Natural Disasters and Tourism. Are the Risks Taken Into Account?

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Abstract The tourism sector can be severely affected by unforeseen events, such as natural disasters, which are characterized as events with low probability but high impact. The COVID-19 pandemic came as an unprecedented shock to the tourism sector, with numerous reports appearing in many media outlets showing industry experts and directors calling for outside help to avoid worst-case scenarios for their businesses, even in the early days of the pandemic. We therefore wonder whether the approach of tourism companies to risk was inappropriate. Given the number of natural disasters that have occurred over the past few decades, we cannot argue that there have not been enough warning signs to encourage tourism companies to prepare for unforeseen events. A comprehensive review of natural disasters in recent years can be a valuable tool for tourism companies to assess such risks and develop strategies and action plans to increase resilience and sustainability. The latter should become key components of regular business.

1   Introduction

Tourism is influenced by a wide range of factors, with natural disasters being prime examples of such determining risks, as they are generally unpredictable, have profound effects on individuals and society, and as a result have the potential to significantly harm tourism in affected destinations.

Tourism is the single largest non-government economic sector in the world, and the most important economic activity for several local economies worldwide. It is also a fragile industry, in that demand for travel and perceived safety are highly susceptible to disasters and crises. The globalization of the tourism industry has added to this vulnerability, as crises that occur in a single place can affect tourism around the broader area or even worldwide. The problems that natural disasters cause the tourism sector can be summarized as an increase in tourists' concerns about safety and/or destruction of infrastructure and facilities, both general or tourism-related (Maditinos, Vassiliadis 2008).

The COVID-19 pandemic has added a new dimension to the problems caused by natural disasters as it is without doubt the most influential natural disaster in terms of number of affected people and economic impact in modern history. Globally, as of the 6th of December 2021, there have been 265,194,191 confirmed cases of COVID-19, including 5,254,116 deaths, reported to the World Health Organization (WHO, 2021).

Tourism was hit especially hard, with the majority of tourism companies caught off-guard by the speed and severity of the drop in tourism flows, which were caused by unprecedented government measures to limit the spread of infection and steep deterioration in perceived travel safety. According to UNWTO, there was a 76% drop in international tourist arrivals by September 30, 2021 compared to the same time period in 2019 (UNWTO, 2021). Aside from world wars, there are virtually no events in modern history that have limited travel on such a global scale and for such a prolonged period of time.

But smaller incidents did occur surprisingly often, affecting the tourism of regions, countries or individual destinations. The impact of a natural disaster can vary significantly by how long it lasts, how many cumulative effects it has across various areas, how many industries it affects, and whether a shock hits the supply side alone

or also the demand side. Supply chain disruptions lasting a month or longer now happen every 3.7 years on average (Lund et al., 2021). The nature and extent of impacts depend on the type of shock and the resilience of the affected system (OECD, 2014).

The assessment of the impact of natural disasters on tourism with regard to economic damage, affected populations and lives lost is gaining greater attention, as natural disaster risk management is becoming increasingly important (Maditinos & Vassiliadis, 2008).

Understanding crises and disasters and their potential impacts can help in the development of responsive strategies by organizations, thus reducing the severity of their impacts on business and society (Elsubbaugh et al., 2004).

The aim of this article is to explore data on past natural disasters that severely influenced tourism, thus presenting a shock to the system in affected regions, with the aim to provide an overview of most common natural disaster threats to tourism businesses, thus providing a framework for risk assessment that companies can use while assessing their risk profiles in order to improve their resilience in this context.

2   Natural disasters

2.1   Definition

There are many different terms used the in literature regarding unpredictable and adverse natural events, such as disasters, crises, shocks, risks, stresses, emergencies, catastrophes, events etc.

The differences are, to some extent, a matter of perception. Stephenson Disaster Management Institute (2021) defines a crisis in terms of a threat to core values or life-sustaining systems, which requires an urgent response under conditions of deep uncertainty. A disaster is determined by the outcome or consequences for a society: a disaster is a "crisis with a bad ending". When a crisis is perceived to have very bad consequences, we speak of a catastrophe.

Crises can also be defined as low-probability, high-impact events that threaten the viability of an organization, and are characterized by ambiguity of cause, effect, and means of resolution, as well as by a belief that decisions must be made swiftly (Pearson & Clair, 1998).

Laws and Prideaux (2005) argue that the term crisis in tourism refers to a sudden, unexpected event that leads to a shock.

