Natural Disaster Management in 4* & 5* hotels of Greece and the impact of Artificial Intelligence: Evaluating the awareness of hotels’ staff

Maria Gatsi

SCHOOL OF ECONOMICS, BUSINESS ADMINISTRATION & LEGAL STUDIES

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Thessaloniki – Greece
Student Name: Maria Gatsi

SID: 1109170008

Supervisor: Dr. Ioannis Magnisalis

I hereby declare that the work submitted is mine and that where I have made use of another’s work, I have attributed the source(s) according to the Regulations set in the Student’s Handbook.

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Abstract

The dissertation was written as part of the MSc in Hospitality and Tourism Management at the International Hellenic University. In recent years, extreme natural phenomena have become an increasing rife, causing serious material damage and human casualties. These phenomena are nowadays also reported in locales that have never had such experiences before and, therefore, concerns of the wider international community have been raised. For this reason, natural disaster management has attracted the attention of researchers across various disciplines. One of the major areas affected by natural disasters is the hotel industry, which entails that disaster preparedness and management are - or ought to be - the fundamental parts for the proper operation of each hotel unit. Within this framework the different types of natural disasters are identified, specified and categorized. Also, the importance of preparedness and management of natural disaster events is clarified and the various phases of these procedures and their importance for the hotel units, are explained. The study also examines the significance of smart technology in natural disaster management. Moreover, the researcher presents specific cases where natural disasters have affected the hotel units of the local community and admittedly major natural disaster events that have occurred in Greece in recent years. The purpose of this study is to investigate the level of preparedness of 4* and 5* hotel units in Greece for natural disasters - through the use of quantitative research based on questionnaires that were distributed employees and managers of hotels around Greece- and also, their perspective on the actual and potential contribution of smart technology. As the research shows, even though the participants highlight the importance of smart technology and the belief that a higher number of natural disaster phenomena are likely to occur in the future, there is a stagnant use of technological means as well as the level of practice for natural disaster management.

Keywords: Natural Disasters, Management and Preparedness, Greek Hotels, Artificial Intelligence

Maria Gatsi
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I. Introduction

The purpose of this research is to outline a holistic approach of natural disaster management on the hotel tourism industry and to propose suggestions in order to face these incidents with the implementation of smart technology. In fact, study motivation to cover this subject was the big earthquake that the researcher experienced in Kos island while working at a hotel unit, in July of 2017. After such an experience, it was noticeable that there is no specific approach regarding the management of natural disaster events in Greece, and in this specific case, in hospitality and tourism industry. Since in the next few years smart technology will be further developed, it is considered to comprise one of the main pylons of proactive and reactive strategies.

This research explores the basic definitions of natural disaster events, natural disaster preparedness and management and how these extreme phenomena can impact on the hotel industry for both tourists and businesses. Likewise, the research examines the latest technology developments and applications for dealing with disaster and suggests a possible use of them in the hotel industry. Additionally, it examines some empirical cases and outlines the most severe natural disasters that Greece has suffered the last years. Although disasters cannot be stopped, their consequences can be proactively restricted and reactively confronted. The objectives of this study is to provide -through an extended survey that is conducted for employees and managers of 4* and 5* hotels of Greece- important results and conclusions so as to analyze the current situation of hotel preparedness and to verify the hypothesis that new technologies can contribute significantly in disaster preparedness and management of hotel units in Greece, in emergency situations arising from natural disasters. This study aims to cover an important gap in Greece regarding the researches on natural disaster management for hotels, to provide some valuable data and information for people how are engaged with hotel security and safety and also to encourage for further and more thorough research, both locally and internationally.
II. Literature Review

Natural disasters and emergency management

Identifying natural disasters

According to Perry & Quarantelly, a natural disaster is an extreme event caused by natural causes and has serious consequences that threaten human lives, properties and the environment itself and require a concerted and rapid reaction (2005). These natural causes can be described as earthquakes, tsunamis, floods, hurricanes and other forms (Richardson, 1994).

Moreover, Mileti (1999) defines natural disasters as natural phenomena, e.g. natural hazards that interact with the environment, causing social disruption. A key feature of this approach is the emphasis on the unforeseen nature of these phenomena, which results in the unpredictable reaction of people, characterized by the limited time of response.


“an act of a nature of such magnitude as to create a catastrophic situation in which day-to-day patterns of life are suddenly disrupted and people are plunged into helplessness and suffering, and, as a result, need for food, shelter, medical and nursing care and other necessities of life, and protection against unfavorable environmental factors and conditions”.

These acts of the nature can be clearly described by the International Database of Natural Disasters (EM–DAT, n.d), with the classification of the main categories of natural disasters (Figure 1), which are:

- geophysical,
- meteorological,
- hydrological,
- climatic,
- biological and
As mentioned above, the forms of such phenomena can vary and be associated with tsunamis, floods, earthquakes, wildfires, hurricanes, tornadoes. Contrary to the approach of EM-DAT, Mileti considers that such disasters not only can be foreseen but they can also be effectively dealt with, to some extent (1999). Researchers such as Brown et al., approach natural disasters as phenomena of a sudden nature due to external factors and have significant social consequences, with the ultimate of them being the immediate mobilization of the society to repair the damages. More specifically, according to Brown et al (2017, p.363) a natural disaster is:

“a sudden event where the trigger is outside the current control of the affected area (community and / or business), the event disrupts the function of that area and requires additional resources (other than available within the area) to respond to and recover from the event”.

\[1\] In the sense that they are due to factors outside the Earth’s atmosphere.
Perry and Quarantelly (2005) also mention that such consequences extend not only to social, but also to natural and technological levels and cause disruption of social normality. In general, there is a natural disaster every year, affecting the hotel sector and the tourism industry since tourist destinations in most parts of the world are considered to be exposed -to a great extent- on the aforementioned types of natural disasters (Faulkner, 2001).

In top of that, Europe is the third most frequented continent with floods and landslides representing the highest occurrence (47%), followed by storms with the second highest frequency (42%), the extreme weather and wildfires to a lesser extent (7%) and earthquakes, tsunamis and volcanic eruptions with the minimum extent (5%), (Low, 2019).

**Types of natural disaster phenomena in hospitality industry**

Within the hospitality and tourism industry, hotels are vulnerable and exposed to a complex set of natural phenomena. Material infrastructure (such as buildings), water supply, electricity and human resources (employees, visitors) may be at risk from these extreme weather events. The same applies to the hotel's surrounding (which may include marine or forest areas) that can also be disaster-prone and thus, make the whole hotel area less attractive to the upcoming and repeated visitors (Becken et al, 2013).

Such an extreme phenomenon of natural disaster is the hurricane Katrina of 2005, which has had a severe impact on New Orleans' society resulting in the closure of 1,409 hospitality businesses, the loss of working positions to approximately 33,000 people in the hospitality industry and the general loss of almost $ 15.2 million per day (Pearlman and Melnik, 2008).

Natural disasters are one of the main categories of crises², identified by scholars as serious threats to the hospitality sector. In fact, the major forms of natural disasters that have plagued various destinations and hospitality businesses in the past are earthquakes, hurricanes, tsunamis, floods, and heavy thunderstorms. Further, natural disasters appear to have occurred with a higher frequency in recent years and in areas

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² The other categories concern terrorism, political instability-war and epidemics.
that were not expected to take place in comparison with the past (Maditinos and Vassiliadis, 2008).

The main problems that seem to be caused by natural disasters in the field of hospitality are:

- the increasing concerns and uncertainties of tourists regarding their safety and security and
- the destruction of material infrastructure, resources and main facilities of the hotel and its surrounding

On the one hand, visitors’ perceptions and attitudes are further negatively affected by these phenomena and they tend to choose tourist destinations that are less likely to be exposed to a natural disaster. The effective management of such natural phenomena and the availability of an equally effective preparation and training plan are the key components to mitigate these concerns and gain visitor’s confidence (Maditinos and Vassiliadis, 2008). On the other hand, the resulting destruction of infrastructures by these phenomena extends also to the environment around the hotel unit, such as means of transport, roads and other.

