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Stakeholders' Perceptions of Seismic Risk and Adaptive Capacity to Earthquake: The Case of Anse-à-Veau (Haiti)

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Abstract

Earthquakes were responsible for more than half of all natural disaster deaths worldwide between 2000 and 2019. Populations in developing countries are the most affected. What can help stakeholders to increase people adaptive capacity to earthquake in a context of very limited financial resources? The perception of seismic risk by the stakeholders and the perception of their adaptive capacity seemed to be able to influence the stakeholder's adaptive capacity to earthquakes as well as that of the population. Haiti, a country at risk of earthquakes and ranked among the poorest in the world, is a relevant place to explore the potential people adaptive capacity to earthquake. In 2020, qualitative methods through face-to-face interviews were conducted with 21 stakeholders in the town of Anse-à-Veau. This paper, therefore, focuses on exploring their perceptions of risk and adaptive capacity, just one year before an earthquake in the region. The results show that stakeholders were mostly aware of earthquake risk. This was identified by their perception of seismic risk related to the zone and the

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perception of their adaptative capacity to deal with earthquakes. Respondents perceived that some drivers such as self-capacity, motivation, and self-responsibility can increase their adaptive capacity. Some temporal and physical factors have been highlighted as constraints to stakeholders' adaptive capacity to earthquake. As expected, training, awareness, and appropriate constructions were identified as effective ways to increase the adaptive capacity of stakeholders and that of the local populations to earthquakes. Currently, earthquake unpredictability was seen as a barrier of preparedness. However, some respondents perceived unpredictability as a factor of motivation for earthquake preparedness. Thus, this observation must be examined to find the way that unpredictability can facilitate stakeholders' adaptive capacity to earthquake or not. Human resources are targeted as the main resource to cope with an earthquake. Also, training and awareness were recognized as means to increase the adaptive capacity of stakeholders and that of the local populations to deal with such an event, despite the limited financial resources.

Keywords: Risk perception, adaptive capacity, earthquake, qualitative method, Haiti

Introduction

Over the past two decades, more than four billion people have been affected by natural disasters worldwide with approximately 1.2 million deaths. Among the 10 deadliest disasters in the world, the earthquakes associated with tsunamis caused 58% of deaths during 2000-2019 (UNDRR, 2019). The 2004 Indian Ocean earthquake and tsunami (226,408 deaths) and the 2010 Haiti earthquake (220,000 deaths) significantly increased the number of deaths from these hazards during this period (IFR & RCS, 2012). Death toll in developing countries as a result of natural hazards is high, which is due to poverty, inadequate resources, and other factors including place, age, gender, community structure, and political issues (Ncube, Mangwaya, & Ogundeji, 2018).

Low income is often identified as an important driver which limits people's ability to cope with natural disasters (Borderon & Oliveau, 2016). Thus, this results to the death of more vulnerable and resourceless people (Yohe & Tol, 2002). This is evident for all vulnerable people, especially in developing countries, and seems to place these people in a state of fatality, where the increase in their income appears to be the sole condition to reduce their vulnerability. However, it is possible to put the weight of income into perspective by considering the resources available to the population to adapt to an earthquake. A study conducted in Utah (USA) showed that income is not considered as a key determinant to adapt to earthquake (Nicoll & Cova, 2016).

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A comparative study in Seattle (USA), Osaka (Japan), and Izmir (Turkey) showed that people preferred the least costly adaptation measures (knowing the location of nearby medical emergency centers, having a first aid kit, and having a 4-day supply of dehydrated or canned food) in the face of earthquake (Lindell & Perry, 2000; Solberg, Rossetto, & Joffe, 2010). Also, another study conducted in Germany and Zimbabwe compared economic resources and perceived adaptive capacity at the household level. The study demonstrated that past experiences, perceived risk of future impacts, and perceived adaptive capacity are likely to be more important determinants of adaptation than economic resources (Grothmann & Patt, 2005).

These studies appear to support the humanities and social sciences perspective that implementing adaptation measures can reduce vulnerability and improve personal safety (Nicoll & Cova, 2016). A social approach to risk management (bottom-up), based on participatory management that values local knowledge, may be less costly and more effective in reducing risk at the community level (Bétard & Fort, 2014). Gaillard mentioned many cases (Australia, New Zealand, and the Philippines) where people used their passive prevention skills to avoid negative impacts on their lives and livelihoods (Gaillard, Cadag, & Rampengan, 2019). However, such an approach requires a prior good knowledge of the population's risk behavior in their area.

Within a society where citizens protection is not a priority, the inhabitants are generally poor and the culture of risk is absent. It is therefore important to find a way to help people prepare for uncertainty. This study was conducted in the city of Anse-à-Veau (Haiti), an earthquake-prone area, and it aimed to evaluate stakeholders' perception on seismic risks and their adaptive capacity to earthquake.

1.1. Stakeholders' Perception of Seismic Risk

The perception of stakeholders seems important to be studied to determine their capacity to act for their protection because human beings can exacerbate or reduce risk depending on how they perceive it (Deng et al., 2019). Stakeholder is defined as *"any group or individual that can be influenced by, or can itself influence, the activities of the organization"* (Gray, Owen, and Adams cited by Friedman and Miles (2006, p.9)). The perception of risk varies based on people's level of education and experience (Lopez-Ramirez et al., 2019). A study of earthquake risk perception conducted in the United States of America, Italy, and Turkey showed that people with higher levels of education as well as those who already have experienced an earthquake have a better perception of risk (Joffe et al., 2013).

A review of the literature on household adaptation to earthquakes involving 23 studies, 20 of which were conducted in California, found that there is generally, but not always, a significant correlation between risk

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perception and seismic hazard adaptation measures (Lindell & Perry, 2000). This means that people who have a high level of risk perception are more likely to implement adaptation measures. Negative correlations were found between earthquake perception and likelihood, potential damage, and predictability in the implementation of seismic hazard adjustments on the other hand (Joffe et al., 2013).

Renn (1990) used four elements considered to be intuitive biases in risk perception. The first element is "availability", i.e., events that come immediately to people's minds are considered more likely than those that take longer to come to memory. The second is the "anchoring effect", whereby the probabilities of an event are adjusted according to the information available or the perceived importance of that information. The easier it is to imagine a disaster or another negative effect, the more likely people are to perceive it. The third element is "representativeness", which shows that unique, personally experienced events are considered more important than frequency-based information. The fourth element is "cognitive dissonance": information that challenges perceived probabilities already embedded in a belief system will either be ignored or minimized (Renn, 1990).

Furthermore, authors have argued that risk perception is shaped by experience, optimism, and demographic factors, including gender and age (Solberg, Rossetto, & Joffe, 2010). Lindell and Perry (2000) spoke about personal consequences, including death, injury, loss of property, work interference, and social dysfunction (Lindell & Perry, 2000).

Many studies showed that some factors such as education, experience, and psychological aspects contribute to influence risk perception by stakeholders. In the next section, stakeholders 'perception of adaptive capacity' will be reviewed to understand their strategy to deal with an event.

1.2. Stakeholders' Perception of Adaptive Capacity

In addition to the stakeholders' perception of risk, it is important to explore how actors perceive their capacity to adapt to earthquakes. *"The adaptive capacity of a human system represents the potential of the system to reduce its social vulnerability and thus minimize the risk associated with a given hazard"* (Brooks, 2003). In reference to earthquake risk, adaptive capacity can be defined as the ability of people to prepare for, cope with, and recover from an earthquake. Adaptive capacity affects vulnerability by reducing sensitivity (Engle, 2011). Even if a hazard level is constant over time, adaptation will allow a system to reduce the risk associated with this hazard by reducing its social vulnerability (Brooks, 2003). As explained by Morin (2008), exposure represents the situation whereby a potential hazard and the exposed elements are brought into relationship in a given environment. Nonetheless, sensitivity is seen as the susceptibility that an exposed element,

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

community or organization will be affected by the manifestation of a hazard (Morin, 2008, p.10). It is important to note that sensitivity can be seen as the equivalent of social vulnerability when it concerns a human system (Brooks, 2003). To reduce the human vulnerability to earthquakes, it is thus important to increase their adaptive capacity by reducing their susceptibility and their exposure if possible (Martins & Gasalla, 2020).

Regarding earthquakes, it is impossible to act on the hazard related to the exposure. However, human actions may affect susceptibility. Reducing the susceptibility of houses by strengthening structures can be costly and is often beyond most individuals' or even the government's financial capacity in developing countries (Shapira, Aharonson-Daniel, & Bar-Dayan, 2018). When financial resources are limited, enhancing the adaptive capacity in order to promote adaptative behavior may be a real way to reduce the peoples` susceptibility (Thomas & Gagnon, 2019). Less costly adaptation measures are already promising in reducing earthquake damage in the United States (Lindell, Arlikatti, & Prater, 2009).

