for each hazard type. The left part of the table shows the number of hotels the model had predicted the result correct (or wrong). For instance, for the tsunami hazard, the model predicted the preparedness level in the index for 11 out of the 21 hotels, which were included in the tsunami regression. For earthquakes, the model was able to predict only 16 out of the 75 hotels. These levels are similar for wildfires, security crises and pandemics as well.

Due to the ordinal nature of the index and the inherent variability in predicting precise preparedness levels - partly influenced by the subjectiveness of survey responses - a tolerance range of ±1 point was applied to the predicted values in the confusion matrices. Applying this ±1 point tolerance allows us to account for minor discrepancies that do not meaningfully alter the overall assessment of preparedness. The importance of this approach is that it reduces the impact of slight inaccuracies and provides a more realistic measure of the model's effectiveness in predicting preparedness levels. This means that if the predicted preparedness level for a hotel was, for example, 5, the prediction was considered "correct" in the adjusted calculation on the right part of Table 5.12 if the observed preparedness level was 4, 5, or 6.

When looking at the adjusted results, with a tolerance range of ±1 point, the predictive accuracy of the OLM improved significantly. The right-hand side of Table 5.12 shows how the accuracy for earthquakes increased from 21% to approximately 41%; for tsunamis, from 52% to 76%; for wildfires, from roughly 27% to 59%; for security crises, from 20% to 32%; and for pandemics, from 29% to 50%.

Table 5.12. Summary of the confusion matrices across all hazard types

Hazard Type	Correct Prediction	Wrong Prediction	Adjusted Correct Prediction	Adjusted Wrong Prediction
Earthquakes	16	59	31	44
Tsunamis	11	10	16	5
Wildfires	20	55	44	31
Security Crises	15	60	24	51
Pandemics	22	53	38	37

5.2. Findings and discussion

The ordered logit regressions for all five hazard types revealed several patterns regarding the explanatory variables' predicting abilities of the preparedness levels of the hotels included in the study. Despite the omission of certain explanatory variables in two of the regressions due to technical issues, one can derive several interesting observations from the overall analysis.

First, the most noticeable of the explanatory variables were ASSIST and EMPL, which illustrated significance across four out of the five types of hazards included in the study. Having a designated employee for emergency management and disaster preparedness is found in this study to be a strong predictor for earthquake, wildfire, security crises, and pandemic preparedness. The presence of such an employee significantly increases the likelihood of higher preparedness levels. This finding supports the conclusions of Sadiq & Graham (2014), who found that the presence of a risk manager promotes the adoption of risk-reducing measures. Strengthening the conclusions of previous studies increases the credibility and robustness of the data. This is of practical significance for the hospitality sector as this indicates the importance of focused personnel in enhancing disaster preparedness.

Second, four types of hazards (tsunamis, wildfires, security crises, and pandemics) were found to be significantly impacted by whether hotels received external assistance. This implies that hotels with outside assistance - whether in the form of funds, training, or awareness raising assistance - tend to be more prepared for these hazard types. This has practical implications for the hotel industry, public policy and national and local government decision-makers. Since this was demonstrated to be a strong predictor of preparedness, public authorities who wish to increase hotel preparedness should allocate resources in public assistance for strengthening emergency disaster preparedness.

The findings also showed that COUNTRY was a significant predictor of wildfire preparedness, with the Greek hotels demonstrating slightly better preparedness levels than the Israeli hotels. This can be the result of differences in prior wildfire experience, different national policies or regional emphasis on preparedness measures. Although this is outside the purview of this study, addition research could examine how many large-scale wildfires occurred in Greece compared to Israel and determine whether the prevalence of large-scale wildfires nationwide, with their widespread media coverage, has had any effect on how hotels perceive wildfire risks. Other than wildfires, the country variable was not significant for other types of hazards, suggesting that the effect of country-specific factors may vary depending on the type of hazard. These findings are consistent with the hypothesis of the study, which claimed that there should be no differences between the countries because no regulations were found at the national or local level that justify such a distinction.

When looking at the preparedness of hotels for wildfires, one other variable of significance is the size of the hotels. With reference to the hotels included in the sample, smaller hotels (< 50 rooms) had a much lower likelihood of being prepared to wildfires compared to the larger hotels in the sample. This corresponds to the findings of Drabek (1991, 1995), Sadiq (2010), Han & Nigg (2011) and others who found that firm or hotel size is a strong predictor of disaster evacuation planning and business disaster preparedness. Ivkov et al. (2019) specifically found that larger hotels are more resilient to disasters. This is perhaps because larger establishments may have greater capacity to allocate resources for preparedness, while smaller hotels may require additional support or incentives to enhance their resilience.

Age was found to be a significant negative predictor with regards to earthquakes and pandemics. In other words, this result means that older hotels in the sample were found to be generally less prepared for earthquakes and pandemics compared to their newer counterparts. The negative coefficient indicates that as the age of a hotel increases, its preparedness level decreases.