The OECD defines a risk as a probability of a negative event and its negative consequences. A shock occurs when this risk becomes reality. Stress on the other hand is the result of a long-lasting trend. There are different types of risks, shocks and stresses (OECD, 2014):

1. infrequent events with an impact on almost everyone in the target group, such as earthquakes, volcanic eruptions or pandemics – covariate shocks,
2. significant events that specifically affect individuals and families, such as the death of the main breadwinner or the loss of income-generating activity – idiosyncratic shocks,
3. seasonal shocks, such as annual flooding linked to the rainy season, or recurring shocks such as frequent displacement or endemic cholera in particular communities,
4. long term trends, weakening the potential of a system and deepening the vulnerability of its actors, like increased pollution, deforestation, etc. – stresses.

Despite the fact that there are differences among the definitions of disaster, crisis and emergency, the terms are closely interconnected, interdependent and overlap significantly. The sudden nature of the event and the damage caused are the common features of all three, though an emergency is not always of a sudden nature. Further, many common features have been identified between disasters and crises, so they can be used interchangeably to a certain extent. The term emergency, however, does not share many common features with the other two terms, and has some contradictory features (Al-Dahash et al., 2016).

For purposes of this article the EM-DAT definition of natural disasters will be used. The EM-DAT database (2021), one of the most comprehensive databases on natural disasters, defines a disaster as an event conforming to at least one of the following criteria:

– 10 or more people dead,
– 100 or more people affected,
– The declaration of a state of emergency,
– A call for international assistance.

Table 1: General classification of natural disasters

Disaster Group	Disaster Subgroup	Definition	Main Types of Disaster
Natural	Geophysical	A hazard originating from solid earth. This term is used interchangeably with the term geological hazard.	Earthquake
			Mass movement (dry)
			Volcanic activity
	Meteorological	A hazard caused by short-lived, micro- to meso-scale extreme weather and atmospheric conditions that last from minutes to days.	Extreme temperature
			Fog
			Storm
	Hydrological	A hazard caused by the occurrence, movement, and distribution of surface and subsurface freshwater and saltwater.	Flood
			Landslide
			Wave action
	Climatological	A hazard caused by long-lived, meso- to macro-scale atmospheric processes ranging from intra-seasonal to multi-decadal climate variability.	Drought
			Glacial Lake Outburst
			Wildfire
	Biological	A hazard caused by the exposure to living organisms and their toxic substances (e.g., venom, mould) or vector-borne diseases that they may carry. Examples are venomous wildlife and insects, poisonous plants, and mosquitoes carrying disease-causing agents such as parasites, bacteria, or viruses (e.g. malaria).	Epidemic
			Insect infestation
			Animal Accident
	Extraterrestrial	A hazard caused by asteroids, meteoroids, and comets as they pass near Earth, enter the Earth's atmosphere, and/or strike the Earth, and by changes in interplanetary conditions that effect the Earth's	Impact
			Space weather

Disaster Group	Disaster Subgroup	Definition	Main Types of Disaster
		magnetosphere, ionosphere, and thermosphere.	

Source: (EM-DAT, 2021) http://www.emdat.be

Natural disasters can be further dived into sub-groups that describe individual events with greater precision. Detailed definitions of natural disasters subtypes types are presented in Table 2.

Table 2: General classification of natural disasters – subtypes

Disaster Subgroup	Disaster Main Type	Disaster Sub-Type	Disaster Sub-Sub-Type
Geophysical	Earthquake	Ground movement	
		Tsunami	
	Mass Movement (dry)	Rock fall	
		Landslide	
	Volcanic activity	Ash fall	
		Lahar	
		Pyroclastic flow	
		Lava flow	
Meteorological	Storm	Extra-tropical storm	
		Tropical storm	
		Convective storm	Derecho
			Hail
			Lightning/thunderstorm
			Rain
			Tornado
			Sand/dust storm
			Winter storm/blizzard
			Storm/surge
			Wind
			Severe storm
	Extreme temperature	Cold wave	
		Heat wave	
		Severe winter conditions	Snow/ice
			Frost/freeze
	Fog		
Hydrological	Flood	Coastal flood	
		Riverine flood	
		Flash flood	
		Ice jam flood	

Disaster Subgroup	Disaster Main Type	Disaster Sub-Type	Disaster Sub-Sub-Type
	Landslide	Avalanche (snow, debris, mudflow, rockfall)	
	Wave action	Rogue wave	
		Seiche	
Climatological	Drought		
	Glacial lake outburst		
	Wildfire	Forest fire	
		Land fire: brush, bush, pasture	
Biological	Epidemic	Viral disease	
		Bacterial disease	
		Parasitic disease	
		Fungal disease	
		Prion disease	
	Insect infestation	Grasshoppers	
		Locusts	
	Animal accident		
Extraterrestrial	Impact	Airburst	
	Space weather	Energetic particles	
		Geomagnetic storm	
		Shockwave	

Source: (EM-DAT, 2021) http://www.emdat.be

2.1.1 Occurrence of natural disasters

After detailing the classification of natural disasters, we must further determine the occurrence of different subtypes.

