

Social perceptions of natural and environmental risks: The case of Santorini

Xenia Katsigianni^a, Pavlos-Marinos A. Delladetsima^b

^{a,b}Department of Geography, Harokopio University Athens
70 Eleftheriou Venizelou Av., 17671, Kalithea

Abstract: The exacerbated risk and vulnerability environment of Santorini as shaped by its volcanic and seismic nature (having experienced the devastating earthquake in 1956) is further amplified by the contemporary new waves of human-induced risks. The emerging reality involves acute population flows and, in turn, uncontrolled building activity revealing a multi-vulnerable milieu, which becomes aggravated by the limited risk perception and awareness of the local institutional and societal setting. The present study aims to analyze the multi-vulnerable regime of Santorini and to examine social perceptions of risks as influenced by a number of associated factors. To this end, a 'multi-risk' approach has been adopted for recording natural and environmental hazards encountered in the insular setting. Further, an empirical work is conducted involving questionnaires that are distributed to the local population, institutions and businesses in order to explore whether the latter perceive (or not) the recorded risks and related vulnerable conditions of built environment.

Keywords: risk perception; environmental hazards; multi-risk; islands; vulnerability; Santorini; built environment, tourism

Introduction

Environmental Risk is an ever-present threat to human societies as well as natural systems. The broad definition of 'Risk' includes several types of hazards that are perceived in a very different way and the historical overview of the term reveals this multidimensionality of risk perception. Scientific explanation moved the causes of risks from the 'superior force' of God to the force of nature. Nevertheless, natural hazards were still perceived as 'those elements of the physical environment harmful to man and caused by forces extraneous to him' (Burton & Kates, 1964 in Smith, 1992). Positivist approaches adopted technical solutions to confront extreme natural phenomena and environmental determinism brought "science" in the first place of environmental hazards management. Risk became a measurable probability, expressed by several equations, such as ' R (risk) = p (probability) x L (loss)' or ' $R = H$ (hazard) x E (exposure)'. Technological progress and the entailing appearance of new types of threats, such as technological disasters, nuclear accidents and electromagnetic pollution, brought out the role of man in risk cause and the social contribution to the context of environmental hazards. Whereas previously science and technology provided safety, they are now seen as the source of several hazards

and uncontrolled catastrophic events. Beck (1992) describes this new reality, stating that social production of wealth is systematically accompanied by the social production of risk. This 'paradigm shift' (Chester et al., 2002) framed a new research base in Risk Analysis and Risk Management giving prominence to social sciences where the socially constructed side of risk is pointed out.

The increasing importance of social perceptions in risk epistemology

The current definition and typology of environmental risks include technological accidents and toxic materials, which are dreadful consequences of global development, as well as dangers that existed before but were not identifiable (eg. natural radioactivity or climate change). New features, including the different way in which risks are now perceived, characterize new threats. To put this into context, a new categorization of risks has been proposed. According to Adams (2013) risks fall into three main categories: (i) the ones that are visible to the 'naked eye', (ii) others perceptible through science and (iii) 'virtual' risks. The importance of perceptibility, combined with the stakeholders' disagreement in several cases of Environmental Risk Management, gave birth to the term "acceptable risk". Admitting that there is no absolute level of safety, the identification of "acceptable" levels of risk is based on societally determined tolerable circumstances, associated with economic benefits, scale of negative impacts and other political, social and cultural values (Starr, 1969; Fischhoff et al., 1978; Hunter & Fewtrell, 2001). In European law, the concept of "acceptable risk" inserts social risk perception in regulatory terms and decision-making, setting up an overrun of the traditional quantitative perception of 'hazard'. Environmental Risks, nowadays, do not simply refer to phenomena of natural world existing "out of us", but to the occurrences of natural and human world whose construction or interpretation are a result of the prevalent social circumstances, cultural values and scientific respects of a given period (Irwin, 2001).