Stakeholders' perception of their adaptive capacity can play a crucial role in expecting actions to reduce their vulnerability to earthquakes. Perceived adaptive capacity is related to what actors think they can do, while motivation is related to what the actors want to do to cope with a situation (Grothmann & Patt, 2005). Three subcomponents of perceived adaptive capacity can be identified: perceived adaptation efficacy, perceived self-efficacy, and perceived adaptation costs (Grothmann & Patt, 2005). Other factors such as education (Lopez-Ramirez et al., 2019), motivation (Bandura, 1982), drivers, barriers such as denial, fatalism, or delusional optimism (Joffe et al., 2013), and personal responsibility (Mulilis & Lippa, 1990) seem important to consider in understanding stakeholders' perceptions of their coping skills.

1.3. Research Questions

The objective of this paper focuses on exploring how stakeholders' perception of seismic risk and adaptive capacity can influence their own adaptive capacity and that of the local populations towards earthquakes. The conceptual framework (Figure 1) simulates two situations: 1) The initial situation shows a population with high vulnerability to earthquakes, as the product of its exposure, its susceptibility, and its adaptive capacity; (2) The expected situation simulates a reduced vulnerability, as the product of a constant exposure, and reduced susceptibility through increased adaptive capacity.

Three research questions have been identified. The first question (Q1) aims to target the stakeholders seismic risk perception, the second question (Q2) addresses stakeholders' adaptive capacity perception, and the third

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

question (Q3) focuses on exploring the ways and means that the seismic risk and adaptive capacity by stakeholders may influence people adaptive capacity to earthquake.

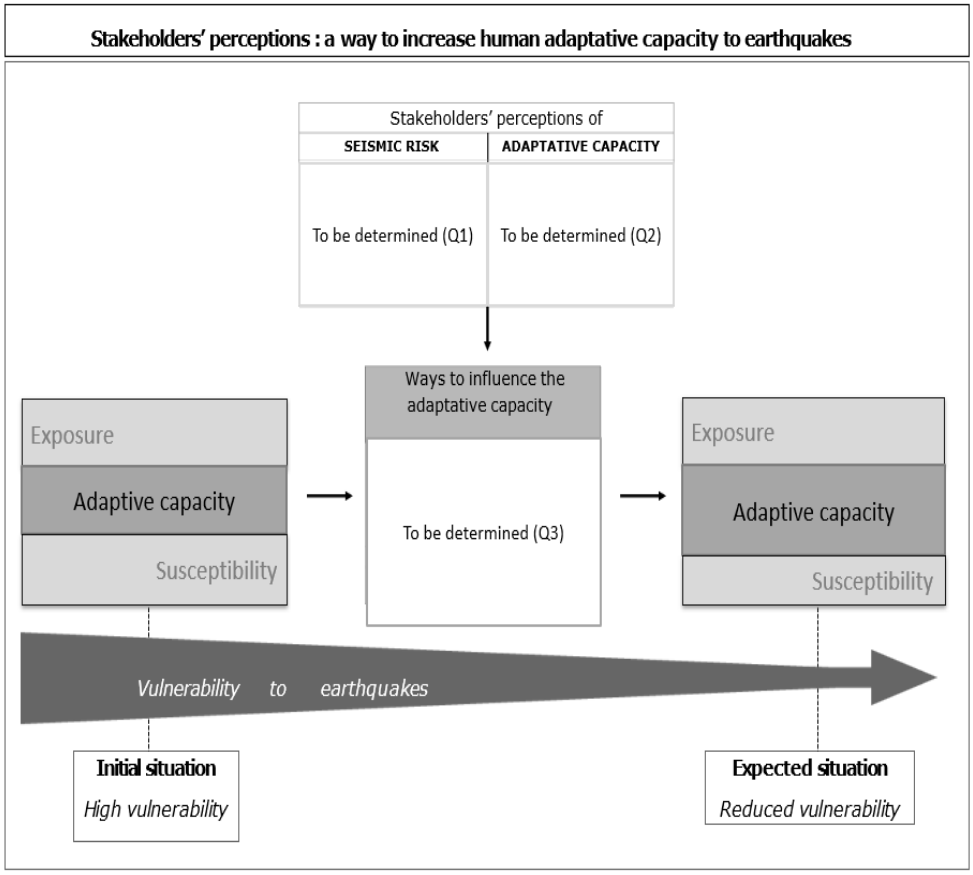

Figure 1. Stakeholders' perception of risk and adaptive capacity to earthquakes (not filled in)

2. Study Area

Haiti: A Relevant Case Study for Estimating Earthquake People Adaptive Capacity

Haiti is a Greater Antilles country among the Caribbean islands, of more than 10 million inhabitants, living in an area of 27,000 km² (IHSI, 2015). The country is subject to seismic risk because it is located on the Caribbean plate with two main faults: the Enriquillo-Planten-Garden and the Septentrional. The high population density, poor quality of construction, political instability, and poverty make the population vulnerable to a range of natural and man-made hazards. The 2010 earthquake of 7.0 magnitude, which killed 220,000 people, is evidence of the country's high level of vulnerability (PDNA-Haiti, 2010).

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

The town of Anse-à-Veau is located 125 kilometers from the capital Port-au-Prince. It is a coastal town, bathed by the Gulf of Gonâve (Figure 2). This municipality in the department of Nippes was chosen as the study area because of its history of earthquakes and recently recorded tremors. Lately, Anse-à-Veau has benefited from some interventions on seismic risk, notably by an American organization called Geohazard International, and from seismic monitoring by the technical seismology unit of the *Bureau des Mines et de l'Energie* (Mining and Energy Office) of Haiti.

Demographically, the municipality of Anse-à-Veau has a population of about 35,000 people concentrated in an area of approximately a hundred square kilometers. Our study area focuses on the center of the town which counts more than 4,000 inhabitants distributed in 1,160 households over an area of 1.34 km^2 (IHSI, 2015).

Tectonically, the Enriquillo-Plantain-Garden Fault zone (EPGF), which cuts across the entire southern peninsula, crosses the municipality of Anse-à-Veau. The main fault caused major earthquakes in 1860 and 1952 (USGS, 2012), while the most recent earthquakes in 2010 and 2021 occurred on associated faults.

This study focuses on the Town Center Anse-à-Veau which is geomorphologically divided into two main parts: Basse-Ville (Lower Town) and Haute-Ville (Upper Town). The lower part is the historic town built on the seashore at the mouth of the Usine River. This part is made up of alluvial soils that can experience increased accelerations during an earthquake. The Haute-Ville is largely located on bedrock, which makes it more resistant to earthquakes.

Culturally, the belief in God is dominant in the town of Anse-à-Veau. Christianity is present through the Catholic Church and various denominations of Protestantism such as Baptists, Adventists, Pentecostals, and Jehovah's Witnesses. No Vodou temple was found in the Center of the Town. Therefore, belief can be seen as an element that influences the perception of risk and the ability to cope with it (ISDR, 2008).

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

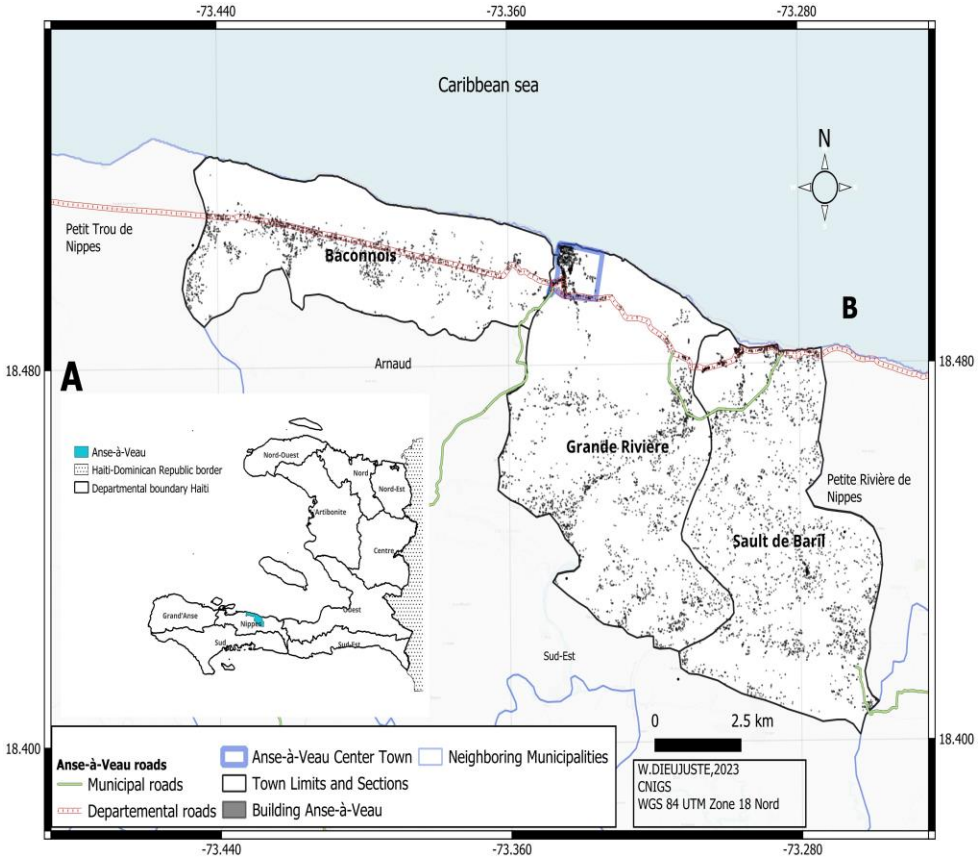

Figure 2. A) Map of Haiti B) Map of Anse-à-Veau

3. Data and Method

This study focuses on employed qualitative methods, including semi-structure interviews and direct observation to collect data. This method was adopted due to the sensitivity of the topic and the scope of the study. Land-related and disaster matters are very sensitive and must be addressed with care, professionalism, and discretion (Abdul-Kareem, Gnansounou, & Adongo, 2021).

