Risk perception of local stakeholders on natural hazards: implications for theory and practice

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Abstract. In Romania, local stakeholders' knowledge plays a decisional role in emergencies, supporting rescue officers in natural hazard events, coordinating and assisting physically and psychologically the affected populations. However, despite in the Iași Metropolitan area (NE of Romania), the occurrence and severity of natural hazards are increasing, there is a lack of knowledge of local stakeholders to address the population toward safety actions. For this reason, 118 local stakeholders were interviewed to determine their risk awareness and preparedness capacities over a set of natural hazards to understand where the lack of knowledge, action, and trust are exacerbated the most. Results reveal substantial distinctions among stakeholders and the different threats based on their cognitive and behavioral roles in the communities. The role of responsibility and trust has been seen as important driving factors shaping their perception and preparedness. Preparedness levels were low, and, not for all, learning and preparatory actions are needed to withstand the negative occurrences of natural hazards. As their role is to refer with direct interventions in affected areas managing communication initiatives with the entire population of the community, there is the need to create stakeholders' networks, empowering local actors that could serve as a bridge between authorities' decisions and local people to make effective risk management plans and secure more lives and economies.

1 Introduction

Increasing the level of preparedness of communities is an essential part of risk management, a complex process that challenges scientists and involves communities, authorities, but also some key stakeholders. Decisions and actions, included the speed of those, have an essential role in reducing the vulnerability of communities for improving societal resilience. From global to local, communities are affected every year by disasters. Compared to the 1980-1999 period, the last 20 years are marked by an increase in the number of climate-related disasters with a significantly higher number of people affected and economic losses compared to other types of disasters (UNDRR, 2020, van Westen et al., 2020; excluded epidemiological disasters). Recent studies forecast an increase in climate hazard impacts in the future due to global warming (Dottori et al., 2018; Forzieri et al., 2018; Vousdoukas et al., 2018). Especially in Central and Eastern Europe, there is evidence of an increase in heat extremes, a decrease in summer precipitation, and an increased risk of river floods due to climate changes in the last two decades (Anders et al., 2014; IPCC 2013, 2018). These events can threaten the wellbeing of communities, especially in

Romania, since its population demonstrated to have a low copying capacity of natural hazards induced risks (Dunford et al. 2015; Vanneuville et al. 2017).

In many countries, besides the national government agencies which coordinate emergencies management (Strand et al. 2010) and have much more structural and financial resources, local stakeholders are often involved in disaster planning and risk reduction because of their knowledge of the community, norms, and habits and for their capacity to assist and control people during crises (Meltzer et al. 2018; ERCC, 2019; Scheuer and Haase, 2012; Horton et al. 2011). Local stakeholders are defined as individuals or groups (generally place-based) who demonstrated capacities to coordinate and cooperate before, during, and after emergencies (Hommels and Cleophas, 2013), as widely documented during the recent pandemic crisis (Alon, 2020; WHO, 2020). They are among the best communicators in their settlements (Slovic, 1993; Reed, 2008; Straja et al., 2008), stimulating proactive two-way communication and even run negotiations, being able to influence (positively) the community and acting as a bridge between national authorities' decisions and actions. For certain types of hazards, such as floods, there is already a separation of stakeholders' responsibilities: decisions regarding local flood defense improvements are devolved to local decision-makers, whereas decisions about river training are taken at national and international levels (Merz et al., 2010). A similar situation is encountered in the case of heavy snow, in which case a first assessment and intervention fall under the responsibility of local authorities.

Local stakeholders in Romania play an influential and decisional role in emergencies (Mărgărint and Niculiţă, 2014; Meltzer et al., 2018), helping rescue officers in the onset of natural hazard events, and can coordinate and assist, both physically and psychologically, affected populations. People seemed to trust those key agents rather than county or governmental stakeholders (Beshi and Kaur, 2019). At the national level, in Romania, the emergency management is coordinated by General Inspectorate for Emergency Situations (IGSU) and at ATU3 (Administrative Territorial Unit) level by the Local Committee for Emerging Situations. According to the specific legislation (NSO - National Organization System, EO - Emergency Ordinance, 20/2004) these inter-institutional committees act as main social coordinators in emergencies triggered by natural or anthropic hazards (RG - Romanian Government - EO, 68/2020). Under the leadership of mayors, these committees act in synergy and work as consultants: vice-mayor, ATU 3 administrative secretary, representatives of public institutions, and local economy.