Alongside the socio-natural co-production of hazard and the social dimensions of vulnerability, the ways in which different societal groups perceive hazard, vulnerability and risk need to be taken into account to understand the social construction of risk (Birkmann et al., 2013). The enriching notion of vulnerability underscores the social side of risk cause taking into account the spatial context and the physical elements that are exposed to risk. The current study aims to develop a framework, which integrates knowledge on risk perception into vulnerability and risk analysis. To this end, social and physical vulnerability are analyzed through the lenses of social perceptions as shaped by a number of influencing factors. Existing research on risk perception illuminates these factors.

Existing approaches of risk perception

The multidimensional nature of environmental risk has attracted various disciplines. Psychologists, sociologists, anthropologists as well as planners and geographers have tried to interpret the way people perceive risks and the factors that interfere in related cognitive and perceptual processes. The most significant theoretical approaches to risk perception are the Psychometric model, developed mainly in the field of Psychology and Cultural Theory (Douglas & Wildavsky, 1982). Combinations of these models have been designed and similar theoretical and methodological approaches have sought to further explore risk perception.

As risks are conceived by human senses as real phenomena, psychologists explored cognitive mechanisms and heuristics that people use in order to create mental models of risk notions. They translated these heuristics into factors that influence judgments and estimations of individuals about risks. To this end, psychometric research revealed factors such as knowledge, previous experience, newness, voluntariness, personal ability to influence risks, familiarity with the hazard, and the catastrophic potential. While the Psychometric paradigm has been micro-oriented, focusing on the subjective judgments of an isolated individual, it often excludes from risk perception study interactive processes and socio-cultural aspects. In Cultural approach, perceptions are built within a social context, which hosts different ideologies and value systems. Thus, risk perception is mediated through 'cultural biases' (or worldviews) and individuals should be expected to form perceptions of risk that reflect their commitment to one or another "cultural way of life" (Thompson et al., 1990). Each way of life corresponds to a specific social structure and a particular outlook on risk.

Factors affecting risk perception

Due to the multi-dimensional factors that influence people's understanding and estimations about environmental risks, risk perception study seems to be a complicated process. In the current research, factors affecting risk perception are divided into four main categories: (i) Risk factors, (ii) Context factors, (iii) Personal factors and (iv) Social factors. Risk factors have been explored through the empirical studies of Psychometric Paradigm and include aspects associated to the scientific characteristics of risk. These include the causes of hazard (natural or human-induced), its observability, the newness, the catastrophic potential, the existing knowledge about the threat, the perceived likelihood and magnitude of a disaster and the nature of catastrophic impacts (seriousness, duration, immediacy). Personal factors include the heuristic bias of availability, like experience of risk or disaster and memorability, as well as profit trust and acceptability. Social factors incorporate political and economical influences as well as informational factors (Wachinger & Renn, 2010). In this context, social legitimacy, social values, social trust, trust on experts and governance agents are analyzed as social features that influence risk perception. Various factors may be included in more than one category (e.g. profit, trust and acceptability may be part of either social or personal characteristics that influence risk perception). Context factors include aspects of natural and built environment associated with the physical vulnerability of a place. Context factors influencing risk perception include the proximity of a place to the source of hazard although it concerns mainly specific natural hazards, the quality of urban environment, home ownership and place attachment.

A new problematic approaching risk perception

Limited research has been conducted regarding the relation between physical vulnerability and social risk perception (Brody et al., 2007). The present study intends to further explore the role of built environment and the incorporated vulnerability on social risk perceptions. In this respect, the current approach is developed in two levels. The study begins with a qualitative analysis of physical vulnerability, as shaped by natural and environmental hazards encountered in the study area and the

hazardous features of built environment. A multi-risk analysis of physical vulnerability is adopted in order to reveal the context factors that influence risk perceptions. In a second step, the way in which locals perceive the aforementioned risks and context factors is further explored. To this end, an empirical study is conducted involving the distribution of questionnaires to the local population, institutions and businesses. The current approach aims to integrate socio-spatial characteristics that influence social perception of risk into vulnerability analysis (Figure 1).