It is interesting to point out that this study did not align with the findings of Han & Nigg (2011), who identified risk perception among decision makers as the strongest and most significant predictor of business disaster preparedness. Similarly, Tierney & Dahlhamer (1995) concluded that risk perception plays a key role in explaining business preparedness and vulnerability to earthquake-related damages and disruption. In this study, risk perception showed no explanatory power for earthquake preparedness. However, in the case of security

crises, it was found to have a marginally positive impact on preparedness measures. Overall, risk perception did not significantly explain preparedness levels.

To conclude this aggregate analysis, one can highlight that across the five types of hazards, hotel preparedness levels appear to be influenced by a combination of an organizational factor (having a dedicated employee to emergency management and disaster preparedness) and an external factor of public assistance. The other independent variables did not consistently have explanatory abilities across the different hazard types. As the results span across five different types of hazards and nine hypotheses, it is helpful to summarize the regression analysis using a table. Table 5.13 illustrates concisely whether the hypotheses have been supported or refuted according to the statistics used in the analysis.

Table 5.13. Summary of the regression results across all hazard types

Variables	**Type of Hazard**				
	Earthquakes	**Tsunamis**	**Wildfires**	**Security Crises**	**Pandemics**
HAZARD	P-value 0.0046 Significant positive impact **H1 supported**	P-value 0.1770 Not significant H1 refuted	P-value 0.3279 Not significant H1 refuted	Not Included	Not Included
COUNTRY	P-value 0.902 Not significant **H2 supported**	P-value 0.2502 Not significant **H2 supported**	P-value 0.0007 Significant positive impact H2 refuted	P-value 0.5496 Not significant **H2 supported**	P-value 0.428 Not significant **H2 supported**
ASSIST	P-value 0.0017 Significant positive impact **H3 supported**	P-value 0.0301 Significant positive impact **H3 supported**	P-value 0.1714 Not significant H3 refuted	P-value 0.0085 Significant positive impact **H3 supported**	P-value 0.0397 Significant positive impact **H3 supported**
X01.50 (Size)	P-value 0.263 Not significant H4 refuted	N/A	P-value 0.0021 Significant negative impact **H4 supported**	P-value 0.267 Not significant H4 refuted	P-value 0.1574 Not significant H4 refuted
X51.100 (Size)	P-value 0.8192 Not significant	N/A	P-value 0.0738 Marginally significant negative	P-value 0.9061 Not significant	P-value 0.779 Not significant

Variables	Type of Hazard				
	Earthquakes	**Tsunamis**	**Wildfires**	**Security Crises**	**Pandemics**
	H4 refuted		impact H4 refuted	H4 refuted	H4 refuted
X101.200 (Size)	P-value 0.2003 Not significant H4 refuted	N/A	P-value 0.6286 Not significant H4 refuted	P-value 0.1750 Not significant H4 refuted	P-value 0.2638 Not significant H4 refuted
Family.run. hotel (OWN)	P-value 0.542 Not significant H5 refuted	N/A	P-value 0.3668 Not significant H5 refuted	P-value 0.6870 Not significant H5 refuted	P-value 0.977 Not significant H5 refuted
Corporate. owned. single.hotel (OWN)	P-value 0.896 Not significant H5 refuted	N/A	P-value 0.7798 Not significant H5 refuted	P-value 0.7694 Not significant H5 refuted	P-value 0.5320 Not significant H5 refuted
Part.of.a.local. chain.of.hotels (OWN)	P-value 0.632 Not significant H5 refuted	N/A	P-value 0.3922 Not significant H5 refuted	P-value 0.8406 Not significant H5 refuted	P-value 0.4177 Not significant H5 refuted
EMPL	P-value 0.0002 Significant positive impact **H6 supported**	P-value 0.1155 Not significant H6 refuted	P-value 0.0018 Significant positive impact **H6 supported**	P-value 0.0031 Significant positive impact **H6 supported**	P-value 0.0127 Significant positive impact **H6 supported**
AGE	P-value 0.0414 Significant negative impact **H7 supported**	P-value 0.7208 Not significant H7 refuted	P-value 0.3182 Not significant H7 refuted	P-value 0.2847 Not significant H7 refuted	P-value 0.0383 Significant negative impact **H7 supported**
RETROFIT	P-value 0.5324 Not Significant H7 refuted	P-value 0.3714 Not significant H7 refuted	P-value 0.1975 Not significant H7 refuted	P-value 0.8999 Not significant H7 refuted	P-value 0.2568 Not significant H7 refuted
EXP	P-value 0.4634 Not significant H8 refuted	P-value 0.2482 Not significant H8 refuted	N/A	P-value 0.2360 Not significant H8 refuted	P-value 0.4629 Not significant H8 refuted
PERCEP	P-value 0.6327 Not significant H9 refuted	P-value 0.3473 Not significant H9 refuted	N/A	P-value 0.0829 Marginally Significant positive impact H9 refuted	P-value 0.1385 Not significant H9 refuted

Before moving to the conclusions and limitations of the study, one interesting intellectual exercise is to examine whether hotels' perceptions of hazards align with the actual hazard levels of their locations. This involves examining the relationship between two variables: the hazard levels (HAZARD), which are based on location, and the perception of the hotels to those hazards (PERCEP). A logical expectation would be for hotels in hazardous locations to be aware of the risks they face and perceive their risks from those hazards higher than hotels which are not located in hazardous locations. For instance, we would expect a hotel in Mykonos, which received the highest hazard level of wildfires in this study, to be aware of its situation, while a hotel in Santorini, which is ranked low (in the first group of the Wildfire Hazard Index), to be aware that its wildfire hazard is low.