Another hazardous case is the tsunami of Indonesia in 2004, which not only had disastrous consequences for the hospitality sector but also harmed perceptions of potential visitors as they began to consider the regions of South-East and South Asia as perilous, leading to dramatically reduction of arrivals in these areas (Zhang, 2005). Once again, it is considered of great importance to have appropriate training, preparation, and management programs for such crises, also for the units of the hotel industry (Maditinos and Vassiliadis, 2008)

**Natural disaster response planning & management**

Natural disasters appear to have increased importantly in various parts of the world in recent years and this situation has raised concerns in the field of hospitality. Managers are looking for various ways and methods that could potentially help address these unforeseen phenomena on time and limit the damaging effects in order to enhance the sustainability of the hospitality world (Mitroff, 2004).

To effectively address the various challenges, the researchers believe that a necessary background constitutes a rational assessment of the current state of preparedness and
planning of the disaster response by the hospitality industry. This requires an in-depth assessment of the relationship between certain organizational characteristics (Figure 2), such as the size or the type of a business and actions notable designed with the intention of preparing the hotel accordingly for natural disasters. (Kash and Darling, 1998)

![Types of Hotels / Classification of Hotels](setupmyhotel.com)

*Figure 2: Types and classification of hotels (Source: Setupmyhotel.com)*

Given the above, policymakers have been motivated to look for ways of predicting effectively the phenomena in advance of their occurrence, but also to take appropriate action in order to reduce the potential impact of a disaster event in a unit (Cohen, 2008). The hospitality sector is one of the most exposed and vulnerable sectors to natural disasters thus that, these phenomena have gradually become much more complicated and frequent. This on the one hand, has caused major malfunctions in the various units and on the other hand, has shown the urgency of the need to make an effective disaster preparedness plan and minimize its consequences (Coppola, 2010).

One of the most important processes within natural disaster management of the hospitality sector, is reputed to be the evaluation of the quality of preparedness plans, since it’s one of them needs to be constantly monitored, evaluated and improved. To
some extent, this process is considered essential because the field of natural disaster management is relatively recent and has not yet been established as an integrated scientifically and professionally trained system (Crews, 2001). Consequently, there are several shortcomings in the provision of appropriate staff training, but also in the provision of specialized knowledge by senior managers (Perry and Lindell, 2003).

At a second level, these shortcomings reflect some other gaps, which are related to the disproportionate relationship between available resources, manual procedures and the actual needs of a hotel business in a case of emergency. Considering the above, disaster response planning must be a dynamic and constantly evolving process (Perry and Lindell, 2003). Researchers such as Patton and Alexander (Alexander, 2005) argue that the dynamic nature of disaster response planning is needed to enhance the functionality of a unit's readiness. In the hotel sector, it is considered necessary to maintain constant communication and cooperation with local authorities in order to eliminate any gaps between internal and external planning (Stahura et al, 2012).

Another key component of disaster management planning is to have a clearly defined framework of tasks and functions (Dynes, 1998). To facilitate the effectiveness of this framework it is more desirable being harmonic rather than cutting off from the existing institutional framework of a hotel unit’s operation. This highlights the multi-organizational nature of having a preparedness plan (Perry and Lindell, 2003).

The effective prevention and response to natural disasters in the hospitality and hotel industry requires the presence of dynamic plans, good collaboration and appropriate training. This undoubtedly requires hard work and possibly some innovative decision-making process and self-imposed initiatives by the hotel managers.

**Key stages of emergency management**

Crisis management research in the hospitality industry has shown how important it is to have a plan in place and be alert to menaces that threaten businesses, staff and guests. Despite the importance of the issue, the relevant literature on the actual readiness of hostels and especially hotels, is very limited. In a survey that was conducted in Toronto -Canada- in 2008, only 56% of managers of hospitality units had some degree of preparedness. There is a significant gap in this field and the need to close it is imperative for obvious reasons (Tew et al., 2008).
Concerning the hotel sector, the importance of having a checklist highlighting the potential weaknesses of the hotel in the case of extreme weather events (earthquakes, hurricanes, tsunamis and other) is highlighted. This list should also be supplemented with queries and clarifications regarding procedures followed in the event of an emergency, the building’s evacuation, the hotel readiness, the staff training and management during a natural disaster event (Udu-gama, 2008). For instance, it is essential for the staff to be adequately trained. Training must be continuous so that each individual can deal with extreme weather events, ensuring optimal levels of safety for visitors, themselves and the hotel unit in general.

According to the theoretical framework developed by Faulkner and Vikulov (2001) and Ritchie's (2004) theoretical model, effective crisis management is divided into six key stages (Figure 3):

- the pre-event phase, which is related with planning and prevention of the phenomena,
- the prodromal phase, where the need to activate the preparedness plan arises,
- the emergency phase, characterized by the emergence of the crisis and the presence of early damages,
- the intermediate phase, where additional emergency measures are adopted to meet human needs,
- the rehabilitation phase, which involves the implementation of long-term plans for disaster relief and disaster recovery, and
- the resolving phase, where the preparedness plan that was implemented, goes through an evaluation process to assess its weaknesses and take appropriate action to further improve it and better address future disasters.
In the modern era, the rise of technology and the rapid advances that have taken place have radically transformed people’s lifestyles. One of the areas where various technology applications are now applied is the management of natural disasters. GIS systems, Internet of Things, Big Data and Artificial Intelligence, are some of the applications which have the potential to contribute to a more effective planning of preventive measures and countermeasures (Vyas and Desai, 2007).

More specifically, GIS systems can upgrade and enhance the wider process of natural disaster analysis. First of all, the data deriving from these systems can on the one hand, enhance the formulation of suitable activities and actions and on the other hand, help planners to choose the most appropriate measures and the most suitable way to implement them, in terms of emergency preparedness and response. What GIS systems do, is to provide a range of media for more efficient storage, processing and interpretation of data that can be characterized as remote, spatial and non-spatial. The collection of such data in the event of a natural disaster is thought to facilitate aspects
like mapping, estimating and modeling data for phenomena such as earthquakes, floods, fires (Vyas and Desai, 2007).

For example, data collected from GIS systems are used by meteorologists to design the so-called Threat Maps, which provide indications of possible cyclone events in specific areas and scientists can alert residents of those areas in advance. Such applications are also used to map and monitor earthquakes, landslides and floods. In the case of India, which has been hit by extreme natural phenomena in recent years, GIS systems have been used by meteorological and scientific teams to predict the occurrence of extreme events and therefore to take the needed precautionary measures ahead of time (Vyas and Desai, 2007).

Concerning the hospitality industry and namely the hotel industry, GIS systems could potentially be utilized accordingly so as to have a better plan for dealing with natural disasters both on a proactive and real level of an extreme event. In fact, the possibility that GIS systems can provide clues of possible phenomena can be very useful for hotels, while the crisis planners of each hotel unit could also be connected to meteorological and/or scientific teams that monitor live events through those systems. Such a potential could provide timely updates to the hotel and amplify its effort to react promptly by implementing the adequate preparedness measures. At a more advanced level, Internet technology -with the ability to quench both distance and time- makes possible the operation of a network, through which hotel units of a region or country will be interconnected and have the ability to exchange directly all the necessary data and information in emergency cases.

**The Internet of Things (IoT)**

Recently, the IoT has attracted the interest of many researchers and scientists and seems to become increasingly popular through its application in different fields like the technological, political and economic field. The key function and at the same time the powerful advantage of the IoT is the ability to:

- establish seamless communication between connected electronic devices,
- foster continuous and trouble-free flow of data and information,
- control and process a multitude of daily functions using smart devices.

(Ray et al, 2017)
An example of the use of an IoT system from collecting data to action, is illustrated in the following Figure 4.