To determine what are the prevalent types of natural disasters that represent a shock to the system, how common are they and where they appear, we must look at historic data on such events.

An extensive database of georeferenced natural disasters can be found in the Emergency Events Database (EM-DAT) provided by the Centre for Research on the Epidemiology of Disasters at the Catholic University of Louvain in Belgium. The GDIS dataset includes the dominant geophysical, meteorological, hydrological, and climatological disaster types: floods, storms, earthquakes, volcanic activity, extreme temperatures, landslides, droughts, and (dry) mass movements (EM-DAT, 2021).

The EM-DAT database includes all reported disasters from 1900 until the present and in total contains spatial information on 39,953 locations for 9,924 disasters occurring worldwide between 1960 and 2018 (Rosvold, Buhaug, 2021).

That is roughly 165 significant natural disasters per year, but the numbers are growing year-by-year at an ever-faster pace. We can argue that information technology has made it easier to gather data on such incidents, but some authors believe that number of natural disasters is rising because of factors such as global warming, population growth that forces habitation in more dangerous environments, and other developments (Becken et al., 2014). As such, changes in the environment and the global economy are increasing the frequency and magnitude of shocks. Forty weather disasters in 2019 alone caused damage exceeding $1 billion each – and in recent years the economic toll caused by the most extreme events has been rising (Lund et al., 2021).

Figure 1 presents the occurrence of different subtypes of natural disasters from 1960 to 2018.
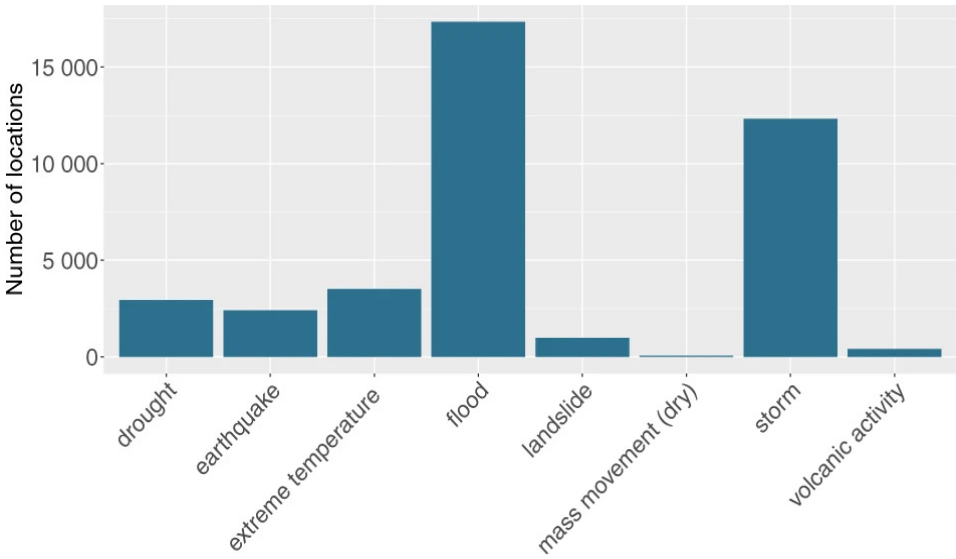
Figure 1: Natural disaster by type, from 1960–2018:
Source: Rosvold & Buhaug, 2021

According to UNDRR there were 7,348 major disaster events recorded between 2000 and 2019 alone, claiming 1.23 million lives, affecting 4.2 billion people and resulting in approximately US$2.97 trillion in global economic losses. This represents a sharp increase over the previous twenty years. Between 1980 and 1999 there were 4,212 disasters linked to natural hazards worldwide, claiming approximately 1.19 million lives and affecting 3.25 billion people, resulting in approximately US$1.63 trillion in economic losses. The last twenty years has seen the number of major floods more than double, from 1,389 to 3,254, while the incidence of storms grew from 1,457 to 2,034, with floods and storms were the most prevalent such events (UNDDR, 2020).