For this purpose, logistic regressions were conducted in R software to see the relationship between the two variables for three hazard types - earthquakes, tsunamis, and wildfires - where hazard levels vary by location. In this case, the dependent variable in each model was the binary perception of whether the hazard is considered disastrous (yes=1, no=0), while the independent variable was the respective hazard level (HAZARD). The logistic regression in the form of probability for PERCEP to be 1 is as follows:

$$P(\text{PERCEP} = 1) = \frac{e^{\beta_0 + \beta_1 \cdot \text{HAZARD}}}{1 + e^{\beta_0 + \beta_1 \cdot \text{HAZARD}}}$$

where β_0 is the intercept and β_1 is the coefficient for HAZARD

For the wildfire hazard, it was decided to use the calculated FWI*WUI multiplication instead of the wildfire hazard index groups (as presented in Table 4.5). This approach allows the use of a continuous variable, which is more suitable for the purpose of this specific statistical analysis than an index score. Table 5.14 shows the results of the logistic regressions.

Table 5.14. Logistic regression results for the hazard and risk perception variables

Statistic	Earthquakes	Tsunamis	Wildfires
Coefficient	7.9750	2.949	0.002984
Std. Err.	3.0697	2.305	0.008836
Z Value	2.598	1.279	0.338
Pr(>|z|)	0.00938	0.201	0.73557
Cox-Snell R^2	0.1047	0.0666	0.0014
Odds Ratio	2907.23	19.08	1.003
McFadden R^2	0.105	0.067	0.001

The results for earthquakes indicate a strong positive relationship between HAZARD and PERCEP, meaning, hotels in earthquake-prone areas perceive relatively well the associated

risks of being in an earthquake-prone area and the odds of perceiving risk increase dramatically with an increase in hazard level. The McFadden R^2 of 0.105, suggests a moderate alignment of the model between hazard levels and perceived risk. For tsunamis the logistic regression found moderate positive relationship, but not statistically significant between the two variables. A McFadden R^2 of 0.067 indicates limited explanatory power of the regression. Hotels in tsunami-prone areas may perceive risk but with uncertain statistical significance. The low McFadden R^2 results across hazards are expected since there are probably other factors that are not present in this regression which impact perceived risk. Omitting these variables causes omitted variable bias that should be noted.

For wildfires, no significant relationship was found. McFadden R^2 was near zero, similarly to the Cox-Snell R^2, indicating no meaningful relationship between wildfire hazard levels and perceived risk. One can say that the perception of wildfire hazard among the hotels of this study is not aligned with their actual hazard levels. The findings of the logistic regressions have practical implications for hotel owners, policy makers and tourists, alike. This is because risk perception alone can affect how individuals, organizations and countries react to different types of hazards. Without fully comprehending in the first place the extent of the hazard and risk, mitigation and preparedness measures are likely to be insufficient and inadequate.

Nevertheless, while risk perception regarding the actual extent of the hazard was often lacking, the study demonstrated how organizational characteristics, such as having a designated employee for crisis and disaster management and receiving public assistance, can mitigate the effects of inaccurately assessed risks. The summary of hypotheses and variables shown in Table 5.13 illustrates how other hotel characteristics, such as size, age, and ownership do not generally have an ability to explain the variance in preparedness levels across hazard types. Interestingly, previous disaster experience was also not found to be a significant predictor for the four types of hazards that included this variable in the regression. This suggests that despite having experienced previous catastrophic events, hotels face barriers or limitations that inhibit their ability to adequately prepare for future disasters.

Conclusions

This study had two main objectives. The first was to assess how well hotels in Greece and Israel are prepared for different types of hazards. The second objective was to identify the factors that explain differences in preparedness levels by using statistical analysis by accounting for the variation in preparedness levels among hotels. With a sample of 75 hotels, the study was able to shed some light on both those issues. As for the first objective, the study found that the levels of preparedness vary considerably across the different hazard types for the hotels included in the sample. Regarding the second objective, among the hotels that were found to be better prepared, receiving public assistance and having a designated employee for emergency disaster preparedness were strong predictors among several of the hazards included in the study.

The finding about the value of public assistance in raising the preparedness levels of hotels is consistent with recent studies in the field of disaster risk management. Garcia et al. (2024), for instance, highlight the need for securing funding to improve natural hazard planning and response activities. Their study suggests that hotels in Batangas can profit from looking into alternative funding options, such as applying for grants or partnering with local and national organizations and authorities. These approaches could help them overcome financial challenges and access the resources needed for effective disaster preparedness.

Another result of interest is the fact that previous disaster experience was not found to be a significant predictor. This finding is both academically and practically relevant as rational thinking suggests that experience should lead to change. When no change occurs, it raises important questions: What are the barriers or factors preventing this change? Addressing these questions has practical implications for both organizations and public authorities and is an important issue for further research.