**Example of an IoT system**

![Diagram of an IoT system](source)

IoT is increasingly used in several important scientific and industrial fields, such as healthcare, robotics, transport, agriculture and other. As noted by Ray et al the IoT “Leverages heterogeneity, interoperability, distributed processing, and real-time analytics in parallel”. (2017, p.18818)

In addition to the above, another special feature that makes IoT to stand out, among other technological applications in the management of extreme natural phenomena, is its flexibility to provide a set of different protocols that can be applied accordingly to the type of physical phenomenon. As noted, natural disasters require a more personalized approach of the protocol to be exploited, as each phenomenon has its own characteristics in terms of its manifestation, its extent and its consequences. Figure 5 presents an illustration of the supported communication protocols provided by the IoT for disaster management. (Ray et al, 2017)
One of the applications that derive from IoT technology is the so-called BRINCO, which can also be used preventively. This sensor-based system is activated by its special sensors like the accelerometer, the signal processing unit, other audio alarm units and can detect vibrations from the ground. After that, it sends instant time data to the BRINCO Data Center (a private cloud service that processes data from a variety of seismic log networks) and immediately assess the risk of an earthquake in order to inform the people of a local area in a timely manner (through notifications on their smartphones) or on a global area with the use of social network sites (Ray et al, 2017). Similar types of beacons using IoT technology are also used for floods and natural phenomena associated with the element of water. These beacons have been designed with multiple functions such as:

- to detect any possible rise of water that may have dangerous extensions,
- to identify where the anchorage is observed,
- to monitor real-time behavior and
- to report immediately when the rise of water exceeds some permissible limits.

This data is stored in cloud-type services for later analysis and processing (Ray et al, 2017). Such technologies could be well incorporated into hotel units located in areas with high frequency of seismic vibrations or also located near marine areas with high probabilities of floods or tsunamis. There are the reasons why the managers of emergency preparedness departments need to install similar sensors in hotel units that will be interconnected with a broader network of accessing similar data on real-time.
The exploitation of this technology can be critical by alerting people for a possible earthquake or tsunami and leading subsequently to the implementation of appropriate preconceived actions.

Artificial Intelligence (AI)

According to the computer scientist John McCarthy, Artificial Intelligence is:

“The science and engineering of making intelligent machines, especially intelligent computer programs. It is related to the similar task of using computers to understand human intelligence, but AI does not have to confine itself to methods that are biologically observable.” (McCarthy, n.d.)

Artificial intelligence and more generally the so-called RAISA technology (Robots, Artificial Intelligence, Service Automation) have been increasingly integrated into hotels in recent years, but mainly in terms of customer service. These technologies, relying more on automation, are replacing human labor in various areas of the hotel. Artificial intelligence technologies exploit the ability of devices to understand and use the human language and in combination with robotic technologies, there are now “intelligent physical devices” (commonly known as robots), which with a degree of autonomy, mobility and external environment processing via sensors, are capable of performing various tasks within the hotel unit (Table 1) (Lukanova and Ilieva, 2019).
Table 1: Main examples of RAISA applications in hotels (Source: Lukanova and Ilieva, 2019)

<table>
<thead>
<tr>
<th></th>
<th>Robots</th>
<th>Artificial Intelligence</th>
<th>Service automation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-arrival</strong></td>
<td></td>
<td>Al search platforms</td>
<td>Virtual reality, Mobile check in</td>
</tr>
<tr>
<td><strong>Arrival</strong></td>
<td>Porter robots</td>
<td></td>
<td>Digital kiosks, Smart-phone rooms, Keys/nonstop check-in</td>
</tr>
<tr>
<td><strong>Stay</strong></td>
<td>Front desk robots, Concierge robots, Delivery robots, Room assistant robots</td>
<td>Interactive social, Hubs, Chatbots</td>
<td>In-room smart technologies</td>
</tr>
<tr>
<td><strong>Departure</strong></td>
<td>Porter robots</td>
<td>Travel assistant</td>
<td>Express checkout, Digital kiosks</td>
</tr>
<tr>
<td><strong>Assessment</strong></td>
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<td>Al platform</td>
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</table>

Regarding the utilization of smart applications for natural disaster management and response they are particularly useful in the immediate, fast and efficient processing and analysis of data (especially geospatial in real time, accurately and reliably). This means that the contribution of such applications is the selection of data, the best decision-making and the immediate implementation of the best response plans and preparedness (Ivic, 2019).

At present, the application of artificial intelligence in the field of natural disasters is an ongoing field. Scientists have made significant advances in designing systems that can detect earthquakes, with the goal of being able to accurately predict them. Other examples of implementing artificial intelligence are found in “vulnerability and exposure assessments” by assessing the degree of exposure and vulnerability of an area to specific weather events and therefore identifying the weaknesses of the area. Artificial intelligence is particularly effective at processing information such as satellite photos and data, thereby helping to respond faster when a natural disaster occurs (Ivic, 2019).
One of the ongoing research areas for exploiting AI in natural disaster management, concerns the detection of data and information that may have predictive value for the occurrence of possible floods. This system is described as Artificial Neural Networks (ANN) and is based on data processing from rain volume and soil moisture. In other cases, the use of specific algorithms from satellite and aerial photographs, in combination with ground photographs, is used to model the manner of flood development and to detect its extent. In general, artificial intelligence technologies of this type process and compare data and algorithms that have been collected in affected areas before and after the occurrence of the natural phenomenon, and thus can and observe existing changes taking place in various aspects of the natural environment, for example the ground, and have an image of the pattern by which the phenomenon manifests. These models (Figure 7), by visualizing the possible “paths” - followed by a flood and the key variables- can have preventive value and thus contribute to the timely implementation of preparedness measures (Saravi et al, 2019).
In the hotel sector it is considered that artificial intelligence, since it is already applied to customer service, is promising a lot for the benefit of disaster preparedness and response. Already at this time period, Google is building an AI platform for flood forecasting in India and through Google Maps and Google Search, it will be able to keep people up to date and take the necessary measures in case of occurrence of the phenomena. Such an application would be very useful for hotel units located near areas that are prone to the occurrence of a tsunami or flood (Joshi, 2019).

Equally useful for hotels may be an AI technology that is also under development and that is foreseeing volcanic eruption. This technology detects various data from tiny volcanic ash elements. In addition, the International Business Machines Corporation (IBM) is already developing an AI technology called Watson, which will be able to predict volcanic activity through seismic sensors and geospatial data processing (Joshi, 2019).

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1Green refers to normal conditions, amber refers to caution for probability of flooding and red refers to a very high risk or event of flooding
Another major technological development that has been expanding and growing in recent years is the Big Data. Increasingly key element to many aspects of daily public and private life, this technology has offered new and promising opportunities in the field of natural disaster management for modeling, visualization, analysis and forecasting of extreme weather events. It has significantly changed the way that people perceive and behave and the deeper philosophy behind the disaster management field (Yu et al., 2018). The so-called technology of Big Data can be defined as (Yu, Yang and Li, 2018, p.2):

“The technological paradigm that allows researchers to conduct efficient analysis of vast quantities of data that is made through the current practices. It is the collection of scientific and engineering methods and tools that help make the most of the massive amounts of data available”.

One of the Big Data applications has to do with the so-called simulation data. This is the numerical simulation of data and predicts the possible occurrence of various natural disasters with reference to specific meteorological phenomena, land surface phenomena or various types of pollutions. Within this technology, an enormous amount of data is utilized, usually extracted during a natural disaster, to produce and refine future models that represent the complex way of how an extreme physical event occurs. This framework leverages information derived from applications such as the three-dimensional landslide geological model to improve evacuation plans, accelerate emergency procedures and reduce human and intangible losses. Such models have been used in Indonesia, Japan and Thailand for tsunami mitigation and design of more effective site evacuation measures (Yu, Yang and Li, 2018).

Another important Big Data technology is the vector-based spatial data. This type of data can provide valuable information for the effective management of natural disasters by producing predictive models of natural disasters related to the potential intensity and extent of a natural phenomenon. The role of such a technology is also important in the analysis of vulnerability in basic building installations (such as schools and hospitals), population groups, but also in analyzing the real impact of a disaster and assessing the
effectiveness of existing resources (supplies, vehicles) for managing the natural phenomenon (Yu, Yang and Li, 2018)

Undoubtedly, Big Data technology can make a significant contribution to hotels' preparedness for natural disasters. Although it is a technology that exploits a variety of technological and digital devices (such as IoT and GIS), it may be more complex to make out the most of its potential through hotel units, as staff will need to be adequately trained in management, processing and interpretation of this data. It is expected in the future that their gradual introduction will be developed mainly due to their ability to detect extreme weather events prior to their occurrence.