A total of 21 stakeholders were investigated in the study area with an open-ended questionnaire of 16 questions. Stakeholders are individuals who are concerned by seismic risk in the town of Anse-à-Veau. They included the Departmental Coordination of Civil Protection of Nippes, the municipality, Red Cross of Anse-à-Veau, Geohazard, and Women's Organization. Hence, they were chosen for the interviews because of the role they play in risk reduction in the municipality. Other dominant stakeholders, such as school principals, religious leaders, radio directors, hospital management staff, hotel owner and manager, and police station chief were also interviewed (Table 1). This is due to their potential to influence people's ability to prepare for

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

earthquakes, starting with their own capacity. The function of the stakeholders, and actual or potential influence were the main criteria of the interviewees' selection. Thus, this section includes the interviewing process, interviewee characteristics, interview guide, and discourse analysis.

3.1. The Interviewing Process

Participants were contacted through phone calls, and most of them readily agreed to take part in the interviews. Data were collected during three phases in 2020 (19-22/08, 6-9/10, 15-21/11) in Anse-à-Veau, a city which have experienced many earthquake events in Haiti, including the one of 2010. The city was also shacked by the earthquake of August 2021, which occurred just after our data collection. Although the interview guide was bilingual (French and Creole), the interviews were conducted in Creole to allow informants to share their views on the subject without any language constraints. The informants' quotations have been translated from Creole to English for the purpose of this paper.

To safeguard the data, all interviewees voluntarily agreed to be recorded. All participants were interviewed on site, except for the Nippes departmental civil protection coordinator, who was interviewed in his office at Miragoâne. For each participant, a form with their profile, contact information, and the date interview date, place, and time was recorded.

3.2. The Interview Guide

Data collected encompassed four main themes of the interview guide: (i) perception of risk, (ii) perception of stakeholders' adaptive capacity to earthquakes, (iii) existing and mobilizable resources, and (iv) protective actions to be undertaken.

Stakeholders' perception of seismic risk was explored through five questions. They include the *likelihood of seismic risk, mental associations related to earthquakes, the perceived consequences of an earthquake, the town's level of exposure, and stakeholders' sources of information.*

Stakeholders' perceptions of their adaptive capacity were explored through seven questions, including *personal and family capacity, motivation, barriers, facilitators, responsibility, and effectiveness of earthquake preparedness.*

Resources mobilization was addressed by questions that sought to determine *the resources that stakeholders or even households can rely on to undertake actions to increase the capacity of populations to cope with earthquakes.*

Perceived protective actions were evaluated taking into account questions related to the increase *of stakeholders' adaptive capacity and*

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

thereby reducing their own and the local population's sensitivity to earthquakes.

3.3. Discourse Analysis

Thematic analysis was used to identify recurrences, groupings, and contradictions in all the responses obtained (Paillé & MucchiellI, 2008). The analysis of the discourse is based on the manifest content, i.e., what the respondents said explicitly (Henry et al., 2022). The different respondents' answers were coded by their relevance related to the research questions. The main trends emerging from the coded data were selected in each theme or subthemes by their recurrence. In addition, some quotations were selected to illustrate some main trends of the study.

4. Results

This section presents the stakeholders' characteristics (Table 1), stakeholders' seismic risk perception, the stakeholder's perception of their adaptive capacity, and the stakeholders' perceived ways (resources and actions) to influence their adaptive capacity, as well as that of the local populations, to earthquakes.

4.1 Stakeholders' Characteristics

Stakeholders interviewed people with professional, educational, religious, economic, and politic functions or activities in their field. The following attributes were considered to characterize them: education level, gender, age, occupation, place of birth, place and years of their residence, and function (Table 1). Most of the stakeholders were male (18/21) and only one had left the school at primary level. The 40-49 and 50-59 age groups are best represented among all respondents. Two-thirds of stakeholders were born in the town and have lived there for more than 25 years, giving them a sense of attachment to the place. Furthermore, nearly two-thirds of the interviewees reside in the Haute-Ville (Table 1).

Table 1. Profile of interviewed stakeholders (Survey conducted by the first author et al., 2020)

Variables	**Numbers**	**Variables**	**Numbers**
Education	**21**	**Gender**	**21**
University	20	Men	18
Primary	1	Women	3
Age	**21**	**Profession**	**21**
30-39	3	Teachers	7
40-49	7	Lawyers	5
50-59	8	Accountants	3
60-69	2	Administrators	2
70-79	1	Other	4
Place of birth	**21**	**Residence**	**21**

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Anse-à-Veau	14	Haute-Ville	13
L'Asile	3	Basse-Ville	6
Cayes	2	Other	2
Port-au-Prince	1		
Paillant	1		
Function	**21**	**Years of the residence**	**21**
School Principals	4	Less than 6	4
Risk actors	4	Between 6 and 25	3
Religious leaders	4	More than 25	14
Radio Directors	2		
Hospital Director	1		
Director of the municipality	1		
Police Station Chief	1		
Owner of the Hotel	1		
Hotel Manager	1		
President of the association	1		
Technical coordinator of the departmental risk disaster	1		

4.2. Perception of Seismic Risk by Stakeholders

Results concerning the perception of seismic risk are related to five sub-themes, which include the perception of earthquake likelihood, mental associations related to earthquakes, perceived consequences, exposure of the town, and the stakeholders' source of information about earthquakes (Figure 3, Q1).

4.2.1. Perception of Future Earthquake

Stakeholders unanimously acknowledged that a new earthquake could strike the town of Anse-à-Veau at any time (all responses were received long before the 2021 earthquake). The three reasons evoked for this likelihood were: historical seismicity, recent tremors, and the existence of faults. Many participants further talked about tremors in the town in recent years. To justify his response, one participant said: *"But when you do the history, you know that there was an earthquake in 1952 that devastated Anse-à-Veau and, in 2015, there were several small earthquakes of which about 37 hit the town"* (Actor of risk, 30-39 years old, Translated from Creole).

For others, the presence of faults that cross the municipality increases the likelihood of the occurrence of earthquakes in Anse-à-Veau. Thus, one participant stated, *"We have a lot of faults, on the Miragoâne side when you take the Haute-Ville, it is the whole fault, since it is a fault site, you are subject to an earthquake, and it is going to hit"* (School Principal, 50-59 years old, Translated from Creole). This response gave an idea about the interviewee's knowledge of the earthquake cause and emphasized the imminence of an earthquake due to the presence of faults in the area.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

4.2.2. Mental Associations Related to Earthquake

Stakeholders were asked about the images associated with earthquakes. Two main trends emerged. On the one hand, most stakeholders emphasized the negative catastrophic aspects. The words mentioned were: "*natural disaster, destruction of houses, damage, disasters, material losses, loss of human life, even the destruction of the area by a tsunami"*. On the other hand, positive associations were related to protective measures. The terms used were : *taking shelter, do not leave the house, get out of the house if possible, do not cross the street, and warn the population.* However, it should be noted that the second tendency was much less dispersed among the stakeholders.

4.2.3. Perceived Consequences of an Earthquake

Participants' responses to the possible consequences of an earthquake in Anse-à-Veau can be grouped into four categories of consequences: (1) Human consequences referred to the loss of human life for almost all respondents. The expression *moun ka mouri (risk of death)* was often used in the interviews; (2) Material consequences related to houses' collapse. Recurring terms were: *dega (damage), katastwòf (disaster);* (3) Environment consequences could be *landslides, and problems with springs, and even animal deaths*; (4) Finally, psychological consequences were phrased as follows: *the earthquake can cause trauma for people who have lost loved ones.* Non-standard construction and lack of earthquake-resistant standards were mentioned to increase the fragility of the Basse-Ville. Concrete slab houses were cited as an element that can significantly increase earthquake damage.