The fact that the age of the hotels was found to negatively affect preparedness levels is also of interest. The study found older hotels to be less prepared for earthquakes and pandemics compared to newer hotels. This has practical implications, especially for the earthquake hazard, where this suggests that older hotels might have outdated infrastructure or construction methods that are not compliant with modern building codes designed to withstand seismic activity. Retrofitting older buildings is important to improve earthquake resilience. For this exact reason, the retrofit variable was included in the study. However, it

was not found to be statistically significant. In addition, the negative aspect of the relationship is of particular interest, as one would have expected the opposite - older buildings should compensate for their old infrastructure by preparing better for earthquakes. The study illustrated this is not the case. All these somewhat surprising results require further scrutiny.

The results of the study indicate several important points for hotels to take into consideration when addressing the risk management of natural hazards and extreme events. Understanding these factors can help hotels, policymakers, and other stakeholders better manage the risks associated with extreme events and natural hazards as they allow them to place more emphasis on policies that have a positive impact on raising the preparedness levels of hotels to different types of hazards.

The practical insights of this study can be divided between the different stakeholders. First, hotels should prioritize appointing staff dedicated to disaster preparedness and actively engage in public assistance programs. Policymakers should promote more public-private partnerships by conducting targeted training programs and raising awareness campaigns. These can significantly elevate overall preparedness, mirroring recommendations by Albattat & Mat Som (2019) for proactive disaster planning. One other group of stakeholders are the tourists, who should be allowed to make informed decisions on where to stay. While this transparency is too much to expect, hotels should at least communicate with their guests about what they should do in case disasters occur during their visit.

The approach and methodology used in this study are not limited to the context of Greece and Israel and can generally be applied to other countries and regions worldwide as the survey tool adopted in this research was taken from a study on hotel preparedness in Wuhan City, China (Wu, Xia, & Bao, 2021). This demonstrates the adaptability of the methodology across different geographical and cultural settings. Nevertheless, as highlighted in the literature review, there are various methodologies and definitions used to examine preparedness and resilience to hazards and extreme events. Each study should adopt a methodology that fits the context-specific factors that influence preparedness levels in the location of interest.

While the findings of this study provide valuable insights into the preparedness of hotels in Greece and Israel, generalizing the specific results to other regions or sectors should be approached with caution. The study's results are influenced by factors such as regional hazard profiles, specific national circumstances, and perhaps economic conditions and cultural

perceptions of risk that were not accounted for in this study due to the need to choose key predictors.

It is important to keep in mind that the Eastern Mediterranean region has a unique combination of seismic activity, wildfires, and security hazards that may not fully reflect the risks faced by hotels in other regions that face other types of hazards, such as typhoons or hurricanes. In addition, the preparedness levels observed in this study might reflect organizational attributes and policy environments specific to hotels in Greece and Israel. One should also note that a sample of 75 hotels cannot truly allow generalization even among the total population of hotels in both countries.

However, the variables identified as strong predictors across several types of hazards - receiving public assistance and having dedicated employees for emergency management - are broadly applicable elsewhere, especially when these findings reaffirm previous studies from other sectors as well. For example, Sharma et al. (2024) highlighted how external assistance from NGOs and international organizations is necessary for effective disaster preparedness and response among stakeholders in Nepal. Sadiq & Graham (2014) highlighted the role of risk managers in leading to the adoption of risk-reducing measures. Kukułka (2016) stresses in a study on Indonesia, that while assistance is important for addressing the economic effects of natural disasters, this assistance must be used in an efficient way. Therefore, when looking at policy suggestions to allocate public assistance, it is not enough to check whether assistance has been given but also measure its effectiveness and efficiency.

These key drivers of preparedness can serve as a foundation for similar research in other countries or regions. Such exercises would offer hotel managers and policymakers additional practical insights into enhancing resilience and preparedness. By adapting the survey and methodology to local contexts, future studies can validate and extend these findings, ultimately contributing to a broader understanding of disaster preparedness in the hospitality sector.

In their meta-analysis of the literature on crisis management frameworks in tourism and hospitality, Casal-Ribeiro et. al (2023) found 14 key crisis management frameworks used in the literature. They emphasized the importance of employing a multi-perspective approach and engaging in proactive planning in crisis management to help destinations and tourism organizations achieve long-term resilience. If one follows their suggestion, future studies should discuss the utilization of holistic risk management frameworks for achieving resilience

and adequate disaster preparedness levels. They also suggest more academic focus on the role of integrating technology at all stages of crisis management.

Similar studies, which include the predictors of this study, can and should be conducted in other economic sectors, just as the literature review presented several studies on businesses in general. However, as preparedness measures differ among sectors, extending the exact same survey to other sectors would not be advisable. Several of the preparedness measures included in the preparedness index here are more specific to the hospitality sector. Given the discussion and conclusions, suggested areas for future research would include widening the study to other geographic locations while adding other predictors. Additionally, in-depth case studies, which will account for internal process-based predictors, could add an important layer of understanding of how hotels manage the risks associated with natural hazards, crisis situations, and extreme events. Addressing the issue of previous disaster experience, as explained above, should also be studied further in-depth.

Taking a sector-specific approach by focusing on the hotel industry limits the ability to generalize findings to other sectors. As originally envisioned by the author, conducting an economy-wide study that compares different sectors could provide valuable insights as a promising direction for future research.