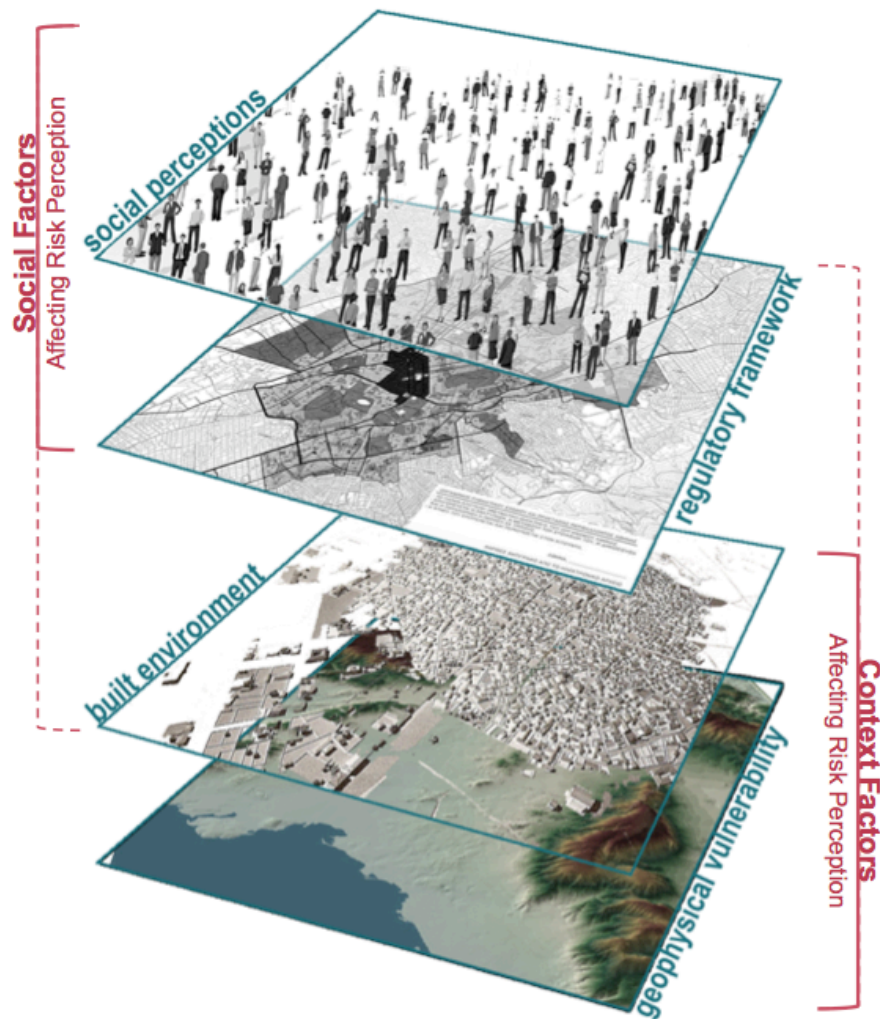


Figure 1: Multiple levels of vulnerability corresponding to the categorization of factors that influence risk perception.

A multi-risk approach to vulnerability: Spatial and social context of Santorini

Recent studies on risk assessment have changed focus from single hazard analysis to ‘all-hazards-at-a-place’ approaches (Hewitt & Burton, 1971; Cutter et al., 2003) taking into consideration ‘the totality of relevant hazards in a defined area’ (Kappes, 2011). The present study, adopts a qualitative multi-risk analysis which includes

different sources of natural and environmental hazards that threaten the insular setting of Santorini, composing its multi-vulnerable milieu (Birkmann et al., 2013; Nadim & Liu, 2013).