4.2.4. The Town's Exposure

Most stakeholders agreed that the Basse-Ville (Lower Town) is mostly prone to earthquake. They reported several reasons for this high exposure, such as its proximity to the sea leading to the risk of tsunami, the loose nature of the soil, the shallow water table, and anarchic constructions. Some stakeholders believed that the Basse-Ville can be destroyed by a tsunami following an earthquake. Only a minority of interviewees considered the Haute-Ville (Upper Town) to be more exposed. These people mentioned landslides and solid constructions (masonry, concrete slab) that do not always respect standards, as well as old and sensitive buildings, such as the catholic church, the high school, and the prison. Some stakeholders declared that the whole town is exposed to earthquakes. To illustrate the situation of the Haute-Ville and the Basse-Ville, one participant reported an opinion commonly shared by most of respondents, stating: *"the upper area of the town is less exposed than the lower part, like here, because this part [Haute-Ville] lies on a large rock. In the lower part of the town, even when a big truck passes by,*

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

houses shake" (Civil protection member, 40-49 years old, Translated from Creole).

4.2.5. Sources of Information

Stakeholders highlighted risk training via workshops organized by Geohazard and Civil protection to raise awareness of the population about earthquakes. This form of training and radio emerged as stakeholders' primary sources of information. Television, school, and social networks were cited as less frequently used sources of information. The internet, books, newsletters, telephone, experience, grandparents, and church were considered a marginal source of information about earthquakes. Additional comments suggested that they have a clear perception and awareness of the seismic threat to the town. The perceived human and material consequences will probably depend on the exposure of each part of the town. After seismic risk perception, the stakeholders' adaptive capacity perception needs to be explored.

4.3. Stakeholders' Perception of their Adaptive Capacity to Earthquake

To determine the stakeholders' perception of their adaptive capacity, six topics (institutional capacity, individual and family capacity, sources of motivation, barriers to preparedness, facilitating factors, and responsibility) were explored (Figure 3, Q2).

4.3.1. Institutional Capacity

Stakeholders mentioned training, awareness, information, prevention, education, and precaution, in order of recurrence to show the way that institutions can involve in earthquake risk reduction. All these terms are closely related to training and risk education, as tools for preparedness. Most stakeholders believed they can support the people by training them via their institutions (Red Cross, schools, churches, and hotels) to be prepared for earthquakes. Half of the religious leaders denied any responsibility by assigning it to the government, which they regard as having the necessary resources. Nevertheless, they acknowledged their responsibility to secure their own homes.

4.3.2. Personal and Family Capacity

In terms of survival skills when an earthquake occurs, the most recurring item for self-capacity was to *"protect yourself in a safe place in the house".* The first perceived actions included things they can do indoors such as: "*get under a solid table or desk", and "stay under a lintel, under the beams, or in a corner".* The second set of expressions that appeared most often was related to the right state of mind such as *"pa fè tèt cho" (stay calm)*. It is

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

also important to have a good attitude such as: "*not to hurry without watching for falling objects", "do not jump downstairs if you are on the second floor",* and *"do not take the stairs".* The third phrase evoked was to "*get out of the house, if possible",* which is considered a possible way to protect oneself after the first tremor. The fourth phrase was *"build stronger".* A quarter of the respondents recognized the importance of building houses that can withstand earthquakes.

In terms of family adaptive capacity, most respondents answered that training their family members on how to behave before, during, and after an earthquake is an effective way of family protection. Other responses expressed the inability to take precautionary measures. Some expressions such as "*only God has the answer*", "*I do not* know", *and* "*construction is so uncontrolled*" showed the impossibility of respondents to act to protect themselves and their households from earthquakes. As a synthesis, participants' responses can be classified into one of the three stages of adaptive capacity which are anticipation, coping, and recovery (Table 2)

Table 2. Summary of perception actions among stakeholders, Jourdan 2023

Capacity to		
Anticipate (before)	**Coping with (during)**	**Recover (after)**
Training/ simulation	Keeping calm	Solidarity
Education	Stay in a safe place	Psycho-sociological support
Preparation	Do not panic	Temporary shelter
Awareness	Do not run without control	
Information	Open space	
Precaution	Saving lives	
Prevention	Do not take the stairs	
Building safe homes	Get out of the house if possible	

4.3.3. Motivation for Preparation

According to stakeholders, three main reasons could explain their motivation to deal with earthquake. They include the protection of human life, the consequences of an earthquake, and its characteristics. The first source of motivation refers to survival, and it includes the love of life, its protection, and consequently, avoiding the loss of human life. One respondent expressed the priority of staying alive very well, as the source of his motivation to prepare: "*The first thing is your life, you will have to be saved with others, this could also be the source of my motivation to prepare for an earthquake*" *(Organization member, 40-49 years old, Translated from creole).* Secondly, the consequences of earthquakes are an important source of motivation. Many interviewees emphasized the drama of earthquakes, such as "*the brutal deaths, the problems of the survivors, and the suffering*". In this regard, one interviewee stated, "*when you look at the number of dead people, it is not nice,*

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

it is not nice. When you count the dead. When you look at the collapsed houses. When you count the dead, you see the efforts to get people out of the rubble. It deserves to be prepared" (Assistant Principal of School, 50-59 years old, Translated from Creole). The third source focused on the characteristics of an earthquake such as unpredictability and imminence. To justify the unpredictability, one participant said: "*The earthquake is like we are waiting for the return of Jesus Christ, we do not know when it will happen or when it will not happen*" *(Actor of radio, 50-59 years old)*. However, all these reasons motivated stakeholders to act to protect themselves and their families.

4.3.4. Constraints to Earthquake Preparedness

The constraints identified by the participants to protect themselves can be categorized into four points. Firstly, spatial-temporal constraints refer to people location when the earthquake occurs, and its unpredictability. For example, if an earthquake occurs at night while people are sleeping or inside a sensitive-house, their reaction time may be considerably longer as well their ability to protect themselves may be greatly reduced despite good knowledge of saving-life techniques. Secondly, physical constraint concerns people with illnesses or disabilities that prevent them from protecting themselves during an earthquake. Thirdly, inappropriate behavior is considered a psychological limitation reported by a minority of participants who referred to dispositions such as "*low morale"*, "*rebellion*", "*negligence*", "*personal problems*", *or* "*reluctance to leave a cherished item*" that could be an obstacle to their protection. Lastly, financial constraint was reported by many stakeholders as a limiting factor in the construction of earthquake-resistant homes. However, only two interviewees did not see any difficulties in protecting themselves if an earthquake occurs.

4.3.5. Factors Facilitating Preparation

The interviews highlighted some factors that facilitate earthquake preparedness. Firstly, physical factors related to earthquake-resistant construction, appropriate construction, and lightweight construction were targeted to be important for safe construction. Aligning with this, one participant said: "*I would live in air-conditioned containers if I had more money*". But he insisted it was more important to him "*to have a house that does not serve as a tomb in case of an earthquake*". The second factor is risk education (awareness) expressed as "*training*" and *"information*" in equal parts by the stakeholders. It concerns the precautions to take and the survival skills during an earthquake, the knowledge about the earthquake, its characteristics, and its impact on both human and material levels. Stakeholders think that such training and information can help them to better cope with earthquakes. Finally, psychological factors, refers to terms such as "*being*

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

aware of the exposure of the area", "*being vigilant*", "*having a good morale*", and "*having peace of mind*". All these terms describe attitudes that can drive stakeholders to behave appropriately in the event of an earthquake.

4.3.6. Responsibility for Preparation

According to stakeholder responses, three responsibility levels can be identified as adaptive capacity to earthquake: the national, local, and individual levels.

At the national level, most stakeholders believe that the State (government) has the primary responsibility for the preparedness of the population. This includes the government's responsibility to guide and monitor construction. It covers the implementation of the building code and its revision, the control of construction, and the subsidy of appropriate materials for construction in seismic risk areas. To do so, it must take appropriate measures to raise awareness, motivate, and inform the population. At the local level, preparing the population was mostly identified by stakeholders as the responsibility of the municipality often associated with civil protection. The municipal council must mobilize relevant agencies, such as the Local Emergency Operation Center (COUL), which includes the Police and the Red Cross to assist the population in the event of a disaster. Civil protection is the main institution holding the leadership in natural hazard preparedness. Some interviewees thought that this institution should have a say in every information concerning the population's preparedness that circulates in the media, especially on the radio.

The individual level is cited in third position and equals with the population ones in verbatim. It mainly takes the form of "*Nou menm"* in the interviews, which translates as "*Ourselves"*, specifically referring to the respondents. This responsibility is based on the principle that it is up to everyone to take care of his or her life first. This statement rhymes very well with a Haitian proverb that says "*Se mèt kò, ki veye kò*" *(the master of the body is the bodyguard).*

4.4. The Stakeholders' Perception of Means, Resources, and Actions to Increase People Adaptive Capacity to Earthquake

After examining stakeholders' perception of their adaptive capacity to earthquakes, it is important to consider the way their perceptions seismic risk and adaptive capacity may influence their own adaptive capacity and the one of the local populations. To do so, responses were selected according to three perceived categories: effectiveness tools, resources, and actions (Figure 3, Q3).

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

4.4.1 Perceived Effectiveness of Preparedness Tools to Influence the Community

The interviews showed three means (risk training, awareness, simulation) that stakeholders perceived to increase their adaptive capacity and consequently the people adaptive capacity.