Limitations of the study

This study encountered several challenges which altered the optimal study envisioned in the first place. Some of these challenges can be considered as limitations and will be mentioned in this section along with other limitations. The limitations mentioned are of two types: methodological limitations and limitations related to the results.

Methodological limitations

First, the study relies on self-reported survey data, which may be subject to biases and/or inaccurate recalls of hotel circumstances and information by the individuals who answered the survey. This study relies on the self-reported preparedness behaviors of hotels through questions specifically created for this study without taking into consideration documented actions found in publicly disclosed information or verified by third parties. Technically, as the hotels' survey answers were anonymous, it was not possible to cross-reference information with other sources and external information. As mentioned in the study, the anonymous nature of the survey was the requirement set by the Israel Hotel Association for their help in

circulating the questionnaire. Although the study attempted to validate several hotel responses by cross-checking their answers with factual evidence (such as past disaster experiences), it is important to consider that respondents might not have full knowledge of their hotels' actual practices.

This is related to the second point. Conducting an anonymous survey did not allow precise geographic coordinates for hotels. This created difficulties in linking preparedness levels to specific hazard exposures, limiting the ability to draw more granular conclusions. While also having answers on the preparedness of the hotels to other types of hazards, such as flooding and severe weather events, in the survey, without precise coordinates one cannot quantify these hazards for each hotel. Information on the slope of the street, the elevation of the ground and other asset characteristics is essential to draw conclusions regarding whether, for instance, flooding is a real hazard to the hotel. The wildfire hazard index created for this study was the result of no granular data on hotel locations. As a result, it was necessary to create a general hazard index for the whole of the city or settlement. In an optimal study with exact coordinates, more specific hazard assessment could be conducted for specific physical assets. Such data could differentiate between a hotel in Jerusalem, located in a neighborhood adjacent to a forest or a hotel in the city-center, with no real wildfire risks.

Selection biases also warrant consideration. Selection biases occur when the sample consists of observations that were not randomly selected. As King, Keohane, & Verba (1994) explain, abandoning randomness allows many sources of bias. In the Israeli sample, all the hotels listed in the Israel Hotel Association received the survey, whereas in Greece, the sampling method differed. While there may not appear to be a significant difference between the hotels included in the study from both countries, the use of different methods for approaching the hotels could have introduced bias in the types of hotels that participated in the survey.

The limitations with the choice of predictors will be discussed in the section on the limitations related to the results and the generalization abilities of this study. Here, when discussing the choice of independent variables, other than risk perception, this study did not consider other determinants at the individual level of analysis. This is a particularly significant limitation because managers' differing perspectives on crises can shape an organization’s orientation and influence its operational decisions in crisis management (Ghaderi, King & Hall, 2022).

The author is aware that the ordinal nature of the preparedness index used in this study may have oversimplified the complexity of preparedness to the different types of hazards. The study focused on preparedness activities without considering broader organizational capitals, as used for example in the definitions of resilience by Brown et al. (2018) who used a multi-capital-based approach to assess natural disaster resilience within the hotel industry. Developing more nuanced measurement tools could provide deeper insights into the factors that influence preparedness or resilience. The reasons for choosing this operational definition of preparedness have been thoroughly discussed in the study; nevertheless, their limitations are acknowledged here.

One other important limitation of this study is its focus on hazards, without accounting for exposure or vulnerability. The analysis overlooks the critical dimensions of a conventional risk assessment. An optimal study would have accounted for risks rather than hazards. This would involve addressing hazards, elements at risk (exposure), and vulnerability. Here too, the reasons for focusing on hazards alone were elaborated throughout the study, however, this limitation has to be acknowledged in this section as well.

Limitations related to the results

While the ordered logit regression provided valuable insights, there are several limitations to this study that should be acknowledged regarding the results of the study. First, the exclusion of some variables in the regression models for tsunamis and wildfires due to technical issues may have impacted the robustness of the results. Despite efforts to resolve the issues, these variables were ultimately omitted, which could have introduced bias or limited the completeness of the analysis.

There are several other points to take into consideration when discussing the ability to generalize based on the results. First, one of the limitations in this regard is the relatively small sample size. While 111 hotels started the survey, only 75 completed it. The complexity and length of the survey may have discouraged some respondents from completing the survey, leading to this less-than-optimal sample size and potentially affecting the generalizability of the results. Second, the relatively modest sample size of 75 hotels, combined with its geographic focus on Greece and Israel, limits the generalizability of the findings to broader contexts. It should be noted that the initial intent to include hotels from Cyprus was abandoned due to the small number of Cypriot responses. This in turn further limited the

geographic scope of the study. Future studies should consider expanding the sample size and geographic scope to capture regional differences, as suggested by prior research.