Over the last two decades a global increase in the damage coming from natural disasters has been recorded, with the death rates in low-income countries considerably higher than in richer nations (Kirchberger, 2017).

3 Effects of natural disasters on tourism flows

Rosselló et al. (2020) carried out extensive research on the effects of various natural disasters on tourism flows.
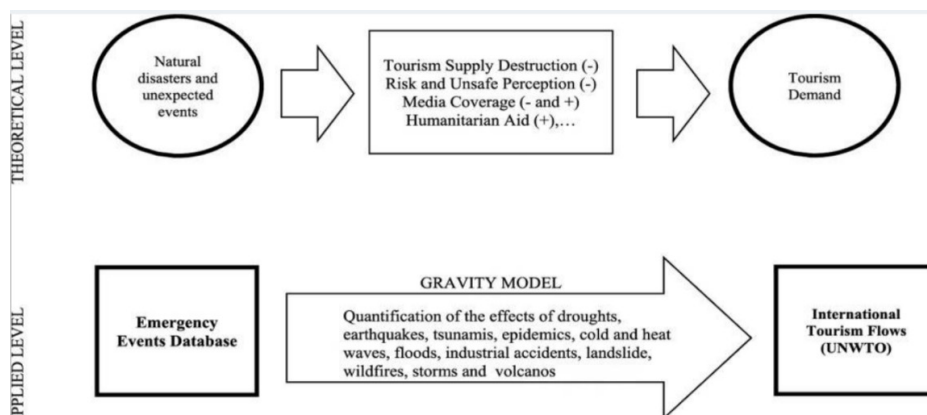

**Figure 2: Model of natural disasters effect on tourism flows**
Source: Rosselló et al. 2020

Researchers found that different types of disaster have different impacts on tourism. Volcanic eruptions are expected to have the most significant and substantial negative impacts on tourism. Floods and tsunamis are also very destructive when they occur, although it is difficult to establish whether the negative effects they have on tourism

flows are caused by destruction of or damage to infrastructure, or by the negative image of the destination generated by such events. Similarly, wildfires, earthquakes, storms or droughts present a threat to tourism flows when economic and infrastructural damage occurs. Researchers found that when these types of disasters result in economic or infrastructural damage, a negative and significant relationship can be established. Landslides, cold waves or heat waves are unlikely to have a major effect on tourist arrivals, which can also be attributed to them having little or no impact on infrastructure and presenting no long-term risk to tourists after the event has finished (Rosselló et al., 2020).

Although Rosselló et al. (2020) did not establish a meaningful negative impact of epidemics on tourism flows, probably because at the time of their work epidemics represented isolated events in relatively remote places, other empirical research has indicated that when there is high numbers of infections epidemics can have an significant impact, as observed in the cases of the SARS and avian flu epidemics (Mao et al., 2010). With the COVID-19 pandemic the literature will certainly change to reflect the fact that epidemics and pandemics are among the potentially most influential natural disasters with regard to tourism flows.

The impact of natural disasters depends on what one is considering. With regard to the loss of life, ground movements are the deadliest, followed by tsunamis and storms. In terms of the number of affected people, floods and droughts have the greatest impacts. With extensive media coverage it may appear to the general public that the number of fatalities from natural disasters has grown significantly in recent years, and destination risk perception has therefore emerged as one of the critical factors in the travel decision-making process (Becken et al., 2016). However, the good news is that the number of fatalities from natural disasters has fallen significantly in recent decades (Ritchie, Roser, 2021), as shown in Figure 2 which presents the number of fatalities caused by natural disasters each year from 1978 to 2020 (the COVID-19 pandemic not being included in the data).
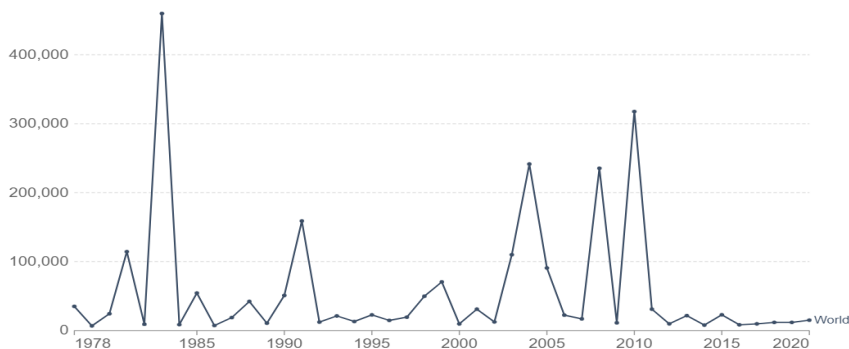
Figure 3: Number of fatalities caused by natural disasters per year
Source: Ritchie & Roser, 2021.