Firstly, ***training*** appeared to stakeholders as the best way to prepare the local population for earthquakes. Elements of training content were identified such as (1) inhabitants' knowledge about the seismic risk and its consequences; (2) prevention which covers actions to be taken before, during, and after an earthquake; and (3) instructing people in the construction of earthquake-resistant buildings. The interviewees said that the target audiences could be the general population and young people who, after having been trained, should share what they have learned with their entourage.

Secondly, ***awareness*** was the second most cited term by stakeholders. Channels such as the community's radio, megaphones, and sound truck were identified for outreach. Schools, churches, and soccer games were suggested as places or events to aim at the following themes that can be used to frame messages: how to behave during an earthquake, optimal building practices to minimize earthquake damage, and peer education.

Finally, ***simulation*** was mentioned only twice by stakeholders but seems to be relatively relevant to prepare people for earthquakes. Simulation sessions could show in a practical way to protect themselves during an earthquake. One interviewee expressed her preference for simulating session about preparation for earthquake. Thus, she stated: "*It is not only theoretical training but also practical training. Because you can have training but no practical sessions, what do you call that? Simulation*" *(Member of School Direction, 50-59 years old, Translated from French).* Therefore, simulation of protective measures against earthquakes is an important way of bringing theoretical training closer to reality.

The different terms used during the interviews allowed us to have an idea about the perceived effectiveness of means to enhance the adaptive capacity of the community of Anse-à-Veau. Stakeholders perceived the means through which they gained awareness as the best way to help people to become aware. Hence, it is important to understand stakeholder's perceptions to better outline their involvement in enhancing the local population's adaptive capacity. The available resources in the area to reach this goal need to be assessed for further actions.

4.4.2. Stakeholders' Perceived Resources to Increase Local Populations Adaptive Capacity

Despite the lack of financial resources, stakeholders were willing to adapt to earthquakes and to help the local populations to develop their adaptive

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

capacity to earthquakes by drawing on available and potential resources for community protection.

In terms of available resources, stakeholders perceived that Anse-à-Veau has human resources to help the community to adapt to earthquakes. Human and social capital and physical capital were identified to be helpful to anticipate an earthquake. Human and social capital refers to people within institutions such as churches, schools, the health center, the Police station, the Red Cross, and women's organization who are available to learn and share knowledge, skills, and capacity to influence earthquake preparedness in the community. The physical capital corresponds to schools and church buildings, which are often used as temporary shelters in case of disasters, including earthquakes.

Potential resources perceived by the stakeholders included human resources that could be mobilized to develop training and awareness on the appropriate behavior before, during, and after an earthquake. Churches and schools could be involved in training the population. Social networks like Facebook and WhatsApp were identified as relevant tools to reach young people. Solidarity was considered as important because it helped to save lives under the rubble during the earthquake of January 12, 2010, in Port-au-Prince. Regarding potential physical resources, stakeholders reported that the development of local resources such as the *Sault du Baril*, a waterfall located in the third communal section of Anse-à-Veau, and the drilling of wells could supply the entire town with drinking water. Some interviewees suggested expanding the health center and improving its services to facilitate access to health service. The construction of an equipped temporary shelter can be very useful for the population to deal with earthquake or any other disaster response.

Concerning financial resources, income-generating activities, such as investment in fishing, trade, stores, and financial services (banks and money transfer offices), could be developed to make the area more dynamic. These activities could compensate, to a certain extent, for the lack of financial resources that limit protectives measures.

In terms of institutional resources, the role of the Municipality was identified as crucial to improve the adaptive capacity of the community. According to the stakeholders, the Municipality should control the land occupation, the issuance of building permits, and the supervision of construction. To implement such measures, the municipal engineering department must be restored. The Municipal council can promote the training of earthquake-resistant construction engineers and technicians, as well as the learning of disaster response brigades.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

4.4.3. Perceived Actions for Increasing Adaptive Capacity

The actions perceived by the stakeholders to adapt to earthquakes can be located at two levels: community and household/individual levels.

At community level, two broad categories of actions are perceived by stakeholders: awareness raising/training and building safe houses. The first category appears as an effective preparation measure for stakeholders to influence the community. Several interviewees felt that it would demand only a little financial resource. Human resources, such as Red Cross volunteers, and the population itself, are important in promoting actions to help people to survive an earthquake. The second category of actions identified by the stakeholders concerns safe houses (build better). The availability and enforcement of building standards, especially earthquake standards, should be ensured by the Municipality Council and the Government. A minority of respondents do not feel responsible due to the lack of resources and the unpredictability of earthquakes.

At household and personal levels, stakeholders' actions can be classified into two broad categories: information sharing and building safety. Firstly, they aim to share useful information to help their family members to protect themselves. They focused on necessary actions to survive an earthquake, such as preparing survival kits and identifying safe places in their home. The behavior during an earthquake involves practicing the protective measures learned, such as "staying calm, making safety a priority, and leaving the house carefully". Secondly, building safety was highlighted as important actions to better cope with an earthquake at household and personal levels. Consequently, comments from some stakeholders seem to show that concrete slab houses are perceived as more dangerous in the event of an earthquake than sheet metal roofing houses.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

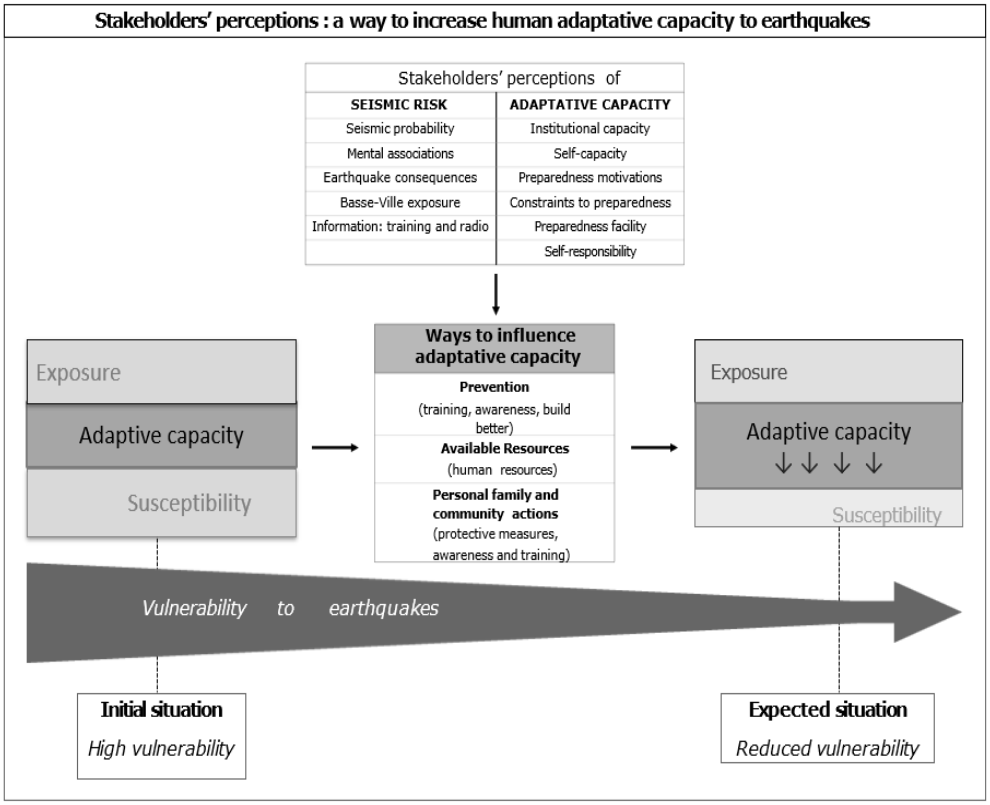

Figure 3. Stakeholders' perception of risk and adaptive capacity to earthquakes (completed)

5. Discussion

5.1. Relation between Education Level, Age and Place of Residence, and Risk Perception

Among the socio-demographic characteristics, the stakeholders' level of education, age, and place of living need to be discussed in relation to the seismic risk perception. Firstly, despite the stakeholder's education level was currently high, it seemed difficult to assign the stakeholder's risk perception to their education level because school was seldom cited as their source of information. In addition, interview data revealed that stakeholders may have a high seismic risk perception without real knowledge about earthquakes. For example, a school principal, university level, thought that earthquakes are caused by the heat. Such explanation is hardly surprising because the education of risks has been neglected in school curriculum in Haiti. Moreover, the only participant who had a very low education level had also a high perception of the seismic risk in the area. Secondly, the age groups which are the most representative of interviewees were 40-60 years old (Table 1). It is not surprising that this generation had never heard the word *risk* at school. Several studies found that education level influences risk perception (Tekeli-

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Yeşil et al., 2010). However, other findings showed that high education level did not necessarily lead to high-risk perception. For example, a study at Dhaka (Bangladesh) showed that people with high education level had low risk perception because they lived in modern apartment perceived as earthquake-resistant (Paul & Bhuiyan, 2010). Thirdly, the place can influence stakeholders' risk perception as they lived in the town long enough to have enough knowledge about the risks associated with the place. More than half of the participants lived in the town twenty-five (25) years ago. The 2010 earthquake hit the country only 11 years ago, at the time of the interviews. Finally, each of these elements can contribute to influence stakeholders' seismic risk perception, but it is still difficult to assign their seismic risk perception to one element specifically.