The study did not account for other organizational-level determinants of preparedness, such as financial condition and other organizational characteristics, including several of the theories on the organizational level included in the theoretical review. The exclusion of these independent variables may mean that contributing factors for explaining the preparedness levels of hotels to natural disasters and other types of extreme events were not taken into account, and the study does not reflect a complete picture. It should be noted that not including significant variables in the model may cause omitted variable bias, what implicates that some coefficients are insignificant. These points relate to the McFadden's R^2 values, which suggest for several of the regressions that a substantial proportion of the variance in preparedness remains unexplained. The McFadden's R^2 values should be at the range of 0.2-0.4 to be considered an excellent logistic regression model (McFadden, 1974). To sum this point, the results of this study imply that other factors, not included in the study, might also play significant roles in determining hotel preparedness.

Future research could explore additional variables, such as management attitudes toward risk, financial variables, or other predictors mentioned in the theoretical review, to provide a more comprehensive understanding. Having that in mind, there was a need to choose the most appropriate variables according to the literature review and also make use of variables fit for quantitative analysis. Managerial traits or organizational processes might explain preparedness levels, but their translation into quantifiable variables might be a problem in quantitative analysis. This issue suggests that future research should incorporate a hybrid approach, integrating quantitative and qualitative methods of analysis.

As the study adopted the survey developed by Wu, Xia & Bao (2021), it is appropriate to compare the results to explore whether further generalizations can be made. Their findings revealed a generally high level of preparedness for crises and disasters[9] among five-star hotels in Wuhan, China, with fire disasters identified as the most significant risk. However, their study did not differentiate preparedness by specific types of hazards, nor did it explain the methodology used for any aggregation, making direct comparisons with this study somewhat

[9] While it is a bit difficult to determine exactly, a finger calculation suggests that in terms of the preparedness index used in this study, most of the Wuhan hotels would have received an index score of 15 or more.

challenging. Furthermore, as their research focused exclusively on five-star hotels, their results cannot be easily generalized to hotels with other star ratings.

During the planning of this study, there were considerations about including a question regarding the star-rating of the hotels. However, while the star-rating system in Israel aligns with that of European countries such as Greece, participation in the rating process in Israel is voluntary, and only a portion of hotels have received official ratings. For this reason, it was ultimately decided not to include this question in the survey. Nevertheless, future studies should address star ratings, as well as financial resources to address different types of risks faced by hotels.

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List of Tables

List of Figures

Appendixes

Annex I. TA-25 index components as of 10.4.2016, and an Illustration of whether natural disasters are considered a corporate risk factor

	Name	Symbol	ISIN	Sector	Are Natural Disasters included in risk factors disclosed? *	Is Business Local or International**
1	PERRIGO	PRGO	IE00BGH1M568	Consumer healthcare, Rx Pharmaceuticals, Diagnostics, Specialty Sciences	**No**	International
2	TEVA	TEVA	IL0006290147	Pharmaceuticals	**No**	International
3	POALIM	POLI	IL0006625771	Banking	**No** except for consequences of NDs on IT	International
4	LEUMI	LUMI	IL0006046119	Banking	**No**	International
5	BEZEQ	BEZQ	IL0002300114	Telecommunication	**Yes** but only regarding *Pelephone* (cellphone company)	International
6	NICE	NICE	IL0002730112	Software	**Yes**	International
7	OPKO HEALTH	OPK	US68375N1037	Biopharmaceuticals and diagnostics	**Yes**	International
8	ELBIT SYSTEMS	ESLT	IL0010811243	Defense, homeland security, commercial aviation applications	**No** except for consequences of natural disasters on IT	International
9	ICL	ICL	IL0002810146	Mining	**Yes**	International
10	MYLAN	MYL	NL0011031208	Biotechnology & Pharmaceuticals	**Yes**	International
11	FRUTAROM	FRUT	IL0010810823	GDRs, Flavors, Specialty Fine Ingredients, Pharma/Nutraceutical and Personal Care	**No**	International
12	ISRAMCO L	ISRA.L	IL0002320179	Oil and gas exploration and extraction	**No** (did mention dependency on weather & sea conditions)	local
13	DISCOUNT	DSCT	IL0006912120	Banking	**No**	International
14	ORMAT TECHNO	ORA	US6866881021	Geothermal energy	**Yes**	International
15	MIZRAHI TEFAHOT	MZTF	IL0006954379	Banking	**Yes** Through its operational risks management	International

	Name	Symbol	ISIN	Sector	Are Natural Disasters included in risk factors disclosed? *	Is Business Local or International**
16	PAZ OIL	PZOL	IL0011000077	Energy	**Yes** With specific reference to earthquake	Local
17	AZRIELI GROUP	AZRG	IL0011194789	Commercial Real-estate, refined oil products	**No**	International
18	GAZIT GLOBE	GZT	IL0001260111	Commercial & Household Real-estate,	**Yes** including earthquakes, hurricanes, flooding	International
19	DELEK GROUP	DLEKG	IL0010841281	Energy, Automobiles, institutional investing	**Yes** Through its operational risks management	Local
20	AVNER L	AVNR.L	IL0002680119	Oil and gas exploration and extraction	**No** (did mention dependency on weather & sea conditions)	Local
21	FIBI	FTIN	IL0005930388	Holdings Company, including Banking	**No** (has a business continuity plan for emergencies)	International
22	MELISRON	MLSR	IL0003230146	Commercial Real-estate	**No**	
23	STRAUSS GROUP	STRS	IL0007460160	Food & Beverages, Health and Water	**No**	International
24	OSEM	OSEM	IL0003040149	Food & Beverages	**No**	International
25	ISRAEL CORP	ILCO	IL0005760173	Industry	To be Completed	International
26	DELEK DRILL	DEDR.L	IL0004750209	Natural gas exploration and extraction	**No** (did mention dependency on weather & sea conditions)	International

*Financial Statements for 2014. **Corporations in the TA-25 Index are most probably corporations with international activities. A larger sample of corporations would allow variance in this feature.