Empirical Cases of natural disasters

The case of Jordan and Malaysia

Jordan is a modern middle-income country located in the center of the Middle East in North-West Asia, with a semi-arid climate and exposed to a variety of natural phenomena (Figure 8) such as earthquakes, droughts, floods and hurricanes that have affected the state, economic and social structures of the country and the hospitality industry (UNDP, 2010). Together with Malaysia they have experienced severe disasters in the past. However, hotels still face significant gaps and shortcomings not only in terms of the availability of effective preparedness plans, but also in terms of resources and staff training (Albattat and Som, 2014).

Research has shown that there are significant gaps in the design of preventive measures in order to effectively deter and limit the negative consequences of various crisis situations. It also noted that hotels are heavily dependent on government agencies and that some of the preparedness plans out there are not adopted by the hotels, yet without clarifying the reasons why this is happening. What emerges, is that the practical implementation of these plans is flawed (Albattat and Som, 2014).

Concerning the perspectives of hotel managers about factors favoring the effective design of preparedness measures, some have suggested that there should be a close cooperation and communication network between hotels so as to facilitate the exchange of information regarding the upgrade, the assessment and the management of their plans. Furthermore, respondents emphasized the importance of providing staff
with adequate training in crisis management and response. In addition, they stated that civil defense organizations and bodies have an important role to play in: informing citizens about existing security measures and systems, supporting hotels to integrate within these measures and defining the role of hotel employees in the case of an extreme weather event. Some of them also mentioned the need for appropriate logistics equipment such as power generators in the case of a power failure, appropriate machinery for people with disabilities to facilitate early the evacuation of the site and others among them. (Albattat and Som, 2014).

As part of the same survey of Malaysian hotels the managers involved said they did not have a plan to deal with an emergency. What is particularly interesting is their response that they do not want to adopt a preparedness plan, even if a disaster occurs, because they do not have sufficient resources to support the development of such a plan. In fact, a small percentage of the hotels reported that some disaster preparedness and response plans exist only in written forms. However, half of them were of a 'general' nature and/or concerned only with the possibility of a fire occurring (Albattat and Som, 2014).

![Figure 8: Jordan - Flood Hazards by District (PreventionWeb.com)](image-url)
The case of Maldives

The Maldives is a chain of 1,190 islands located south-west of Sri Lanka and India. In 2004, the Maldives maritime region suffered from the Tsunami of the Indian Ocean. It was the most devastating natural phenomenon in the history of the area. More than a few islands were severely damaged, many tourist businesses were affected, many human lives were lost, and many people were forced to abandon their homes. The tsunami has had a negative impact on the country's economy, which is mainly based on tourism, while total losses are estimated to have reached $ 470 million (Tostovrsnik et al, 2015).

Furthermore, the Maldives is considered experienced in the phenomenon of the tsunami, while counting the number of at least 85 tsunamis since the year of 1816. Also, according to the research these islands are widely exposed and vulnerable to strong cyclonic winds, which can reach up to 180 km/h. In addition, scientists are warning about an increase in the incidence of extreme weather events in the future due to climate change (Tostovrsnik et al, 2015).

Yet, despite repeated tsunami events and cyclones and the constant warnings of scientists about the high degree of exposure to natural disasters (Figure 9), the Maldives Tourism Ministry has belatedly adopted and institutionalized the "Disaster Management Guideline for Guesthouses / Hotels" in 2013. This legislation essentially requires hotel facilities to formulate a preparedness plan that will include in detail all the necessary information on disaster management and response. The plans are required to refer to basic aspects such as "disaster management, floor plans, vulnerability assessment, preparedness and evacuation strategies for a range of natural hazards, communication, and evacuation drills" (Tostovrsnik et al, 2015, p.11).
Another study in Wellington, New Zealand, attempted to evaluate the effectiveness of "disaster resilience" in the hotel sector. The cause was serious material damage - mainly to buildings of the area - after the Kaikoura earthquake in 2016. The so-called "disaster resilience" according to Brown et al (2019, p.78) is perceived as "a dynamic condition describing the capacity of a hotel, with its stakeholders, to access, innovate, adapt and overcome possible disruptions that may be triggered by the disaster". The Disaster Resilience Framework for Hotel concerns the effective utilization of economic, cultural, social, human, physical and natural capital for disaster management (Figure 10) (Brown et al, 2019). The respondents of this study were the staff and managers of hotels in the Wellington area. On the financial level, research has shown that hotels generally do not invest significant funds in disaster management, as well as low levels of staff security.
In addition, the social capital research has shown through staff responses the need to strengthen cooperation and communication links with other organizations that may be useful in the event of a disaster. In addition, participants indicated that there was a need for better information on aspects related to the condition of the hotel premises and their wider behavior in the event of a disaster (Brown et al, 2019).

Concerning the utilization of human capital, participants reported that their only training in natural disaster management involved some procedures for evacuating the hotel in the event of a fire, providing information on earthquake prevention and first aid training. Since the Wellington area has previous experience with earthquakes, it seems that hotel preparedness measures and staff training focus primarily on managing a potential earthquake. As the research showed, there are significant gaps and deficiencies in dealing with other natural disasters, such as tsunamis. As a result, it is necessary to have a multilevel and holistic approach for the training of hotel staff in the management of
various natural disasters to assure the efficiency of the hotel preparedness (Brown et al, 2019).

The case of Greece

In the history of Greece, natural disasters have occurred since ancient times, most notably the eruption of the Santorini volcano around 1500 to 1640 BC which resulted in the destruction of an entire civilization. Following with the modern history of Greece, where there have been various tremendous natural disasters such as earthquakes, floods and fires which caused many human losses and material damage. The country's efforts to organize natural disasters mainly focused on the stage following their occurrence, which means in other words that the focus was only on rehabilitation and not on prevention. This trend was evident throughout the private sector, with the absence of a civil protection system (Καρανασιοπούλου, 2010)

Natural disasters in Greece have become more and more frequent in recent years. As such, the magnitude of the economic losses they cause is highly fluctuating, which bothers society. In a study that was held by the Hellenic Association of Insurance Companies (EAEE) over the period 1993-2018 regarding the number of reported losses and the amount of large-scale and high-intensity disaster claims, it was presented overall that the causes of damage are five: snowfall, rainfall (including tornado and flood phenomena), forest fires and earthquake (Table 2) (EAEE, 2019).

<table>
<thead>
<tr>
<th>Disaster event</th>
<th>Number of claims</th>
</tr>
</thead>
<tbody>
<tr>
<td>Snowfall</td>
<td>1</td>
</tr>
<tr>
<td>Rainfall</td>
<td>17</td>
</tr>
<tr>
<td>Forest fires</td>
<td>3</td>
</tr>
<tr>
<td>Earthquake</td>
<td>5</td>
</tr>
</tbody>
</table>

Some of the most devastating natural disasters in Greece were related to the earthquakes of 1953 during which the islands of Zakynthos, Kefalonia and Ithaca suffered the worst disasters. Indeed, that year's earthquakes are regarded as the worst natural disaster to hit the country, leaving 455 dead people. The phenomenon first occurred in Ithaca with a 6.4 Richter earthquake and later in Zakynthos with 6.8 Richter.
The culmination of the phenomenon occurred the following day, August 12, when a 7.2 Richter earthquake struck Kefalonia. These earthquakes literally leveled all three islands, causing 33,300 houses to be destroyed and a significant part of the population moving to other parts of Greece (Newsbeast, 2018).

One of the major natural disasters that Greece experienced was also the flood of Athens on 5th of November 1961. Heavy rain caused floods so extensive and severe that they resulted severe property damage and destroyed hundreds of homes in areas such as Nice, Faliro, Aigaleo and Liosia. In addition to the property damage, 43 people died and over 4,000 people were forced to remain homeless. Since that time, the region of Attica has unfortunately experienced many major floods with the most serious being November 1977 with 37 dead, 1994 with 9 dead and Mandra 2018 with 24 dead (Newsbeast, 2018).