Natural hazards on Santorini

Santorini embodies an immense variety of different natural and environmental risks. Volcanic risk and volcano-induced hazards (e.g. volcanogenic earthquakes, tsunami, toxic gases, ash fall and ballistic ejecta), earthquakes and landslides characterize the island's morphology landscape and socioeconomic history. The Minoan eruption was the most devastating activity of Thera Volcanoes and it has been widely and extensively studied as one of the largest volcanic events in recorded history. The latest volcanic activity was recorded between 1925-1928, 1939-1941 and in 1950, including earthquakes, lava flows and ash fall. Research on volcanic risk assessment on Santorini points out the aforementioned hazards as possible future events, as well as landslides on the Caldera slopes, toxic gases, pyroclastic ejecta and tsunami waves that may affect the coastal regions on the north and east parts of the island. While volcanic activities are usually accompanied by 'warning' natural phenomena, abrupt seismic events result in distinct incidences. The most catastrophic event recorded in the modern history of Santorini, was the result of a devastating earthquake which occurred in Aegean sea, on July 1956. One quarter of existing building stock was destroyed completely, while entire areas had to be evacuated because of serious damages.

Emerging risks and aggravation of vulnerability

The unpredictable and all-encompassing hazardscape of Santorini, including earthquakes and volcanic eruptions that are accompanied by a multiplicity of secondary hazards, such as landslides and tsunamis, is aggravated by the prevailing socio-economic context. Over the last decades, new types of risks have emerged due to the new developmental trajectories, the related population flows (Figure 2) and the rapid growth of tourism industry. In turn, these rapidly increasing flows trigger new phenomena like building construction in highly vulnerable areas (Figure 3), degradation of built and natural environment, energy overconsumption, power failures and overuse of natural resources (insufficient water supply, loss of agricultural land). The overall multi-risk context grows in an insular setting with limited natural resources as well as limited and disjointed planning policy.

Risk status rapidly fluctuates between summer and winter periods on Santorini. By the end of tourism period, specific regions are abandoned, due to their exclusively touristic nature. Sometimes, elderly people remain in areas that are difficult to access. Traditional settlements are characterized by high density of built environment, very narrow streets, not accessible by emergency vehicles and lack of open spaces. In case of an emergency, built environment will be an 'unsafe' component of risk management and evacuation processes.

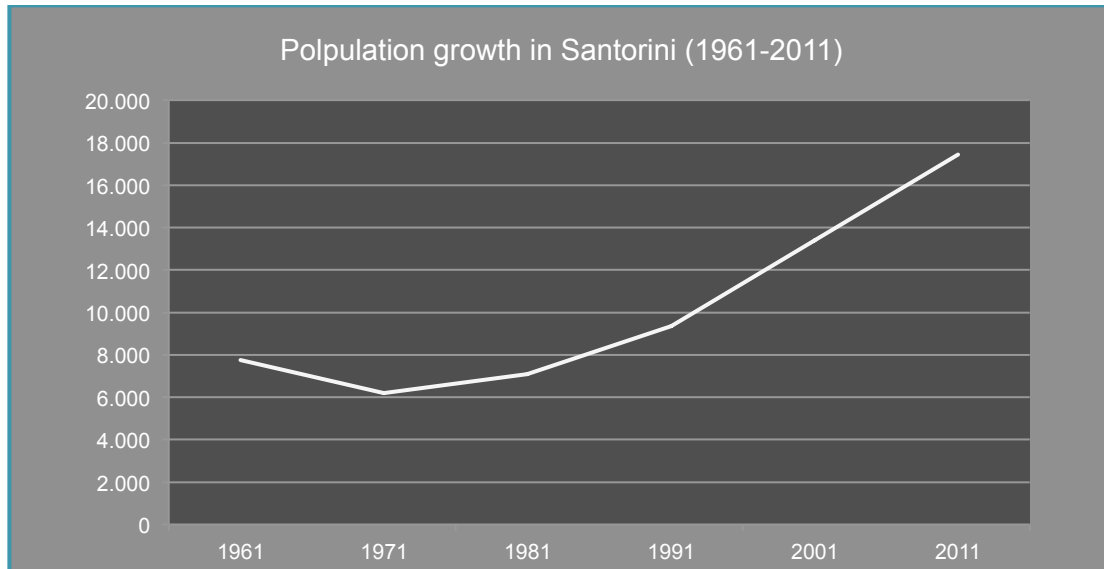


Figure 2: Population growth in Santorini from 1961 (period of reconstruction after the devastating earthquake in 1956) to 2011 (Data source: Hellenic Statistical Authority – EL.STAT)