Annex II. Survey questionnaire as circulated in English

POZNAŃ UNIVERSITY OF ECONOMICS AND BUSINESS

Hotel Industry Preparedness to Natural Disasters

Hotel Industry Preparedness to Natural Disasters

The hotel industry is especially vulnerable to natural hazards as hotels are located mostly in high demand locations, either in coastal regions, urban settings or areas that are prone to different natural hazards, which are projected to rise in frequency and intensity in the future due to climate change. To understand how to manage the risks of these natural hazards in the hotel industry, it is important first to gather information about the preparedness levels of hotel to these natural hazards.

The purpose of this survey is to bridge the data gap that exists in the field. The survey includes thousands of hotels chosen randomly in 3 countries (Israel, Greece and Cyprus) and is part of a PhD study conducted by Ms. Galit Palzur at the International Economics Department at the Poznan University of Economics and Business, Poland and is with the interest of the Hellenic Ministry of Tourism.

The survey is anonymous and should take up to 8 minutes to complete. It is advisable that the survey be filled by the person in charge of the issue at the hotel.

Please respond by July 7, 2023. Your input is important! For more information or enquiries, please write to: galit.palzur.phd@gmail.com.

POZNAŃ UNIVERSITY OF ECONOMICS AND BUSINESS

Hotel Industry Preparedness to Natural Disasters

General Questions about the Hotel

* 1. What is the type of ownership of the hotel?
Please select the answer which best describes the hotel.

- ◯ Family-run hotel
- ◯ Corporate owned single hotel
- ◯ Part of a local chain of hotels
- ◯ Part of an international chain of hotels

* 2. How many rooms does the hotel have?

- ◯ 1-15
- ◯ 16-30
- ◯ 31-50
- ◯ 51-100
- ◯ 101-200
- ◯ 201-300
- ◯ 301 or above

* 3. When was the hotel built?
Please answer either specific year or decade (i.e., 1980s, 1990s, 2000s...)

* 4. Has the hotel been retrofitted or renovated to address the risks of natural hazards?

- ◯ Yes
- ◯ No

* 5. In which fields has the hotel received public assistance for strengthening emergency disaster preparedness? Tick boxes that apply.

- ☐ Funding
- ☐ Training for employees
- ☐ Raising awareness
- ☐ The hotel did not receive any public assistance for strengthening emergency disaster preparedness
- ☐ Other (please specify)

6. Is it mandatory for hotels in your country to prepare an emergency preparedness plan for disasters?

◯ Yes

◯ No

* 7. Does the hotel have an employee in charge of emergency disaster preparedness?

◯ Yes

◯ No

8. Is the person responsible at the hotel for emergency disaster preparedness (or similar functions like risk management or business continuity) answering this survey?

◯ Yes

◯ No

* 9. Where is the hotel located?
Please write name of town / city / local authority and country.

* 10. Is the hotel situated on the seacoast (up to 500 meters from the coast)?

◯ Yes

◯ No

Hotel Industry Preparedness to Natural Disasters

Questions related to Pre-Disaster Preparedness Measures

* 11. Has the hotel previously experienced one of the following disaster? Please select types of events that apply (multiple answers)
For the purpose of this survey, a disaster is an extreme event that does not allow the hotel to continue business as usual; there have been casualties, loss of life, great damage to assets and/or significant loss of income.

☐ Earthquakes

☐ Floods and/or landslides

☐ Wildfires

☐ Weather related extreme events (i.e. extreme heat, droughts, storms, extreme winds, heavy snow)

☐ Tsunami

☐ Pandemics

☐ Security Crises (i.e terrorist attacks, prolonged armed conflict, refugee crisis)

☐ Other (please specify)

* 12. What do you think are the main extreme-event hazards facing the hotel?
Tick the box if you think the hazard type can have a devastating effect on the hotel.

☐ Earthquakes

☐ Floods and/or Landslides

☐ Wildfires

☐ Weather Related Extreme Events (i.e. extreme heat, droughts, storms, extreme winds, heavy snow)

☐ Tsunamis

☐ Pandemics

☐ Security Crises (i.e terrorist attacks, prolonged armed conflict, refugee crisis)

☐ Other (please specify)

13. Please tick box if the questions below apply for the specific type of hazard listed.
For example, in the first row, if the formal written emergency management plan refers to earthquakes, tick the box for "yes" or leave empty for "no". Do the same for the other types of hazards (floods and/or landslides, wildfires, etc.)

	Earthquakes	Floods and/or Landslides	Wildfires	Weather Related Extreme Events	Tsunamis	Pandemics	Security Crises
Does the hotel have a formal written emergency management plan?	☐	☐	☐	☐	☐	☐	☐
Has the plan been revised annually?	☐	☐	☐	☐	☐	☐	☐
Does the hotel have early warning systems?	☐	☐	☐	☐	☐	☐	☐

14. Continuation of Previous Question:
Please tick box if the questions below apply for the specific type of hazard listed.