5.2. Influence of Reality of Earthquake, Awareness, and Radio on Seismic Risk Perception

Most of the stakeholders were fully aware of earthquakes. The stakeholders' judgment revealed that they have a high perception seismic risk in their community. Their perception of earthquake associated with Basse-Ville have been confirmed by the history that the 1860 earthquake destroyed the Basse-Ville, and the Haute-Ville served as refuge for people (Scherer, 1912). The stakeholder's seismic perception seemed to be influenced by the reality of earthquake, awareness, and radio as information sources. The earthquake reality shows that stakeholders have a vivid memory about the seismicity of the zone, especially the 1952 earthquake and the little tremors that hit the town recently. Their perception seems to be influenced by the awareness and risk training conducted largely by an international institution (Geohazard). Radio was presented as the second source of information by the stakeholders. Benjamin reported that radio is considered as the most popular media channel in Haiti (Benjamin et al., 2021). However, their risk perception can positively or negatively influence their capacity to act when an earthquake occurs. For example, in reference to earthquake consequence, respondents who believe that the Basse-Ville could be destroyed by a tsunami after an earthquake may feel powerless to take protective action. This trend may lead to fatalism because the consequence is perceived as beyond the capacity of stakeholders to act (Tekeli-Yeşil et al., 2010; Solberg, Rossetto & Joffe, 2010). Contrary to this perception of tsunami, there is no study that mentioned a tsunami on the town level at Anse-à-Veau.

Although school is less cited as a source of information, stakeholders still recognized the importance of developing risk education at school. Education could be reinforced to play an important role in promoting the culture of risk. However, Nepal is already engaged in such awareness program to prepare its population to face risks through school (Tuladhar et al., 2015).

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

In the long term, this measure may be less costly to the country than any other pathway. Moreover, countries that are well-prepared for earthquakes, such as Japan, New Zealand, and the United States, have all promoted risk education from an early age.

Consequently, this way of perceiving the risk can be a driver to stimulate them to take protectives measures. Some findings showed that risk perception can influence people to take decisions to protect themselves (Yu et al., 2015). Other authors showed that the risk perception does not determine the willingness to take precautions (Tekeli-Yeşil et al., 2010). Additionally, the recognition of the risk is important to create an expectation for people to take some protective measures. This is because it is difficult to ask someone to do something to protect himself if he does not feel to be at risk.

5.3. Influence of Motivation, Enabling Factors, and Self-responsibility on Adaptive Capacity

The interviews revealed that stakeholder's adaptive capacity perception is significant to motivate them to take protective measures for earthquake. Thus, three fundamental elements need to be discussed: motivation, enabling factors, and self-responsibility. The stakeholder's motivation is clearly expressed in their willingness to protect their life. A motivation that finds its root in the human life is great. This is especially because a man can give up anything just to save his life. For enabling factors, most stakeholders felt sufficiently aware of the protective measures or survival skills to protect themselves and their families in case of an earthquake. They are confident that they will be able to take actions to survive an earthquake. This perception of the stakeholders adaptive capacity is consistent with a study in rural China about respondents perceived capacity (Yu et al., 2019). Self-responsibility is important to help people to take the responsibility for their protection. Arlikatti and colleagues suggested that responsibility for protection is highest at the personal and family level (Arlikatti, Lindell, & Prater, 2007). Montreux et al. (2017) showed that people can adapt well despite the lack of financial resource when they feel the responsibility to protect themselves. Conversely, people tend to stay inactive when they think that their protection depends on government responsibility or other entities.

Self-capacity, as an element of stakeholder's adaptive capacity, could contribute to a good performance in real-life situations. This has been confirmed by different tests in health assessments (Bandura, 1982). Another study carried out in Mexico on seismic, industrial, and anthropological risk showed that the people's internal control of a situation is positively associated with active strategies to face the seismic risk in particular (López-Vázquez & Marván, 2003). Indeed, people's perception of their own adaptive capacity to a stressful situation determines their decision to act in real life.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Construction safety emerged as crucial factor for earthquake prevention. The quality of construction is central for reducing earthquake damage. The statement about the danger of houses that are not properly built to withstand an earthquake was taken up in a study in Italy (Massazza, Brewin, & Joffe, 2019). However, earthquake-resistant construction as practiced in developed countries may be difficult to implement in Haiti where most of the population is lacking the financial resources. Nevertheless, one could design locally appropriate solutions to build better houses. Indeed, the concrete slab, considered as a visible sign of wealth in Haiti, is considered to be dangerous because this type of house resulted to many human deaths in the 2010 earthquake at Port-au-Prince. Thus, the perception of concrete constructions could start changing in favor of lighter constructions.

Some constraints have been underlined such as the time of occurrence (at night), people's location (fragile houses), level of responsibility (who does what), and financial resources (low income). If the time of occurrence cannot be controlled because of the unpredictability of earthquake, nevertheless, some elements such as human settlements, local authorities' responsibility, and access to income could be considered in case of eventual actions to enhance people adaptive capacity. However, it is important to underline that these actions cannot be undertaken only with the local populations due to the lack of financial resources. What is worse is that such things received a low priority for most Haitian leaders where gaining and maintaining power were the priority of the majority of politics during several decades in Haiti (Corbet et al., 2023).

5.4. Perceived Means, Resources, and Actions to Increase Adaptive Capacity

Stakeholders tried to target means, resources (available and potential), and actions to increase the local population's adaptive capacity. The means identified by stakeholders are very important to make people aware of the seismic risk. However, several years of research showed that awareness did not lead automatically to the decision to take protective measures. Thus, it would be interesting to find some alternative means to involve the local populations more actively in their preparedness. It worth noting that financial resources are very limited in a poor municipality in a poor country (Llorente-Marrón et al., 2020). However, a study in rural China found that income and various sources of income did not affect respondents' intention to adapt to earthquakes (Yu et al., 2019). Thus, making the effort to identify the available and potential resources can be helpful to allow stakeholders find possible ways to increase people adaptive capacity. Hence, some elements were found like human/social capital and physical capital. These available forms of capital could be utilized by stakeholders to enhance their adaptive capacity as well as

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

that of the local populations. These potential forms of capital could be explored to translate them to actions for increasing people adaptive capacity. Thus, the stakeholders' leadership is crucial to mobilize these resources around a project to make the town safe. It is possible for stakeholders to find external resources to realize a project which is beyond the local financial resource.

Awareness raising/information sharing and building better houses were mentioned as possible actions both at the community and household level. Effectively, not much money is needed to create awareness about earthquakes or other risk. The essential is to be able to mobilize the necessary means and institutions available to do it. Some authors argue that non-structural measures can be taken at individual level with limited resources (Tekeli-Yeşil et al., 2010). However, it is important to note that awareness is not sufficient to make people more likely to take decisions to take protective measures. Therefore, this is consistent with a study in Dhaka City (Bangladesh) which showed that earthquake awareness and education program initiated by the government was not completely successful (Paul & Bhuiyan, 2010). It seemed necessary to review the current campaign of awareness by emphasizing the active ways of learning that lead to decision. In this case, the serious game may be one of the more active ways to train the local populations to increase their adaptive capacity.

In contrast, building safe houses does not just need only some financial resources but also the involvement of local authorities in controlling safe construction in the community. At a personal level, it is always possible to build a suitable home with the means at your disposal. It would be prudent for someone to undertake concrete slab construction if they have sufficient financial resources to build well. The best solution is to find some alternative ways to build a safe house with limited resources. In addition, the traditional house has already shown their capacity to resist earthquakes, and it would be important to capitalize on this technology to build better houses despite the limited resources.

Unfortunately, women were only poorly represented among the stakeholders, and this prevents a more accurate picture of women's perceptions in this study. Women's perceptions are often different from that of men's, both in terms of risk perception and adaptive capacity (Lundgren & Strandh, 2022). These authors highlighted the role of women in drought management in local communities in rural Mozambique. Their low representation must be taken into account in possible actions to increase the community capacity, even more so because women are a very dynamic category at the household level in Haiti (Mathieu et al., 2003).

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Limitations

The findings of this study suggest a clear perception of stakeholders of seismic risk and adaptive capacity. This is an important insight when considering the role that stakeholders play in influencing the attitude of local populations. However, the selected stakeholders were a privileged category in the community and their perception could be very different from that of the public at large. Given the context in which the study was carried out, it was not possible to cross-reference the perception of risk and the ability of stakeholders to adapt with other categories of the society. This would provide a better understanding of the issues studied. Therefore, their perception of seismic risk and adaptive capacity are not a representative for the whole community. Moreover, the findings are more representative for male because they constituted most interviewees. Despite these considerations, it seemed important to explore stakeholders' perception adaptive capacity to verify the way they can involve in increasing local populations adaptive capacity. Future research is significant to assessing the perception and adaptive capacity of local populations at household level. This is aimed at finding the component that needs to be reinforced so as to increase the peoples' adaptive capacity.

