



Analysis of risk assessment factors of individuals in volcanic hazards: Review of the last decade

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ABSTRACT

During the history of mankind, natural disasters have had severe repercussions on the different ecosystems, with volcanic eruptions being a clear example of this. This review is responsible for gathering the most important volatile hazards assessment research of the last decade with the objective of knowing the state of the art in relation to the studies of people's risk perception and acceptance in communities threatened by the danger of volcanic eruptions. In addition, this study includes the analysis of several cases across different countries. The results that this research offers serve as a frame of reference to determine and understand how resilient a community affected by the volatile hazards can be, since they are able to identify the main incident factors of risk that affect the communities to different degrees according to the context at the time of making the risk judgment. On the other hand, through this review, it is proposed as a future research topic to understand the levels of risk acceptance of individuals, due to the fact that the studies related to this subject are scarce.

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1. Introduction

In the context of an individual's risk assessment or evaluation, two major decision-making groups are identified: risk perception and

acceptance (Wilde, 1982) The process of collecting, selecting and interpreting signals about uncertain events impacts refers to an individual's perception of risk (Wachinger et al., 2013). On the other hand, the long-term determinant is the acceptance of risk, which depends on the evaluation of costs and benefits of the different options that a person can take in the face of a risk (Wilde, 1982).

In the case of natural disasters, the research related to them is very extensive. However, most assessments or risk analyzes have been

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focused on disasters such as earthquakes or tsunamis, leaving aside a type of events that has even more serious consequences than those previously mentioned; the volcanic eruptions. An example of how devastating an eruptive event can be is that of the Krakatoa volcano in 1883, which killed approximately 36,000 people (Shaw, 1905). For these reasons, the traditional approach to risk management of a volcano at rest consists basically of two key operations: first, the evaluation of the type and size of a possible eruption in the event of a volcano reactivation and; second, the development and maintenance of an efficient monitoring system (Barberi et al., 2008). This leads to the participation both of authorities and entities responsible for risk management and of the inhabitants themselves who are exposed to a volcanic hazard.

This research aims to analyze which are the main factors studied in the existing literature that affect individual's risk assessment and which of them influence a possible evacuation decision in case of a volcanic hazard. Many studies have not paid attention on the identification of factors according to the social and cultural context of a population. For this reason, various cases from different countries will be analyzed. Carrying out this kind of identification of factors and patterns that encourage people's behavior can help in future research to determine the interrelationship of influential variables in order to understand methodically the decision-making of individuals.

Slovic et al. (1977), identifies two related aspects in Behavioral Decision Theory: normative and descriptive. The regulations involve the provision of courses of action that conform closely to the beliefs and values of decision makers. The purpose of the descriptive approach is to represent these beliefs and values, and the way in which individuals incorporate them in their decisions. Finally, and in simple words, by understanding the elements involved in decision-making in the face of high-risk natural events, it would be possible to mitigate risk in future scenarios, thus minimizing significant associated losses; However, many factors influence the perception and acceptance of risk and many models fail to explain it, making it difficult to understand the phenomenon (Sjöberg, 2000).

2. Methodology

This literature review contains scientific papers that aim to analyze the risk assessments of individuals exposed or affected by volcanic eruptions. These articles have the characteristic of being studies coming from different parts of the world, but belonging to the last decade, the latter being the main restriction in the selection of these. The condition of considering studies from different parts of the world is mainly due to the fact that the social and cultural contexts in which people develop in the face of natural disasters in general are completely different, especially when compared at different times. An example of this is the need for and accessibility to reliable sources of information at the time of a given natural disaster, or the different rates of delinquency in each sector, making the decision-making process directly influenced by this type of components. In addition, it is important to mention that this review includes studies of different disciplines, focusing mainly on those whose main objective is to determine and/or analyze the most relevant factors in the perception and acceptance of individuals' risk in the face of volcanic hazards. Then, it is hoped that we should properly define a frame of reference for later studies with the objective of determining how resilient a community that lives in danger of being affected by a volcanic eruption can be.

The criterion for reviewing the articles was based mainly on an individual and pragmatic analysis, where the abstract of each article was analyzed and an exhaustive review of citations and references were reviewed. To achieve this, the databases reviewed were Science Direct (<http://www.sciencedirect.com/science>) and Mendeley (<http://www.mendeley.com/research-papers/>), because of the quantity and quality

of items they have. The search for these was made in relation to the following combinations of keywords:

- ✓ First, we considered the natural disaster under study through the words “volcanic”, “volcano” and “volcanic eruption”.
- ✓ Second, the above words were combined independently with “risk perception” (search 1), “risk acceptance” (search 2), “risk management” (search 3), “risk assessment” (search 4), “risk governance” (search 5).

The total results obtained in the two databases were approximately 840 articles (see Table 1). It is possible to notice that the words “Risk Governance” and “Risk Acceptance” had a small amount of results (except the first one that in some cases obtained results).

It is important to note that in the Science Direct database, an advanced search was performed considering only the keywords of the articles (that is why it is the database that found the least results); On the other hand, the search in Mendeley's database considered citations and references, but it did not offer the option to search for articles within a specific date (hence the high number of results). Because Science Direct offered a more personalized search than Mendeley, emphasis was placed on the first one for selecting the articles. In addition, it is important to note that studies prior to the last decade (main restriction in the search for articles) that are considered relevant in the discipline of risk assessment were included in this review because of the number of times they were cited in Slovic (1987) and Slovic et al. (1980) who proposed interesting points of view on the risk perception of individuals.

In order to limit the number of articles found, the following criteria were considered: first, priority was given to the documents collected from Science Direct, since it considered only the keywords; second, those articles that were found in both databases were considered; third, the selected articles were those that focused the research on at least one risk factor to be analyzed; and fourth, the final choice of articles was based on their impact.

In order to analyze the impact of each article, 3 metrics of their respective journals were considered: CiteScore (average citations received per document in the journal), SJR (weighted quotes received in the journal) and SNIP (actual citations received in relation to the expected dates). For the CiteScore indicator, a minimum of 2 citations received on average was required; for SJR a minimum of 1 weighted

Table 1
Results according to word combinations for each database.

Search	First word	Second word	Science direct results	Mendeley results
1	Volcanic	Risk perception	11	57
2	Volcanic	Risk acceptance	0	0
3	Volcanic	Risk management	12	171
4	Volcanic	Risk assessment	12	295
5	Volcanic	Risk governance	1	10
6	Volcano	Risk perception	3	31
7	Volcano	Risk acceptance	0	0
8	Volcano	Risk management	8	66
9	Volcano	Risk assessment	3	110
10	Volcano	Risk governance	0	1
11	Volcanic eruption	Risk perception	0	1
12	Volcanic eruption	Risk acceptance	0	0
13	Volcanic eruption	Risk management	0	22
14	Volcanic eruption	Risk assessment	4	10
15	Volcanic eruption	Risk governance	3	3
	Total		94	786

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