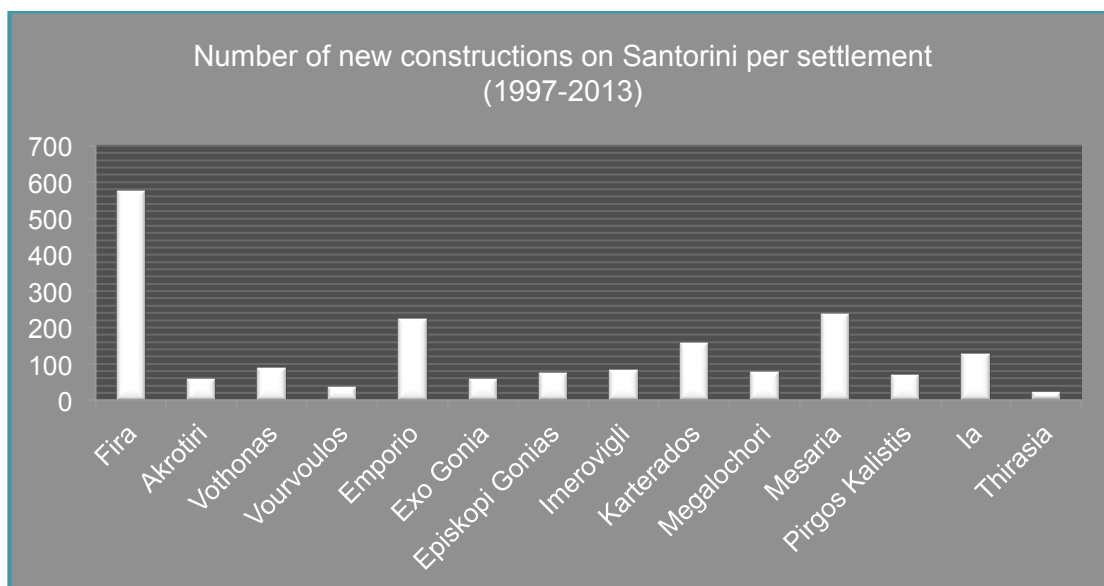


Figure 3: Spatial distribution of new buildings (1997-2013). The higher concentration is presented in one of the most vulnerable settlements of the island, the town of Fira.

However, the multiplication of the hazardous potential takes place during summer months, when the population of the island quadruples in size. The carrying capacity of the island, formed by its limited natural resources and infrastructure, is incompatible with the occurring tourism loads. Transportation network becomes overwhelmed, resulting in traffic jams and road accidents, while there is no safe environment for pedestrians inside or outside of the settlements. Although Caldera slopes present very high levels of physical vulnerability, due to its high landslide risk (Lekkas, 2009) and the high localized hazard zone of ballistic ejecta (Fritzas & Papadopoulos, 1988), they receive the major touristic load. Furthermore, high densities and numerous old constructions characterize built areas on Caldera.

Regulatory framework and planning practices

The aforementioned circumstances reveal a multi-vulnerable milieu, which is further aggravated by the lack of regulatory framework. There is no evacuation plan for the island, planning policies are disjointed between the different levels of spatial planning, and building regulations are not always applied. Indicative in this respect is the example of planning practices in the case of Caldera, as shaped by laws of zones determination for settlement control. In 1990, statutory framework permitted a number of land uses, such as residence, warehouses, port facilities and tanks, on the Caldera cliffs (FEK 139A/90). The result of settlement development in the aforementioned region was disappointing and rather dangerous, leading to a Ministerial Order, which temporarily suspended the building permits. Finally, in 2012, the amendment of the law that Determines Zones for Settlement Control (ZOE) prohibited any new construction on Caldera and permitted only authorized repair and restoration practices. In 1998, a planning consortium produced a regional plan for the island, but it was not approved, thus leaving Santorini without spatial planning and development trajectories until today.