The most devastating natural phenomena in the country include also the earthquakes of Thessaloniki in 1978 and Athens in 1999. In the first case, the event of an earthquake on the night of 20th June brought about the death of 49 people and caused serious material losses in thousands of buildings and in other smaller cities in the periphery of Thessaloniki. The earthquake in Athens on 7th of September 1999 resulted a building collapse causing the death of 143 people (Newsbeast, 2018).

In addition to the above, wildfires are a common phenomenon in Greece while in recent years they have become so intense with a great difficulty to be confronted in a reasonable amount of time and this results in the endanger of human lives, properties, buildings, businesses, natural landscapes and other. One of the biggest fires was that of Peloponnese in August of 2007, where the multiple fronts of flames could not be controlled and this caused the loss of 37 human lives and hundreds of thousands of acres of forest to burn (Newsbeast, 2018). However, the fire that broke out in Kineta area, on July 23 of 2018, was the deadly fire in the history of the modern Greek state and the second most devastating fire world of 21st century (102 dead, thousands of homes were destroyed and tens of thousands of acres of forest burned), following the fires in Australia in February 2009, which killed 180 people (KAΘΜΕΠΙΝΗ, 2019; EFSYN, 2018).
III. Methodology

The empirical cases in the previous chapter provided inspiration to the author so as to propose a methodology and specific research questions. Thus, the author has identified, by reviewing the relevant literature, that although there are scarce attempts to design a strategy for disaster mitigation, there is no methodological way of doing so in general. This study advances in the hospitality and tourism area towards these directions and provides a tool that can be used as a first step of identifying and measuring the attitude of key-decision stakeholders in the hospitality area, regarding issues of disaster management. Moreover, the researcher focuses on the field of Artificial Intelligence that seems promising in providing resolutions for managing disasters.

Research Methodology

Research Methodology can be defined as “the philosophy or the general principle which will guide your research” (Dawson, 2009, p. 14). This methodology can be filtered into two research methodologies, which are the qualitative and the quantitative. In addition to the above, Dawson provides an understanding description of these two:

- **Qualitative research explores attitudes, behavior and experiences through such methods as interviews or focus groups.**
- **Quantitative research generates statistics through the use of large-scale survey research, using methods such as questionnaires or structured interviews.** (Dawson, 2009, p. 14-15).

The research undertaken by the author aimed to investigate whether 4* and/or 5* hotels of Greece provide adequate training to their staff in dealing with extreme natural phenomena and the opinions of the employees and managers regarding the current versus the potential impact of Artificial Intelligence in such crisis. Furthermore, the research questions that arise from the study, are:

- Do the demographic characteristics of the participants affect their opinion about: 1) the importance of “Disaster Management Training”, 2) the disastrous natural phenomena of Greece and 3) the use of Artificial Intelligence for the management of natural phenomena?
• Do the experience of the participants in crisis incidents, the working experience in 4* and/or 5* hotels of Greece and the “Disaster Management Training” of the hotels affect the participants’ opinion about: 1) the importance of “Disaster Management Training”, 2) the disastrous natural phenomena of Greece and 3) the use of Artificial Intelligence for the management of natural phenomena?

Research design

According to the characteristics of both research methodologies, for the purposes of this research, quantitative analysis was conducted. More specifically, the first approach of the author was the qualitative analysis, but due to the mathematical validity and the significance of presenting the results into statistic numbers, quantitative approach was preferable. In the context of this methodology, a questionnaire was used as the methodological tool. It has been analyzed using inductive methods, which revealed statistically significant dependencies among the research’s variables.

Population

The respondents of this survey questionnaire, who had working experience in 4* and/or 5* hotels of Greece, were 109 in number comprising both employees and managers from different locations around Greece. More specifically, most of the participants were females from 18 to 30 years old, postgraduates and as mentioned previously all of them have had the experience needed for the purposes of this research.

Data Collection Process

The questionnaire was distributed through Internet by emails and other multiple collateral sources as LinkedIn and Facebook pages, targeting on people who work in the hotel industry of Greece. More specifically, a proper Google Form frame was used, which contained not only the questions, but also the purpose of the survey focusing on the importance of participation. Also, the participants were informed that the required time to complete the survey would be approximately 7 minutes and of their anonymity.
Analysis tools

The questionnaire or the research is consisted of 3 sections, which are:

➢ the demographic characteristics of the participants,
➢ their experience in disaster management of natural phenomena and
➢ their opinions about Artificial Intelligence and disaster management.

The first section contained 4 close-ended questions, the second section is consisted of 9 close-ended questions, 2 of which are multiple-choice questions and lastly, the third section is consisted of 4 questions, 3 of which are close ended (1 of which is a multiple-choice question) and one Likert type question, split into 5 sub-questions.

Reliability and validity

The reliability analysis was conducted using the Cronbach’s Alpha indicator. More specifically the reliability among the ordinal variables of the present questionnaire was 0.739, which can be considered as “acceptable”.

Ethical Issues

Ethical issues are particularly important in the psychology of participants and need to be taken into consideration by the researcher, as defined by the American Psychological Society (APA, 2001) and the British Psychological Society (BPS, 2014). Specifically, the rules followed by the researcher, are:

• The approval of the participants was requested before the consummation of the investigation,
• The participants were informed in advance regarding the process, the research objectives and that their participation was voluntary
• The participants were also informed that no personal information would be used, and their answers would be leveraged not only for research purposes, but also for further future research.
Data Analysis

Demographic Characteristics

In the first section of this methodology, the researcher analyzes the respondents’ demographic characteristics and more specifically: their gender, age, educational level and their previous working experience in 4* and/or 5* hotels of Greece. As it is illustrated in the following Figure 11, the sample of this survey is comprised by more than 55% of female gender, while the rest of them belongs to the male gender. Also, 57.8% of them have the age between 18 to 30 years old, 31.2% is from 31 to 50 years old, while the rest 11% belongs to people who are more than 50 years old, as also depicted in Figure 12.

Figure 11: Demographic profile of respondents – Gender

Figure 12: Demographic profile of respondents - Age
Furthermore, the sample of the survey seems to acquire a high level of education as it is illustrated in Figure 13, since more than 63% of them have a postgraduate level of education (in terms of a graduate diploma, a master diploma or a “Doctor of Philosophy” diploma), the 27.5% are under-graduators (associate or bachelor degree), while the rest 9.2% of the sample is consisted of participants who finished their education at a secondary level.

![Figure 13: Demographic profile of respondents - Education](image)

As far as the professional experience of the respondents of the survey is concerned, all of them have working experience in 4* and/or 5* hotels of Greece, which is shown in detail in Table 3.

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid Yes</td>
<td>109</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Experiencing disaster management of natural phenomena

In this chapter, the author analyzes the questions that refer to the participants' experience of natural disastrous phenomena and the training that they received from the hotel, in order to manage such phenomena.

As it is illustrated in Table 4 and Figure 14, there is an almost equivalent distribution of the respondents regarding their working experience in 4* and/or 5* hotels of Greece. The 30.3% of them have a working experience up to 3 years, the 24.8% has an experience
from 6 to 10 years, while the 23.9% has an experience from 3 to 5 years. Lastly, the participants with a working experience more than 10 years, occupy the 21.1% of the sample.

Table 4: Working experience of respondents in years

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 3 years</td>
<td>33</td>
<td>30.3</td>
<td>30.3</td>
</tr>
<tr>
<td>3-5</td>
<td>26</td>
<td>23.9</td>
<td>54.1</td>
</tr>
<tr>
<td>6-10</td>
<td>27</td>
<td>24.8</td>
<td>78.9</td>
</tr>
<tr>
<td>More than 10 years</td>
<td>23</td>
<td>21.1</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>109</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

As depicted in Table 5 and Figure 15, there is a 56% of the respondents who had lastly worked as employees in a hotel, while the rest 44% of them worked in a managerial position.

Table 5: Working position of the respondents

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employee</td>
<td>61</td>
<td>56.0</td>
<td>56.0</td>
</tr>
<tr>
<td>Manager</td>
<td>48</td>
<td>44.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>109</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Figure 14: Working experience of respondents in years
As shown in Table 6 and Figure 16, more than 64% of the participants have experienced a crisis incident in terms of natural disaster during their career, however the rest of them don’t have such an experience.