The current study focuses on five types of stakeholders, each having a specific role in the risk management process: mayors, police officers, school directors, priests, and farmers. Being primarily a consequence of the centralization of social life during the communist period and due to current legislation, many of the public institutions in Romania are organized at the communal level (ATU 3): town halls, schools, police, and even the church. In this way, the leaders of these organizations are de facto stakeholders with clearly defined responsibilities, included the ones concerning disaster risk management (Ministerul Educației Naționale și Cercetării Științifice, 2016; Romanian Government, 2019, 2020; Romanian Parlament, 2020): (i) majors have a decisional role in administration and public services, including parts of local finances, emergency and disaster situations, local development and territorial planning; (ii) police officers are responsible with the investigation and monitoring of criminal phenomena, take care of public order and safety of people in the administrative unit concerning in situations of disasters; (iii) school directors exercises executive management of the educational unit, in accordance with the education legislation in force, including the organization of exercises to prevent the harmful effects of disasters within the educational building; (iv) priests, in addition to current sermons and duties, care for the afflicted (the poor people, widows, and orphans) and assists the parishioners in their most difficult times, including in the aftermath of disaster, giving phycological support and assist with primary care; and (v) local farmers who have a tremendous influence in the Romanian community, because agriculture has a significant role in the country considering that almost 50% of Romanian population is living in the countryside and being a factor of economic prosperity (Burja, 2014). Farmers have labor and organizational skills to coordinate with their peers in the countryside in case of emergencies. Besides, their knowledge of the territory can help track the changes of the weather and the land, being much more resilient than the urban society (Wilson, 1997; Heitz et al., 2009; Šūmane et al., 2018). For this reason, they are reference actors within the community and a role model, especially in rural areas.

The assessment of local stakeholder's risk perception is an essential issue in exploring possibilities for improving the management of emergencies, which implies individual and social preparedness, scenario-based risk assessment, process manifestation, the first evaluation of the impact, and the recovery phase (Merz et al., 2010; Zhou et al., 2018). A low level of risk perception of local stakeholders often associated with low knowledge of causal factors and the manifestation of natural hazards (e.g., magnitude, timing, spatial distribution) have created conditions in the past for making wrong decisions that have led to increased casualties and economic losses (Kron, 2000; Oliver, 2010; Kaplan et al., 2010; Baker, 2011; Dykes and Bromhead, 2018). According to model projections, in Romania, the effects of natural hazards are dramatic and are getting worse (International Strategy for Disaster Reduction, 2008). The understanding of the level of preparedness of communities requires the analysis of stakeholders' risk perceptions.

The international literature provides a wide spectrum of studies relating to the importance of risk perception research (Scolobig, 2016), analyzing people's cognitive appraisal toward specific hazards (e.g., Salvati et al., 2014; Pereira et al., 2016; Fuchs et al., 2017), related to sensitive geographical settings and communities (e.g., Roder et al., 2016, 2017; Gao et al., 2020; Alcántara-Ayala and Moreno, 2016, Gao et al., 2020) or a combination of multiple interacting factors (e.g., Mondino et al. 2020).

Risk perception is a complex issue, and so far, no universal formal theories for risk perception, evaluation, or acceptance exist (Platner et al., 2006). However, two main theories have been widely used by geoscientists in risk perception assessment: (i) cultural theory, which defines the risk as a social construct, each social group having its own set of risks and criteria to judge, tolerate, and react to risks (Douglas and Wildavsky, 1983; Rippl, 2002, Salvati et al., 2014), and (ii) psychometric model, based on quantitative representations of the perception of the risk, and cognitive maps of risk attitudes and perceptions (Fischoff et al., 1978, Slovic, 1987, Sjöberg, 2000). The last approach has been successfully used in explaining how people judge risk and what are the factors that modulate the perception of risk (Schmidt, 2004).

Risk perception studies emphasized the role in making prudent disaster reduction decisions (Bamberg et al., 2017; Bradford et al., 2012; Buchecker et al., 2016; Rufat et al., 2020; van Valkengoed and Steg, 2019), from this point of view this issue is one of the central themes of the studies approaching climate change and natural hazards (Schneiderbauer et al., 2021). Referring to flood risk, Lechowska (2018) highlights differences between societal perceived risk and the risk level determined by the experts. Local stakeholders' risk awareness and risk governance strategies should fill this gap by improving the active involvement of stakeholders and the public (Gamper, 2008; Fleischhauer et al., 2012). Also referring to rare floods triggered by extreme weather conditions, Burningham et al. (2008) argued for more contextual research that explores local perspectives on flooding within broader evaluations of local life. They also pointed out an underestimation of the perceived risk of these rare events, especially due to the neglect of local-scale analyses.

A key issue in risk perception approaches is related to risk communication, seen not only as a technical, a level of risk, or a potential of a negative consequence, but also the possibility, effectiveness, and cost of private precautionary measures (Grothmann and Reusswig, 2006). Also, risk communication must help people envisage natural hazards' negative emotional consequences (Siegrist and Glutcher, 2008). In a direct relationship between the level of the resilience of the local communities and the harmful effects of natural hazards is the preparedness level, which constitutes another key issue in risk perception studies, as the recent literature emphasizes (Guo and Kapucu, 2019; Mano et al., 2019; Öcal, 2019; Perić and Cvetković, 2019). At the same time, several studies are referring to the importance of stakeholders’ risk perception and their role in varied types of risk mitigation decisions and actions: the management of contaminated sediment disposal (Sparrevik et al. 2011), safety management in construction (Zhao et al. 2016), environmental health risks (Kraaij-Dirkzwager et al., 2017), floods (Heitz et al. 2009; Hazarika et al., 2016) or multiple hazards (Mărgărint and Niculiță, 2014). However, while natural hazards are a particular threat to Romanian people, no studies attempted to understand stakeholders’ role in the wake of natural hazards, nor their perceptions and preparedness. The attention devoted by scholars has concentrated only on people perceptions on a range of different natural and anthropic hazards (Grozavu and Pleşcan, 2010; Comănescu and Nedelea, 2015), or specifically to earthquakes (Armaş, 2006; Creţu et al., 2010; Armaş et al., 2017) or floods (Armaş and Avram, 2009; Ceobanu and Grozavu, 2009; Armaş et al., 2015; Comănescu and Nedelea, 2016). In all these studies, remarkable low-risk perception and preparedness are underlined due to historical, social, and economic reasons.