The distribution of disasters differs across regions and shows considerable variation both in terms of event type and resulting impacts. For instance, although only 16.8% of storms take place in the Americas, the impact in terms of deaths, affected people and costs is comparatively high compared to other regions (above 50%). Earthquakes are most common in the Asia-Pacific region, with disproportionally high impacts with regard to the number of deaths, affected people and economic costs. More than 90% of deaths form natural disasters in Africa are related to droughts, which is the prevalent type of natural disaster on that continent. Europe, with some exceptions, is characterized by a lower incidence of deaths and affected people from natural disaster, although with much higher economic costs, caused mainly by storms, heath and cold waves.

We can summarize that in terms of the economic costs of disasters, the developed world leads with storms ranking first. In terms of lives lost from natural disasters, those living in poverty in less developed nations are most heavily affected (Rosselló et al., 2020). High death tolls tend to be found in low-to-middle income countries without the infrastructure to protect and respond to such events (Ritchie & Roser, 2021).

Below we summarize some of the biggest natural disasters in recent decades in terms of lives lost, people affected and economic damage. Please note that infectious diseases are taken into account only if they occur as a sudden outbreak, while epidemics like HIV, tuberculosis, malaria and so on with no doubt have tremendous

effects on the affected populations, they can be better characterized as persistent stresses to the system, not as unforeseen natural events.

Table 3: Main natural disasters in terms of lives lost

Type of Disaster	Deaths	Year	Country	Description
Pandemic	5,250,000+	2019-	Global	SARS-Cov-2 pandemic
Earthquake (ground movement)	222,570	2010	Haiti	Earthquake (ground movement)
Earthquake (Tsunami)	165,708	2004	Indonesia	Tsunami/Tidal wave
Storm	138,366	2008	Myanmar	Tropical cyclone
Heat wave	55,736	2010	Russia	Heat wave
Flood	30,000	1999	Venezuela	Flash flood
Epidemic	6,908	2011	Haiti	Bacterial disease. Cholera epidemic.
Landslide	1,765	2010	China	Landslide
Cold wave	1,317	2008	Afghanistan	Severe winter conditions+ snow avalanche
Epidemic	774	2003	China & HK	SARS epidemic
Volcanic activity	322	2010	Indonesia	Ash flow (Mt. Merapi)
Wildfire	240	1997	Indonesia	Forest fire
Flood	200	2021	Germany	Flash flood

Source: EM-DAT (2021) www.emdat.be, CDC (2021) www.cdc.gov/DataStatistics/, WHO (2021) www.who.int/emergencies/disease-outbreak-news

Table 4: Main natural disasters in terms of economic damage

Type of Disaster	Cost in USD	Year	Country	Description
Pandemic	24,000,000,000,000+	2019-	Global	SARS-Cov-2 pandemic
Earthquake (tsunami)	210,000,000,000	2011	Japan	Earthquake, tsunami
Storm	125,000,000,000	2005	USA	Katrina. Tropical cyclone + flood
Earthquake	100,000,000,000	1995	Japan	Ground movement + fire
Epidemic	40,000,000,000	2003	China & HK	SARS epidemic
Flood	40,000,000,000	2012	Thailand	Riverine flood, landslide
Cold wave	21,100,000,000	2008	China	Severe winter conditions
Drought	20,000,000,000	2012	USA	Drought
Flood	20,000,000,000	2021	Germany	Flash flood
Wildfire	8,000,000,000	1997	Indonesia	Forest fire
Heat wave	4,400,000,000	2003	Italy	Heat wave
Landslide	890,000,000	1998	China	Landslide
Volcanic activity	150,000,000	2006	Ecuador	Ash fall (Tungurahua)