Conclusion

In conclusion, the aim of this study was to explore the influence of stakeholders' perceptions of earthquake risk and adaptive capacity on their own adaptive capacity and that of the local population in the face of earthquake. This information, currently unavailable in the literature of disaster risk reduction, is crucial in helping decision-makers to leverage on people's experience to build the capacity of local populations to appropriately withstand future disasters in the global south. The study suggests that the stakeholders' perception of seismic risk is relatively high to influence a priori their perception of adaptive capacity to the risk. All components identified in the perception showed a tendency to acknowledge the seismic risk and the consequences an earthquake could have on the local community. Stakeholders' perception of their adaptive capacity to an earthquake suggests that they can play an important role in increasing their own and the local populations' adaptive capacity to an earthquake. The study further found that people demonstrated at household level a better understanding of people's adaptive capacity to earthquakes, outlining the relevance of household heads in creating awareness for building people's adaptive capacity in the face of disasters.

However, good intentions are not enough to change people's attitudes. It is necessary to move from words to deeds to increase the capacity of a population to adapt to earthquakes. This is critical because people generally act according to their perception of a situation. Since human resources have

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

already been identified as the most important for the municipality, this study provided insights into ways on how to prepare the population to cope with earthquakes. Human and socio-cultural capital seems to be a determining factor in increasing the adaptive capacity of a population with limited financial resources. Thus, exploring the latter two elements seems to be an important avenue for understanding stakeholders' behavior in the face of risk and for increasing their adaptive capacity.

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Note about General Data Protection Regulation (GDPR)

The ethics committee of the university of the first author has been consulted regarding the steps to be taken to ensure the protection of interviewees. Given that no personal data leading to the identification of individuals was collected, the recording and transcriptions were anonymised. In this context, by guarantying the anonymity of the participants, no further steps were necessary. However, oral consent was asked and all necessary information about the research and the rights of the participants was communicated before starting the interviews. Thus, the General Data Protection Regulation (GDPR) was not necessary to conduct the interviews.

References:

1. Abdul-Kareem Raheem, Setondé Constant Gnansounou, & Reynolds Adongo (2021). "Effects of the Oil-Find on Land Management in the

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Sekondi-Takoradi Metropolis, Western Coast of Ghana." *Journal of Land Use Science* 16 (4): 398–412. https://doi.org/10.1080/1747423X.2021.1991018.

2. Arlikatti, S., Lindell, K.M., & Prater, CS. (2007). "Perceived Stakeholder Role Relationships and Adoption of Seismic Hazard Adjustments." *International Journal of Mass Emergencies and Disasters* Vol. 25 (3): 218–56.
3. Bandura, A. (1982). "Self-Efficacy Mechanism in Human Agency," 26.
4. Benjamin, F., Katiana, J., Renando, A., Marc, P., Max, M., Ketty, B., & Evens, E. (2021). "COVID-19: Perception of the Pandemic and the Importance of Barrier Measures by the Fruit and Vegetable Sellers of Port-Au-Prince." *European Scientific Journal ESJ* 17 (5). https://doi.org/10.19044/esj.2021.v17n5p165.
5. Bétard, F. & Fort, M. (2014). "Les risques liés à la nature et leur gestion dans les Suds." *Bulletin de l'Association de géographes français* 91 (3): 231–40. https://doi.org/10.4000/bagf.1571.
6. Brooks, N. (2003a). "Vulnerability, Risk and Adaptation: A Conceptual Framework," 20.
7. Corbet, A., Laure, F., Nixon, C., Laennec, H., & Eric, C. (2023). "From a Seismological Network to a Socio- Seismological One: A Citizen Science Experiment in Haïti to Reduce Seismic Risk: Analysis of a 'Small Box' That Can Do a Lot." *Citizen Science: Theory and Practice* 8 (1): 2. https://doi.org/10.5334/cstp.481.
8. Deng, Y., Guiwu, S., Na, G., & Lei, S. (2019). "Perceptions of Earthquake Emergency Response and Rescue in China: A Comparison between Experts and Local Practitioners." *Natural Hazards* 97 (2): 643–64. https://doi.org/10.1007/s11069-019-03663-8.
9. Engle, N.L. (2011). "Adaptive Capacity and Its Assessment." *Global Environmental Change* 21 (2): 647–56. https://doi.org/10.1016/j.gloenvcha.2011.01.019.
10. Friedman, A.L. & Miles S. (2006). *Stakeholders: Theory and Practice*. Oxford ; New York: Oxford University Press.
11. Gaillard, J. C., Cadag, J.R.D., & Rampengan, M. F. (2019). "People's Capacities in Facing Hazards and Disasters: An Overview." *Natural Hazards* 95 (3): 863–76. https://doi.org/10.1007/s11069-018-3519-1.
12. Grothmann, T. & Patt, A. (2005). "Adaptive Capacity and Human Cognition: The Process of Individual Adaptation to Climate Change." *Global Environmental Change* 15 (3): 199–213. https://doi.org/10.1016/j.gloenvcha.2005.01.002.
13. Henry, S., Sébastien, D., Elisabeth, H., & Sofa, C.S.B. (2022). "Qualitative Data and Approaches to Population–Environment

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Inquiry," International Handbook of Population and Environment, 10: 139–63. https://doi.org/10.1007/978-3-030-76433-3.
14. IFR & RCS (2012). "Earthquakes Guidelines on Preparing, Responding and Recovering." Genava: Koninklijke Brill NV. https://doi.org/10.1163/2210-7975_HRD-9813-2015012.
15. IHSI (2015). "Population Totale 18 Ans et plus, Ménages et Densités En 2015." Port-au-Prince.
16. ISDR (2008). "Indigenous Knowledge for Disaster Risk Reduction: Good Practices and Lessons Learned from Experiences in the Asia-Pacific Region."
17. Joffe, H., Tiziana, R., Christian, S., & Cliodhna, O. (2013). "Social Representations of Earthquakes: A Study of People Living in Three Highly Seismic Areas." *Earthquake Spectra* 29 (2): 367–97. https://doi.org/10.1193/1.4000138.
18. Lindell, M.K., Arlikatti, S., & Prater, C.S. (2009). "Why People Do What They Do to Protect Against Earthquake Risk: Perceptions of Hazard Adjustment Attributes." *Risk Analysis* 29 (8): 1072–88. https://doi.org/10.1111/j.1539-6924.2009.01243.x.
19. Lindell, M.K. & Perry, R.W. (2000a). "Household Adjustment to Earthquake Hazard: A Review of Research." *Environment and Behavior* 32 (4): 461–501. https://doi.org/10.1177/00139160021972621.
20. Llorente-Marrón, M., Díaz-Fernández, M., Méndez-Rodríguez, P., & González, R.A. (2020). "Social Vulnerability, Gender and Disasters. The Case of Haiti in 2010." *Sustainability* 12 (9): 3574. https://doi.org/10.3390/su12093574.
21. Lopez-Ramirez, E.O., Morales-Martinez, G.E., Mezquita-Hoyos, Y.N., & Patino-Munguia. L.R. (2019). "Perceived Self Efficacy To Cope With Earthquakes." *Advances in Social Sciences Research Journal*, no. 8: 14.
22. López-Vázquez, E. & Marván, M.L. (2003). "Risk Perception, Stress and Coping Strategies in Two Catastrophe Risk Situations." *Social Behavior and Personality: An International Journal* 31 (1): 61–70. https://doi.org/10.2224/sbp.2003.31.1.61.
23. Lundgren, M. & Strandh, V. (2022). "Navigating a Double Burden – Floods and Social Vulnerability in Local Communities in Rural Mozambique." *International Journal of Disaster Risk Reduction* 77 (July): 103023. https://doi.org/10.1016/j.ijdrr.2022.103023.
24. Martins, I.M. & Gasalla, M.A. (2020). "Adaptive Capacity Level Shapes Social Vulnerability to Climate Change of Fishing Communities in the South Brazil Bight." *Frontiers in Marine Science* 7 (July): 481. https://doi.org/10.3389/fmars.2020.00481.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