In a similar way, safety measures and evacuation plans in case of an emergency do not exist for the insular setting under study. Legal framework for civil protection is formed only in compliance to the national framework, simply describing the responsibilities of the agents involved and the institutional activation in case of an emergency. The current pattern of spatial, social and economic development in Santorini doesn't seem to follow statutory guidelines, either because of the lack of associated legal framework or as a matter of socially entrenched delinquency. As a result, the urban sprawl is characterized by hazardous potential and increasing vulnerability, while natural resources and physical landscape are under serious threat. Demographic estimations and statistics of tourism aggravate the multi-risk setting of Santorini. The growth rate of tourism inflows is alarmingly high (Figure 4) and the predicted population of the island on August 2020 is about 128.000 (Ministry of Development, 2008), 7,5 times more than the current inhabitants. Sustainability is far from existing developmental trends of the island and it is constantly supplanted by increasing environmental risks.

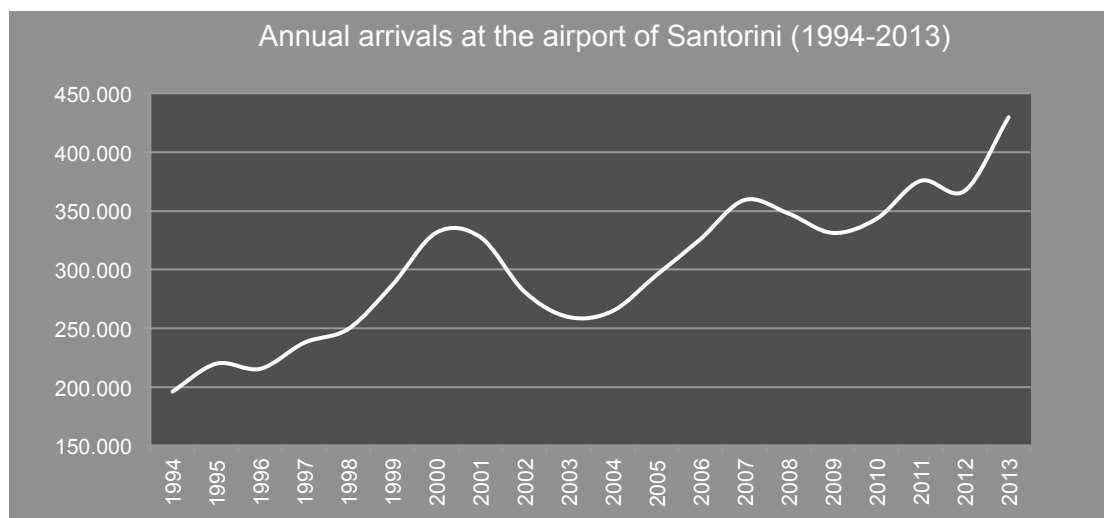


Figure 4: Growth of tourism loads: The arrivals at the airport of Santorini in 1994 were 196.154 and in 2013 were 429.827 (Data source: Santorini's Airport).