Table 6: Experience of the respondents with natural disaster phenomena

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td>Yes</td>
<td>70</td>
<td>64.2</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>39</td>
<td>35.8</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>109</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Have you ever experienced a crisis incident (in Greece) in terms of natural disaster during your career?

Figure 16: Experience of respondents with natural disaster phenomena
Namely, for those who already had an experience of natural disaster event during their career, the researcher requested from them to provide the correspond to the description phenomenon. As it is illustrated in Figure 17, 32.1% of their answers refer to floods, earthquakes reach the 30.2%, fires occupy the 24.5% and storms the 9.4%. Finally, the 2.8% of the total answers belong to the intense winds and the 0.9% to the low temperatures.

![Type of natural disaster phenomena that the participants experienced](image)

*Figure 17: Type of natural disaster phenomena that the participants experienced*

Continuing with Figure 18, the author analyzes the disaster management training that the hotels provided to the participants of the survey. As it can be verified from the analysis, most of the hotels in the Greek hotel industry do not provide disaster management training, since more that 34% of the respondents stated that a few of them provide it and approximately 32% answered that they have never had training on how to respond in a case of natural disaster. While, those who support that some of the hotels provided them a type of training occupy the 18.3%. Finally, the answers “A lot of them” and “All of them” reach the 10.1% and the 4.6% respectively.
In addition to the previous query, the means that were utilized as kind of disaster management training of the respondents, are depicted in Table 7. The most common mean of training among the responds is “The speeches” with the number of 34.9% of the total answers, following by the “Manual procedures” with 34.1% and “The exercises” and “The seminars” that represent the 16.3% and the 13.2% of the answers respectively. Lastly, the rest 1.6% belongs to the mean of training with the use of “Videos”.

Another important query that was propounded to the participants focused on the existence or not of an individual emergency management department among the 4* and 5* hotels of Greece. As it is depicted in Figure 19, the 36.7% of the respondents describe that there were a few hotels with a separate department for emergency management, while 25.7% refers that there was not even one hotel with a separated department for emergency management. Also, the answers “Some”, “A lot” and “All” occupy the 20.2%, the 12.8% and the 4.6% respectively.
Moreover, the great number of 72.5% of the participants strongly agree that the disaster management training constitutes a significant part of the staff’s training in order to adapt accordingly to each incident, while 19.3% also agrees to that. To a lesser extend there is a 6.4% of the participants that are neutral, while those who disagree or strongly disagree with the previous opinion occupy 0.9% of the sample each (Figure 20).

Over the statement “I believe that disastrous natural phenomena are very likely to occur in Greece” more than 50% of the respondents had the tendency of totally agreement,
the number of 24.8% answered as very possible to occur, while the 17.4% of the participants support the previous statement in a moderate level. Lastly, the answer “Slightly” occupies the 5.5% and the answer “Not at all” reaches the 1.8% (Table 8).

**Table 8: Respondents’ perspectives over the occurrence of natural disaster phenomena in Greece**

<table>
<thead>
<tr>
<th>Valid</th>
<th>Frequency</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
<td>2</td>
<td>1.8</td>
<td>1.8</td>
</tr>
<tr>
<td>Slightly</td>
<td>6</td>
<td>5.5</td>
<td>7.3</td>
</tr>
<tr>
<td>Moderately</td>
<td>19</td>
<td>17.4</td>
<td>24.8</td>
</tr>
<tr>
<td>Very</td>
<td>27</td>
<td>24.8</td>
<td>49.5</td>
</tr>
<tr>
<td>Totally</td>
<td>55</td>
<td>50.5</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>109</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

**Artificial Intelligence and Disaster management**

Coming up with the last chapter of this research, the author focuses on the participants’ perspectives with regards to artificial intelligence and its correlation with the disaster management of natural phenomena. First, more than 57% of the participants have worked in hotels of Greece where smart technology and smart devices were used, while the rest of them hasn’t (Table 9). For those who had such an experience, the author requested their description as per the smart devices and the smart technology that they have used. As it is illustrated in Table 10 and Figure 21, 28.2% of the answers belongs to the data analysis, 26.9% to the chatbots, 17.3% belongs to the smart speaker and the personalized activity suggestions occupies the frequency of 16.7%. Continuing, the robotic assistants reach the 3.8% of the total answers, the virtual figure that provides introductory information represents the 3.2%, while the answers “Other” and “Self-driving cars” reach the 2.6% and the 1.3% respectively.

**Table 9: Usage of the smart technology and smart devices in the Greek hotels**

<table>
<thead>
<tr>
<th>Valid</th>
<th>Frequency</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>63</td>
<td>57.8</td>
<td>57.8</td>
</tr>
<tr>
<td>No</td>
<td>46</td>
<td>42.2</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>109</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>
Table 10: Types of smart technology implementation in Greek hotels

<table>
<thead>
<tr>
<th>Valid</th>
<th>Frequency</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-driving cars</td>
<td>2</td>
<td>1.3</td>
<td>1.3</td>
</tr>
<tr>
<td>Personalized activity suggestions</td>
<td>26</td>
<td>16.7</td>
<td>17.9</td>
</tr>
<tr>
<td>Chatbots - Messaging</td>
<td>42</td>
<td>26.9</td>
<td>44.9</td>
</tr>
<tr>
<td>Data Analysis</td>
<td>44</td>
<td>28.2</td>
<td>73.1</td>
</tr>
<tr>
<td>Smart speaker</td>
<td>27</td>
<td>17.3</td>
<td>90.4</td>
</tr>
<tr>
<td>Virtual Figure that provide introductory info</td>
<td>5</td>
<td>3.2</td>
<td>93.6</td>
</tr>
<tr>
<td>Robotic assistants or &quot;employees&quot;</td>
<td>6</td>
<td>3.8</td>
<td>97.4</td>
</tr>
<tr>
<td>Other</td>
<td>4</td>
<td>2.6</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Figure 21: Types of smart technology's implementation in Greek hotels

At this point, a standard format (5-point Likert scale) issued the opinions of the participants recruiters over the appliance of Artificial Intelligence in the Greek hotel industry as a mean of confrontation of unexpected natural phenomena (Figure 22). On a scale of “not at all” (1) to “totally” (5), most of the participants (56%) reported that they “totally” believe that the artificial intelligence could be used for this purpose, 25.7% answered “Very”, while the 12.8% agreed with the previous statement in a moderate level. Those who slightly believe that artificial intelligence can be applied in the hotel industry occupy the 4.6% and the rest 0.9% disagrees that artificial intelligence can be used in hotels to confront unexpected natural disasters.
The last analysis of this section is the participants’ opinions regarding the suggestions of the author as possible applications of artificial intelligence in the hotel industry to deal with crisis situations arriving from natural disasters (Figure 23). The answers accept values from 1 to 5 (1-Strongly disagree, 2-Agree, 3-Neither agree nor disagree, 4-Agree, 5-Strongly agree) and if the mean of those answers increases, so does the participants’ agreement regarding the application of the author’s suggestions. Putting the number into words, between the answers “Agree” and “Strongly agree”, leaning more into the second one, the participants appear to be about the enlightened pathways on every floor of the hotel (4.57). However, in the same scale, but leaning more into the answer “Agree”, are also placed the voice activated virtual assistants (4.35) and the smart watches (4.27). The participants agree that the secret lockers in the rooms could be applied in the hotel industry (4.05) and lastly, between neutrality and agreement, leaning more into the first one, is their opinion regarding the use of self-driving cars (3.30).
Inductive statistics

In this last section of the quantitative analysis, the author investigates the research questions, which are the following ones:

- **Do the demographic characteristics of the participants affect their opinion about:**
  1) the importance of “Disaster Management Training”, 2) the disastrous natural phenomena of Greece and 3) the use of Artificial Intelligence for the management of natural phenomena?

- **Do the experience of the participants in crisis incidents, the working experience in 4* and/or 5* hotels of Greece and the “Disaster Management Training” of the hotels affect the participants’ opinion about:**
  1) the importance of “Disaster Management Training”, 2) the disastrous natural phenomena of Greece and 3) the use of Artificial Intelligence for the management of natural phenomena?