25. Massazza, A., Chris, R.B., & Joffe, H. (2019). "The Nature of 'Natural Disasters': Survivors' Explanations of Earthquake Damage." *International Journal of Disaster Risk Science* 10 (3): 293–305. https://doi.org/10.1007/s13753-019-0223-z.
26. Mathieu, P., Jean, A.C., Josué, N., & Bobby, P. (2003). "Cartes et Étude de Risques, de La Vulnérabilité et des Capacités de Réponse En Haïti." Oxfam International.
27. Morin, M. (2008). *Concepts de base en sécurité civile*. Québec: Sécurité civile Québec.
28. Mortreux, C. & Barnett, J. (2017). "Adaptive Capacity: Exploring the Research Frontier." *WIREs Climate Change* 8 (4). https://doi.org/10.1002/wcc.467.
29. Mulilis, J. & Lippa, R. (1990). "Behavioral Change in Earthquake Preparedness Due to Negative Threat Appeals: A Test of Protection Motivation Theory." *Journal of Applied Social Psychology* 20 (8): 619–38. https://doi.org/10.1111/j.1559-1816.1990.tb00429.x.
30. Ncube, A., Mangwaya, P.T., & Ogundeji, A.A. (2018). "Assessing Vulnerability and Coping Capacities of Rural Women to Drought: A Case Study of Zvishavane District, Zimbabwe." *International Journal of Disaster Risk Reduction* 28 (June): 69–79. https://doi.org/10.1016/j.ijdrr.2018.02.023.
31. Nicoll, K. & Cova, TJ. (2016). "Http://Www.Omicsgroup.Org/Journals/Open-Letter-to-Mr-Bill-Gates-on-Energy-Miracle-2167-0587-1000167.Php?Aid=73984." *Journal of Geography & Natural Disasters* 6 (2). https://doi.org/10.4172/2167-0587.1000168.
32. Paillé, P. & Mucchielli, A. (2008). *Analyse qualitative en sciences humaines et sociales*. 2eme edition. Collection U. Paris: Armand Colin.
33. Paul, B.K. & Bhuiyan, R.H. (2010). "Urban Earthquake Hazard: Perceived Seismic Risk and Preparedness in Dhaka City, Bangladesh." *Disasters* 34 (2): 337–59. https://doi.org/10.1111/j.1467-7717.2009.01132.x.
34. PDNA-Haïti (2010). "Evaluation Des Dommages, Des Pertes et Des Besoins Généraux et Sectoriels."
35. Renn, O. (1990). "Risk Perception and Risk Management : A Review. Pt. 1, Risk Perception." https://doi.org/10.18419/OPUS-7299.
36. Scherer, J. (1912). "Great Earthquakes in the Island of Haiti." *Bulletin of the Seismological Society of America* 2 (3): 161–80. https://doi.org/10.1785/BSSA0020030161.
37. Shapira, S., Aharonson-Daniel, L., & Bar-Dayan, Y. (2018). "Anticipated Behavioral Response Patterns to an Earthquake: The

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Role of Personal and Household Characteristics, Risk Perception, Previous Experience and Preparedness." *International Journal of Disaster Risk Reduction* 31 (October): 1–8. https://doi.org/10.1016/j.ijdrr.2018.04.001.

38. Solberg, C., Rossetto, T., & Joffe, H. (2010). "The Social Psychology of Seismic Hazard Adjustment: Re-Evaluating the International Literature." *Natural Hazards and Earth System Science* 10 (8): 1663–77. https://doi.org/10.5194/nhess-10-1663-2010.
39. Tekeli-Yeşil, S., Dedeoğlu, N., Tanner, M., Braun-Fahrlaender, C., & Obrist, B. (2010). "Individual Preparedness and Mitigation Actions for a Predicted Earthquake in Istanbul." *Disasters* 34 (4): 910–30. https://doi.org/10.1111/j.1467-7717.2010.01175.x.
40. Thomas, I. & Gagnon, A. (2019). "Coaticook : Analyse scientifique de la vulnérabilité intégrant l'implication des acteurs locaux et citoyens pour une ville et une communauté plus résiliente." *Risques urbains* 3 (1). https://doi.org/10.21494/ISTE.OP.2019.0319.
41. Tuladhar, G., Ryuichi, Y., Dahal, R.K., & Bhandary, N. P. (2015). "Disaster Risk Reduction Knowledge of Local People in Nepal." *Geoenvironmental Disasters* 2 (1): 5. https://doi.org/10.1186/s40677-014-0011-4.
42. UNDRR (2019). "Human Cost of Disasters. An Overview of Last 20 Years (2010-2019)." UNDRR.
43. USGS (2012). "Accounts of Damage from Historical Earthquakes in the Northeastern Caribbean, to Aid in the Determination of Their Location and Intensity Magnitudes." Open-File Report. Open-File Report.
44. Yohe, G. & Tol., R.S.J. (2002). "Indicators for Social and Economic Coping Capacity Moving toward a Working Definition of Adaptive Capacity." *Global Environmental Change*, 16.
45. Yu, J. & Hokugo, A. (2015). Graduate School of Engineering, Department of Architecture, Kobe University, and Research Center for Urban Safety and Security, Kobe University 1-1 Rokkodai, Nada, Kobe 657-8501, Japan. "Understanding Household Mobilization Time During Natech Accident Evacuation." *Journal of Disaster Research* 10 (5): 973–80. https://doi.org/10.20965/jdr.2015.p0973.
46. Yu, J., Sim, T., Guo, C., Han, Z., Lau, J. & Su, G. (2019). "Household Adaptation Intentions to Earthquake Risks in Rural China." *International Journal of Disaster Risk Reduction* 40 (November): 101253. https://doi.org/10.1016/j.ijdrr.2019.101253.

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Appendix

Table 3. Summary of results of stakeholder interviews

Theme	***Questions***	***Results of stakeholder interview analysis***
Question 1. Stakeholders' perception of seismic risk		
Likelihood of earthquake	Do you think the area (town or neighborhood) is prone to earthquakes?	Recognizing the likelihood of an earthquake by all stakeholders in the town because of the faults, the history of seismicity, and recent tremors.
Mental association	When you hear "earthquake", what comes to mind?	1. Negative associations about the earthquake consequences. 2. Positive associations about the protection measures.
Perceived consequences	What are the consequences that an earthquake can have in the area?	1. Human consequences (death, suffering, loss of relatives). 2. Material consequences (cracking, the collapse of houses). 3. Disaster-related to a tsunami.
Exposure to the area	What do you think is the most exposed part of the town?	1. Great exposure of the Lower Town because of the soil nature, the sea proximity, and the anarchic settlements. 2. Great exposure of the Upper Town because of sensitive buildings.
Sources of information	By what means do you inform yourself about earthquakes?	1. Training (informal). 2. Radio. 3. Other sources (grandparents, God, school, church…).
Question 2. The perception by the actors based on their capacity to adapt		
Institutional action	What does your institution plan to do to limit the damage of a possible earthquake in the area?	1. Training and information. 2. Share information about protective measures. 3. Apply the knowledge acquired. 4. Building better homes.
Personal and family protection	What will you do to protect yourself and your family in the event of an earthquake?	1. Personal protective measures (protective equipment measures inside, good state of mind, get out of the house if possible, build better homes). 2. Family protection measures (sharing of protection measures). 3. Passive attitudes (God knows, I don't know).
Motivation for preparation	What motivates (pushes) you the most to prepare for the earthquake?	1. Survival (love and preservation of life). 2. Consequences (hunger, suffering). 3. Danger (force, unpredictability, imminence).
Protective barriers	What can prevent you from taking steps to protect yourself?	1. Spatiotemporal constraint (time, place). 2. Physical constraint (disability, illness). 3. Inappropriate behavior (rebellion, neglect, attachment to loved objects, low morale). 4. Financial constraint (lack of means).

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Preparation facilitators	What can help you to better prepare for an earthquake?	1. Physical factors measures (appropriate constructions, earthquake-resistant houses, traditional houses, containers). 2. Educational factors (training, awareness, information). 3. Psychological drivers (being alert, having high morale, peace of mind).
Mainly responsible for the preparation	Who do you think is primarily responsible for preparing people for earthquakes?	1. National level (State, President, Ministries). 2. Local level (municipality, civil protection, NGOs, Red Cross, Police). 3. Individual level (population, citizens).
Question 3. Stakeholders' influence on the adaptive capacities of the community: means, resources, and actions		
Effectiveness of outreach methods	What do you think are the most effective ways to help people prepare for earthquakes?	1. Training 2. Awareness 3. Construction according to standards 4. Prevention
Available resources	What are the available resources you can use to deal with an earthquake?	1. Availability of human resources through the present institutions (churches, schools, health centers, police, Red Cross, organizations). 2. Availability of physical resources (schools, and churches buildings used as temporary shelters).
Potential resources	What are the potential resources to be developed to deal with an earthquake?	1. Economic (financial services, fishing, trade, natural resources). 2. Human (involvement of universities, schools and NGOs, churches for preparation, training of engineers and builders in earthquake resistance, brigade). 3. Physical (water catchment and well drilling, the extension of the hospital, the construction of temporary shelters, housing construction). 4. Policy (building control, zoning, assuming responsibilities, coordinating training activities).
Community actions	What actions can you take to reduce the seismic risk in your area?	1. Awareness and information (memory alive, the protective measures). 2. Training and education. 3. Involvement of Red Cross volunteers and Brigadiers. 4. Compliance with the construction standard.
Personal and family actions	What steps can you take to protect yourself and your family from the earthquake?	1. Personal protective measures (knowledge of life, economy measures, apply the knowledge, prepare survival kits). 2. Better building (seismic-resistant construction, construction according to standards, appropriate construction, and reinforcement of your house). 3. Share information with family members.