**Table 5: Main natural disasters in terms of the affected population**

Type of Disaster	Affected population	Year	Country	Description
Pandemic	global	2019-	Global	SARS-Cov-2 pandemic
Drought	300,000,000	2015-2016	India	Drought
Flood	238,970,000	1998	China	Riverine flood. Broken dam/burst dan
Storm	100,000,000	2002	China	Convective storm
Cold wave	77,000,000	2008	China	Severe winter conditions
Earthquake	45,980,000	2008	China	Earthquake,
Earthquake (tsunami)	2,670,000	2010	Chile	Tsunami/tidal wave
Landslide	2,100,000	2010	China	Landslide
Wildfire	1,000,000	2007	Macedonia	Forest fire
Epidemic	940,000	2011	Brazil	Viral disease. Dengue
Heat wave	500,000	1995	Australia	Extreme temperature
Volcanic activity	300,000	2006	Ecuador	Ash fall (Tungurahua)

Source: EM-DAT (2021) www.emdat.be, CDC (2021) www.cdc.gov/DataStatistics/, WHO (2021) www.who.int/emergencies/disease-outbreak-news

3.1 Natural disasters in Europe

Since Slovenia is part of this territory, we are obliged to take a closer look at natural disasters in Europe. There were roughly 1,000 natural disasters in Europe over the last two decades, of which 951 were weather-related. The combined death toll of these events are estimated at some 150,000 people, while the affected population amounts to well over 11 million with 217 billion US Dollars in economic damage (Below & van Loenhout, 2021).
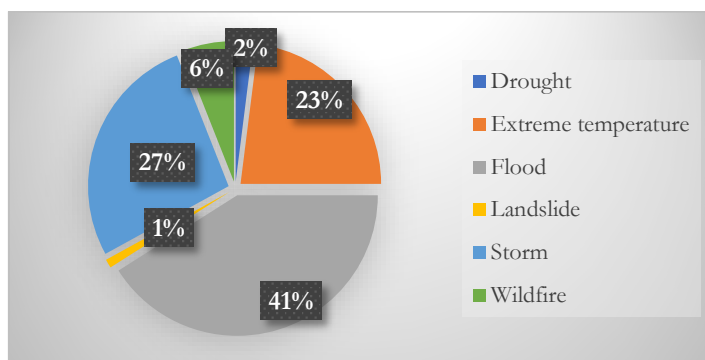
Figure 3: Occurrence of weather related natural disasters in Europe by type from 2001 to 2020.
Source: EM-DAT 2021

In Europe, most deaths from natural disasters over the last 20 years were caused by heath waves (146.000) and cold waves (3.800). In terms of the number of people affected, floods (60%) rank first, followed by storms, droughts and wildfires, each representing an approximately 10% share of the total. Most of the economic losses in Europe are caused by floods (50%), followed by storms (29%).

4   Conclusion

Natural disasters pose a very real risk to tourism, due to damage to general infrastructure, tourism facilities, the perceived safety of a destination, disruption of tourism flows, lives lost, and so on, and can have long lasting negative impacts on the sector. By acknowledging and understanding the risk posed by natural disasters, companies can develop strategies to better cope with and reduce their negative impacts to tourism.

Taking into account the sheer number of natural disasters that occurred in recent decades, we cannot argue that there are not enough warning signs to urge tourism companies to prepare for such events.

In the case of Europe, the systemic ability to respond to natural disasters saves lives, although the economic impact is still severe. Tourism companies should therefore evaluate the risks in destinations where they operate, have sufficient insurance coverage and build up financial reserves in order to boost their resilience. A classification of possible events, backed by data and statistics, can serve as a very effective tool in order to properly assess the real risk in micro locations.

A coordinated response from government bodies and tourism entities plays a significant role in post-disaster actions to cope with the negative impacts of major incidents. Re-establishing public perceptions of safety and attractiveness following a disaster is crucial to attract and reassure potential visitors to travel to an affected destination and, by doing so, assisting the affected area to regain functionality and achieve an economic recovery (WTTC, 2018). This kind of cooperation is currently seen at unprecedented levels as governments and companies collaborate to deal with the impacts of the COVID-19 pandemic. Past studies have shown that tourism recovers rapidly from natural disasters if basic and tourism infrastructures are not damaged, but only the future will tell if that will be the case with COVID-19. Will tourism quickly return to pre-pandemic levels once the pandemic is suppressed, as

general and tourism infrastructures were not damaged. Or will the lower perceived safety of travel prevail, with longer lasting negative effects on tourism flows?

With the occurrence of natural disasters becoming more common over recent decades, preparation for such events can no longer be separated from regular business activities. Therefore, sustainability and resilience are becoming more and more important strategic factors, and companies should incorporate the risk posed by natural disasters in their strategies and action plans to a greater extent.

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