In order to answer the above research questions, the author used the parametric t-test and the non-parametric Kruskal-Wallis test. These tests are used in order to reveal statistically significant dependencies among scale or ordinal variables, as for a nominal grouping variable. More specifically, they calculate the mean values of the studied characteristics in all subgroups created by the grouping variable and extract a value (p-value) which determines if these means are statistically different from each other.
The null hypothesis (Ho) of each test is: “there is no statistically significant differentiation between the subgroups” and is rejected in 95% trust level, if the p-value is below 0.05, indicating a statistically significant result.

The decision of using non-parametric tests, relies on the Central Limit Theorem. Based on it, if the grouping variable splits the dataset into subgroups, with more than 30 observation, parametric tests can be used (t-test for binary variables and ANOVA for variables with more than 2 values), but if there is even one subgroup with less than 30 observations the respective non-parametric test has to be used.

First research question

“Do the demographic characteristics of the participants affect their opinion about: 1) the importance of “Disaster Management Training”, 2) the disastrous natural phenomena of Greece and 3) the use of Artificial Intelligence for the management of natural phenomena?”

To reliably answer this research question, some statistical tests have been used and the results are depicted in Table 11, out of which 4 statistically significant dependencies were revealed.

Table 11: Dependencies as for the demographic characteristics of the respondents

<table>
<thead>
<tr>
<th></th>
<th>Gender (t-test)</th>
<th>Age (Kruskal-Wallis)</th>
<th>Educational level (Kruskal-Wallis)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All of the 4* or 5* hotels that I have worked for, during my career, had specific department for Emergency Management.</td>
<td>0.656</td>
<td>0.005</td>
<td>0.811</td>
</tr>
<tr>
<td>I believe that Disaster Management Training constitutes a significant part of the staff’s training in order to adapt accordingly to each incident.</td>
<td>0.010</td>
<td>0.391</td>
<td>0.921</td>
</tr>
<tr>
<td>I believe that disastrous natural phenomena are very likely to occur in Greece.</td>
<td>0.340</td>
<td>0.006</td>
<td>0.777</td>
</tr>
<tr>
<td>Do you believe that Artificial Intelligence can be also applied in the Greek hotel industry so as to confront unexpected natural disaster?</td>
<td>0.040</td>
<td>0.210</td>
<td>0.052</td>
</tr>
<tr>
<td>Smart watches so as to track down the guests any time of emergency and lead them to the right path so as to avoid the overcrowding</td>
<td>0.681</td>
<td>0.063</td>
<td>0.875</td>
</tr>
<tr>
<td>Voice activated virtual assistants, who will provide all the necessary information and directions to the guests on their native language</td>
<td>0.607</td>
<td>0.711</td>
<td>0.217</td>
</tr>
<tr>
<td>Self-driving cars</td>
<td>0.193</td>
<td>0.529</td>
<td>0.077</td>
</tr>
<tr>
<td>Secret lockers in the rooms that will be activated automatically with the use of AI, so as to provide the needed rescue gadgets</td>
<td>0.131</td>
<td>0.873</td>
<td>0.712</td>
</tr>
<tr>
<td>Enlightened pathways on every floor of the hotel that will be activated with the AI and will direct the guests to the nearest exits</td>
<td>0.795</td>
<td>0.440</td>
<td>0.234</td>
</tr>
</tbody>
</table>
The analysis of these statistically significant dependencies that were revealed previously, are shown in Figure 24. In comparison to the male gender, the female gender agrees on a higher level with the statement that “Disaster Management Training constitutes a significant part of the staff’s training so as to adapt accordingly to each incident” and they appear to be more positive about the implementation of artificial intelligence in the Greek hotel industry so as to confront unexpected natural disaster events. Furthermore, as the age increases there are two other variables that also increase. First, the number of hotels which had a specific department for emergency management increases and second, there is a higher agreement that disastrous natural phenomena are very likely to occur in Greece.

![Figure 24: Dependencies as for the demographic characteristics of the respondents](image)

**Second research question**

“Do the experience of the participants in crisis incidents, the working experience in 4* and/or 5* hotels of Greece and the “Disaster Management Training” of the hotels affect the participants’ opinion about: 1) the importance of “Disaster Management Training”,

40
2) the disastrous natural phenomena of Greece and 3) the use of Artificial Intelligence for the management of natural phenomena?“

For the analysis of the second research question, as mentioned before, the t-test and Kruskal-Wallis test were used. The p-values of the statistical tests are shown in the following Table 12, out of which 10 statistically significant dependencies were revealed.

Table 12: Dependencies as for the experience in crisis incidents, the working experience and the disaster management training that was provided

<table>
<thead>
<tr>
<th>Issue</th>
<th>Have you ever experienced a crisis incident (in Greece) in terms of natural disaster during your career? (Kruskal-Wallis)</th>
<th>Working experience in 4* and/or 5* hotels of Greece. (t-test)</th>
<th>Did the hotels (4* or 5*) that you worked for, provide any kind of &quot;Disaster Management&quot; training? (Kruskal-Wallis)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All of the 4* or 5* hotels that I have worked for, during my career, had specific department for Emergency Management.</td>
<td>0.019</td>
<td>0.005</td>
<td>0.000</td>
</tr>
<tr>
<td>I believe that Disaster Management Training constitutes a significant part of the staff’s training so as to adapt accordingly to each incident.</td>
<td>0.054</td>
<td>0.065</td>
<td>0.623</td>
</tr>
<tr>
<td>I believe that disastrous natural phenomena are very likely to occur in Greece.</td>
<td>0.000</td>
<td>0.000</td>
<td>0.912</td>
</tr>
<tr>
<td>Do you believe that Artificial Intelligence can be also applied in the Greek hotel industry so as to confront unexpected natural disaster?</td>
<td>0.016</td>
<td>0.003</td>
<td>0.891</td>
</tr>
<tr>
<td>Smart watches so as to track down the guests any time of emergency and lead them to the right path so as to avoid the overcrowding</td>
<td>0.048</td>
<td>0.005</td>
<td>0.999</td>
</tr>
<tr>
<td>Voice activated virtual assistants, who will provide all the necessary information and directions to the guests on their native language</td>
<td>0.114</td>
<td>0.886</td>
<td>0.953</td>
</tr>
<tr>
<td>Self-driving cars</td>
<td>0.070</td>
<td>0.013</td>
<td>0.386</td>
</tr>
<tr>
<td>Secret lockers in the rooms that will be activated automatically with the use of AI, so as to provide the needed rescue gadgets</td>
<td>0.597</td>
<td>0.928</td>
<td>0.977</td>
</tr>
<tr>
<td>Enlightened pathways on every floor of the hotel that will be activated with the AI and will direct the guests to the nearest exits</td>
<td>0.091</td>
<td>0.813</td>
<td>0.959</td>
</tr>
</tbody>
</table>

As for the second research question, the statistically significant dependencies are also presented in the following Figure 25. It is noticed that the participants who have experienced a crisis incident in terms of natural disaster, they have also worked in a larger number of hotels with a specific department for emergency management and they also agree on a higher level that disastrous natural phenomena are very likely to occur in Greece.
Furthermore, they find more possible that Artificial Intelligence can be implemented in the Greek hotel industry so as to confront unexpected natural disaster and finally, they agree more with the fact that smart watches could be used in Greek hotels so as to track down the guests any time of emergency and lead them to the right path avoiding the over-crowding. However, as the years of working experience in 4* and/or 5* hotels increase, it is more common that the participants have worked in a hotel with specific department for emergency management.

Also, on the same way the respondents with working experience from 6 to 10 years in hotels with 4* and/or 5* believe on a higher level that disastrous natural phenomena are very likely to occur in Greece, they support more the suggestion of the use of artificial intelligence, they agree more with the use of smart watches and the use of self-driving cars. Lastly, it is concluded that the more of the participants that got provided with disaster management training, the larger is the number of hotels – where they have worked at - with a specific department for emergency management.
Figure 25: Dependencies as for the experience in crisis incidents, the working experience and the disaster management training.
IV. Results & Discussion

The investigation of this research focused on the opinions of employees and managers of the Greek hotel industry, whether 4*, 5* hotels of Greece provide adequate training to their staff in dealing with extreme natural phenomena and furthermore the current versus the potential impact of Artificial Intelligence in such crisis. More specifically, in the research’s participants were 109 employees and managers, most of them females, from 18 to 30 years old and postgraduates, while all of them have a previous working experience in 4* and/or 5* hotels of Greece.