	Earthquakes	Floods and/or Landslides	Wildfires	Weather Related Extreme Events	Tsunamis	Pandemics	Security Crises
Does the hotel have a regular safety training program?	☐	☐	☐	☐	☐	☐	☐
Does the hotel participate in community-based disaster preparedness activities?	☐	☐	☐	☐	☐	☐	☐
Does the hotel purchase any insurances against the specific type of hazard?	☐	☐	☐	☐	☐	☐	☐

Hotel Industry Preparedness to Natural Disasters

Questions related to Emergency Measures during and after a Disaster

15. Please tick box if the questions below apply for the specific type of hazard listed.
For example, in the first row, if the hotel has an evacuation procedure for earthquakes, tick the box for "yes" or leave empty for "no". Do the same for the other types of hazards (floods and/or landslides, wildfires, etc.)

	Earthquakes	Floods and/or Landslides	Wildfires	Weather Related Extreme Events	Tsunamis	Pandemics	Security Crises
Does your hotel have specific evacuation procedures?	☐	☐	☐	☐	☐	☐	☐
Does your hotel provide multi-language evacuation maps?	☐	☐	☐	☐	☐	☐	☐
Does your hotel have disaster drills?	☐	☐	☐	☐	☐	☐	☐
Does your hotel have special provisions for protecting accurate documentation of organizational assets and equipment in the event of a disaster?	☐	☐	☐	☐	☐	☐	☐

16. Continuation of Previous Question:
Please tick box if the questions below apply for the specific type of hazard listed.

	Earthquakes	Floods and/or Landslides	Wildfires	Weather Related Extreme Events	Tsunamis	Pandemics	Security Crises
Does your hotel has a plan in place to protect the assets in the event of a disaster?	☐	☐	☐	☐	☐	☐	☐
Does you hotel has procedures for damage assessment after a disaster?	☐	☐	☐	☐	☐	☐	☐
Does your hotel has business continuity planning after a disaster?	☐	☐	☐	☐	☐	☐	☐
Does your hotel have a disaster recovery plan?	☐	☐	☐	☐	☐	☐	☐

* 17. Does your hotel have emergency supplies stored in case of disasters?

◯ Yes

◯ No

* 18. Are the materials and supplies sufficient to sustain at least 72 hours after a disaster?

◯ Yes

◯ No

* 19. Does your hotel have a list of people who are competent in different languages (except mother tongue and English)?

◯ Yes

◯ No

* 20. Does your hotel have a formal document in which emergency authorities are set for certain people?

◯ Yes

◯ No

Hotel Industry Preparedness to Natural Disasters

Effects of Natural Disasters and other Extreme Events on the Hotel

* 21. Please answer which type of hazard, in your opinion, can cause the following impacts on the hotel. For example, in the first row, if earthquakes, in your opinion, can cause reputational damage to your hotel, tick the box for "yes" or leave empty for "no".
Note: If, in your opinion, the hazard is not relevant to the hotel, please tick N/R.

	Reputational Damage	Lifeline Function Failure (Failure of water, energy, transport, communications)	Business Interruption	Bankrupcy	Casualties (Employees/Guests)	Decrease in No. of Guests	Investors & Staff Confidence Loss	N/R
Earthquakes	☐	☐	☐	☐	☐	☐	☐	☐
Floods and/or Landslides	☐	☐	☐	☐	☐	☐	☐	☐
Wildfires	☐	☐	☐	☐	☐	☐	☐	☐
Weather-related Extreme Events	☐	☐	☐	☐	☐	☐	☐	☐
Tsunamis	☐	☐	☐	☐	☐	☐	☐	☐
Pandemics	☐	☐	☐	☐	☐	☐	☐	☐
Security Crises	☐	☐	☐	☐	☐	☐	☐	☐
Other	☐	☐	☐	☐	☐	☐	☐	☐

Other (please specify)

Hotel Industry Preparedness to Natural Disasters

Statistical Questions regarding the Person Answering the Survey

22. What is your age?

- ◯ 18-24
- ◯ 25-34
- ◯ 35-44
- ◯ 45-54
- ◯ 55-64
- ◯ 65+

23. How do you identify?

- ◯ Man
- ◯ Woman
- ◯ Non-binary
- ◯ Prefer to self-describe, below:

24. What is your educational level?

- ◯ High School
- ◯ Undergraduate Degree
- ◯ Graduate Degree (Master's) or above
- ◯ Other (please specify)

25. Years of Experience in the Hotel Industry

- ◯ < 5 Years
- ◯ 5-10 Years
- ◯ 11-20 Years
- ◯ > 20 Years

26. Which of the following categories best describes your employment status?

- ◯ Manager Position
- ◯ Permanent Employee
- ◯ Salaried Employee
- ◯ Seasonal Employee
- ◯ Hourly Employee
- ◯ External Consultant to the hotel
- ◯ I work for the corporation which owns the hotel
- ◯ Other (please specify)