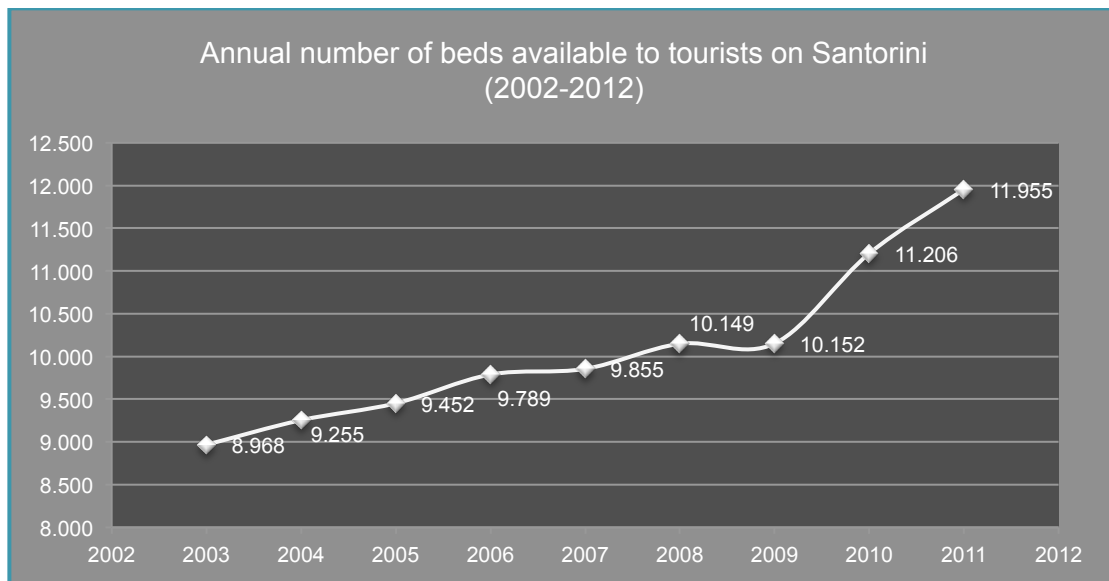


Figure 5: Growth of annual number of beds available to tourists from 2002 to 2012 (Data source: EL.STAT.)

Risk Perception Research in the multi-vulnerable milieu of the study area

The complex interplay of socio-economic features and spatial patterns of development in Santorini, as presented above, depicts a hazardous environment, which is not protected by regulatory frameworks and planning practices. This lack of safety measures reveals a lack of social awareness about the growing multi-risk context. Existing research, focusing on volcanic risk perceptions on Santorini, shows that although there is a satisfactory level of knowledge related to volcanic hazards, the general public and, more alarmingly, agents in authorities and public administration have no clear idea of emergency planning and risk management (Dominey-Howes & Minos-Minopoulos, 2004). Additionally, research findings on perceptions of tourism growth illuminate the perceived lack of effective planning and strategic policies able to guide development trajectories and reveal existing grievances about the failure of public sector to provide adequate support and necessary infrastructure (Lichrou et al., 2010).

Little work has been conducted on risk perception in multi-risk environments (Glatron & Beck, 2008), while there is a need for an integrative approach that brings together spatial and social factors of vulnerability. In this respect, the current study aims to expand existing knowledge by examining the intrusive role of physical vulnerability in risk perceptions among local population, institutions and businesses in Santorini. An integrative framework is developed including the recording of multi-risk factors of a vulnerable insular setting and the exploration of social perceptions regarding the recorded vulnerable elements. Furthermore, the crucial role of tourism as a driving force of social and spatial development is incorporated into the analysis. The influence of tourism on public awareness about the emerging multi-risk environment is explored, accordingly. To this end, the empirical study involves the distribution of

questionnaires to the local population, institutions and businesses in order to explore: (i) to what extent acute seasonal fluctuations of population flows affect Santorini's multi-vulnerable regime, (ii) whether the rapidly increasing tourism demands trigger developmental processes for the improvement of infrastructure, the establishment of safety measures and associated spatial planning policies, (iii) to what degree tourism as a socioeconomic factor interferes in social perceptions of risk and vulnerability. The overall aim of the research is to tackle the discrepancy between the scale of risks encountered in Santorini and the inversely proportional existing safety measures.

Instead of a conclusion

The presented integrative framework combines social and spatial components of risk and vulnerability, aiming to tackle the complexity of multidisciplinary approaches of risk perception and risk management. In the same context, further elaboration of the proposed approach may attempt to incorporate risk perception knowledge into participatory models of risk management and planning strategies. The better understanding of social composition of vulnerability and its spatial dimensions plays a pivotal role in developing effective measures of risk reduction and promoting protective action.

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