As resulted from the research, most of the respondents have working experience up to 3 years as an employee, they do have experienced a crisis incident in terms of natural disaster during their careers with a higher frequency of floods and earthquakes. Also, a few of the hotels in which the respondents have worked for, provided disaster management training -mostly by manual procedures- and had specific department for emergency management. Continuing, most of the respondents strongly agree that the disaster management training constitutes a significant part of the staff’s training in order to adapt accordingly to each incident and they totally believe that disastrous natural phenomena are very likely to occur in Greece. Furthermore, a great number of the sample has worked in a 4* and/or 5* hotel of Greece where smart technology and smart devices have been used, while the most common use among the hotels was the data analysis technologies. Finally, the participants totally believe that AI can be also applied in the Greek hotel industry to confront unexpected natural disaster events. Actually, they are more positive about applying enlightened pathways on every floor of the hotel, which will be activated with the use of AI and will direct the guests to the nearest exits so as to avoid overcrowding, while at the same time they do not find applicable enough the use of self-driving cars.

Rising from the first research question, female participants agree on a higher level that disaster management training constitutes a significant part of the staff’s training and they are more positive regarding the implementation of artificial intelligence to confront unexpected natural phenomena. Also, as it emerges, while the age of the respondents increases, the more they agree that disastrous natural phenomena are very likely to
occur in Greece and also more hotels, according to their working experience, had a specific department for emergency management.

Following with the second research question, it was revealed that the participants who have experienced a crisis incident in terms of natural disaster, they have worked in a larger number of hotels with a specific department for emergency management. In addition to that, they agree more that disastrous natural phenomena are very likely to occur in Greece and support on a higher level that AI can be applied in the Greek hotel industry to confront unexpected natural phenomena. Also, they are more supportive to the implementation of smart watches in hotels, in order to track down the guests at any time of emergency and lead them to the right path avoiding the overcrowding. Furthermore, as the years of working experience in 4* and/or 5* hotels increase, more the participants have worked in a hotel that had a specific department for emergency management. To conclude with the dependencies as for the working experience in 4* and/or 5* hotels, the participants with a working experience from 6 to 10 years support more that disastrous natural phenomena are very likely to occur in Greece, that the artificial intelligence can also be used in the hotel industry so as to confront natural disasters and that smart watches and self-driving cars can be used in the hotel industry to confront disastrous natural phenomena. Also, the more the participants got provided any kind of disaster management training, the larger is the number of hotels with a specific department for emergency management.

Despite its methodological benefits, the study has also some limitations. The first of those limitations, which is not uncommon in human resources research, concerns the use of cross-sectoral data. Despite the emphasis given to existing theory and the use of multi-level analysis may have contributed to increased confidence in the researcher’s findings, caution is recommended in the interpretation of this results beyond the precise context of the analysis. Another limitation of this research study was identified by covering relevant questions for the preparedness of a specific hotel cases and that it was also conducted in a specific context - in Greece. Therefore, there should be careful handling regarding the generalization of these findings to other countries and other hotels. For these reasons, it is noted that researchers are careful to reproduce the results of this research without critically examining findings from previous research and, this
underlines the importance of the need for further and more thorough research in Greece.

v. Conclusions & Recommendations

The present study has shown that the disposal of a disaster preparedness and management plan constitutes now a fundamental part of operating a hotel unit. As the gradual appearance of extreme natural phenomena has an increasing and unpredictable character, as well as the fact that Greece is one of the most important tourist destinations internationally, there is a need for further development of appropriate measures to manage such phenomena. Hotel staff’s opinions indicate that the hotels’ existing preparedness plans are rudimentary. In the same situation, it is also evaluated the training they have, as well as the familiarization and utilization of the opportunities offered by the new technologies. Therefore, three practices are recommended.

The first one is to upgrade and improve disaster preparedness and management plans. International experience has taught us a great deal about how to effectively plan prevention and real-time measures. It is therefore necessary to have a network of cooperation, communication and exchange of information, both national and international level, in order to promote improved preparedness plans. The second practice relates to the necessary development of education and training of hotel staff on natural disaster management. From evacuating an area to providing first aids, there is a wide variety of aspects in which the hotel’s staff needs to be trained. This could be done by providing appropriate seminars from civil protection people and experts on natural disaster management. Also, it would be important to have a continuous training and practice within the hotel environment. Finally, as it turned out, the contribution of technology is beyond doubt. Therefore, there is a need for a responsible attitude by hotel managers to make some investments in integrating new technologies that are more effective in dealing with natural disasters and in this respect, it is necessary to establish a communication network with the international arena in order to keep abreast of the latest technological developments in this area.
Bibliography

English


**Greek**


Appendix

Crisis Management of 4* & 5* hotels in the Greek Hospitality Industry: Evaluating the awareness of the employees and the current vs potential impact of Artificial Intelligence

Dear Participant:

My name is Maria Gatsi and I am a graduate student at International Hellenic University. For my final project, I am examining whether the 4* or 5* hotels of Greece, provide adequate training to their staff in dealing with crisis situations at work, and more specifically dealing with extreme natural phenomena. In case that you have working experience in the Greek Hospitality Industry, I am inviting you to participate in this research study by completing the attached survey.

The following questionnaire will be conducted in the English language and requires approximately 7 minutes of your time to complete. In order to ensure that all information will remain confidential, please do not include your name. Copies of the project will be provided to my University’s library, to Dr. Ioannis Magnisalis - supervisor of my Master Thesis and the Course Office of MSc in Hospitality and Tourism Management. If you choose to participate in this project, please answer all questions as honestly as possible.

Thank you for taking the time to assist me in my educational endeavors. The data collected will provide useful information regarding the validation of my thesis and the verification of the conclusions. If you require additional information or have questions or would like a summary copy of this study, please contact me at the email listed below.

Sincerely,

Maria Gatsi
m.gatsi@ihu.edu.gr

Figure 26: Cover Letter of the questionnaire
Gender *
- Female
- Male

Age *
- 18-30
- 31-50
- 51+

Educational level *
- Primary
- Secondary
- Undergraduate (Associate / Bachelor's degree)
- Postgraduate (Graduate Diploma / Master / PhD)

Do you have previous experience in 4* and/or 5* hotels of Greece? *
- Yes
- No

Working experience in 4* and/or 5* hotels of Greece.
- Up to 3 years
- 3-5 years
- 5-10 years
- More than 10 years

What is/was your latest level of working position? *
- Employee
- Manager

Have you ever experienced a crisis incident (in Greece) in terms of natural disaster (earthquake, flood, fire, etc) during your career? *
- Yes
- No

If your answer was "Yes", please check the incident you experienced. (Otherwise, please proceed to the next question)
- Earthquake
- Flood
- Fire
- Other...

2
Did the hotels (4* or 5*) that you worked for, provide any kind of "Disaster Management" training?

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>All of them</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td></td>
</tr>
</tbody>
</table>

None of them

If your answer was "Yes (+1 or more hotels)" please check all that apply. (Otherwise, please proceed to the next question)

- [ ] Manual procedures (steps to be done "by the book")
- [ ] Exercises
- [ ] Speeches
- [ ] Seminars
- [ ] Other...

All of the 4* or 5* hotels that I have worked for, during my career, had specific department for Emergency Management.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td></td>
</tr>
</tbody>
</table>

None

I believe that Disaster Management Training constitutes a significant part of the staff's training so as to adapt accordingly to each incident.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td></td>
</tr>
</tbody>
</table>

Strongly Disagree

I believe that disastrous natural phenomena are very likely to occur in Greece.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Totally</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td></td>
</tr>
</tbody>
</table>

Not at all
Figure 27: Survey’s Questionnaire