The current paper has been designed to investigate stakeholders’ level of knowledge and cognitive appraisal of natural hazards to define the benchmark level and propose risk awareness strategies to help stakeholders increase the level of resilience of local communities. A set of questions has been developed and administrated face to face to selected stakeholders in the rural administrative units of the Iaşi metropolitan area (NE Romania). The Iaşi metropolitan area is one of the largest urban and rural areas in Romania (Iftimoaei and Baciu, 2019), and due to its geographic location, geomorphologic features, and climatic settings, made this area particular fragile to climate extremes and changes, threatening the sustainable economic development of the region. For all these reasons, the Iași area can be considered as a hotspot and can serve as a comparative study for similar realities in Europe. Three work questions guided this study:

RQ1: Does each stakeholder perceive natural hazards differently? The answers to this question can depict stakeholders’ decisional process and priorities, contributing to preventive behavior regarding different hazards in terms of frequency-magnitude-potential impact. Although the selected stakeholders have different roles within the communities and a different timing in the evolution and management of these hazardous events, they all bear extra responsibility (legislative, educational, communicational, and moral) compared to the lay public. In this sense, we stated the second research question:

RQ2: Do different stakeholders have different perceptions and preparedness levels on a set of natural hazards? The psychological, emotional, educational, and professional backgrounds of stakeholders are among the main drivers of preparedness activities facing natural hazards. Research results can help enhance communication of good practices before and after hazardous events, especially for those with rapid evolution, such as earthquakes or floods. Since hilly areas and floodplains characterize Iaşi Metropolitan Area, and during the last decades, there have been localized hazards (landslides in the hilly areas and floods in the floodplains), which could influence the risk perception. As a consequence, we formulated another research question:

RQ3: Do topographical characteristics of locations affect stakeholder's risk perception of different natural hazards?

2 Setting the scene: natural hazards in Iași Metropolitan Area (Romania)

2.1 Geographical settings

Iași Metropolitan area is located in North-Eastern Romania, in the proximity of the border with the Republic of Moldavia (Fig. 1) and accounts for 18 communes (ATU3) situated in its proximity. To have a more unitary image from the point of view of floods and landslides, we decided to add another 5 ATU3 (Costuleni, Golăieşti, Horleşti, Ţigănaşi, and Voineşti) to the 18 communes of the metropolitan area (Fig.1). As part of the Moldavian Plateau, the study area is a monoclinic hilly region, with altitudes ranging from 30 to 400 m a.s.l. (Niculiță et al., 2018), developed in a Miocene mudstone-marlstone lithology, with sands, sandstones, and limestones intercalations, which favored a dense distribution of landslides (Mărgărint and Niculiță, 2017; Niculiţă et al., 2019, Bălteanu et al., 2020). According to the Köppen-Geiger classification of the world climate (Kottek et al., 2006), the analyzed area is characteristic of the dry continental climate (Minea, 2013; Mărgărint and Niculiță, 2017). At Iași meteorological station (102 m a.s.l.), the mean annual temperature and the mean annual precipitation are 9.6°C and 559.7 mm, respectively, for the period 1950 to 2006 (Croitoru and Minea, 2015). Iaşi metropolitan area is particularly vulnerable to anthropogenic hazards (Dicu and Stângă, 2013), but also to natural ones, as a direct consequence of dramatic changes in population dynamic and build-up sprawl in the surrounding settlements of Iaşi city in the last decades. After the period of socio-political adjustments following the events of 1989, with ambiguous legislation, economic stagnation, and the lack of territorial planning, Iaşi became, again, after 2000, one of the main poles of urban and economic growth in Romania (Benedek and Cristea, 2014). In the last decades, there was a noticeable tendency to sprawl the built-up spaces along the main roads, even the low level of construction favourability of the lands (Stoleriu, 2008). The old agricultural activities were gradually replaced by new constructions, industrial and storage spaces, by renting the lands. Individual dwellings appeared more and more on lands with erosive risk, without coherent territorial development plans, in neighborhoods with inadequate infrastructure: undersized lifeline network and unmodernized road network that constantly generates traffic problems. Traditional occupations of the inhabitants (agriculture, vineyards, orchards, vegetable farming, and livestock) were gradually moving further and further away from the central urban pole, thus creating a permanent readjustment of the land cover and labor force (Cîmpianu and Corodescu, 2013).

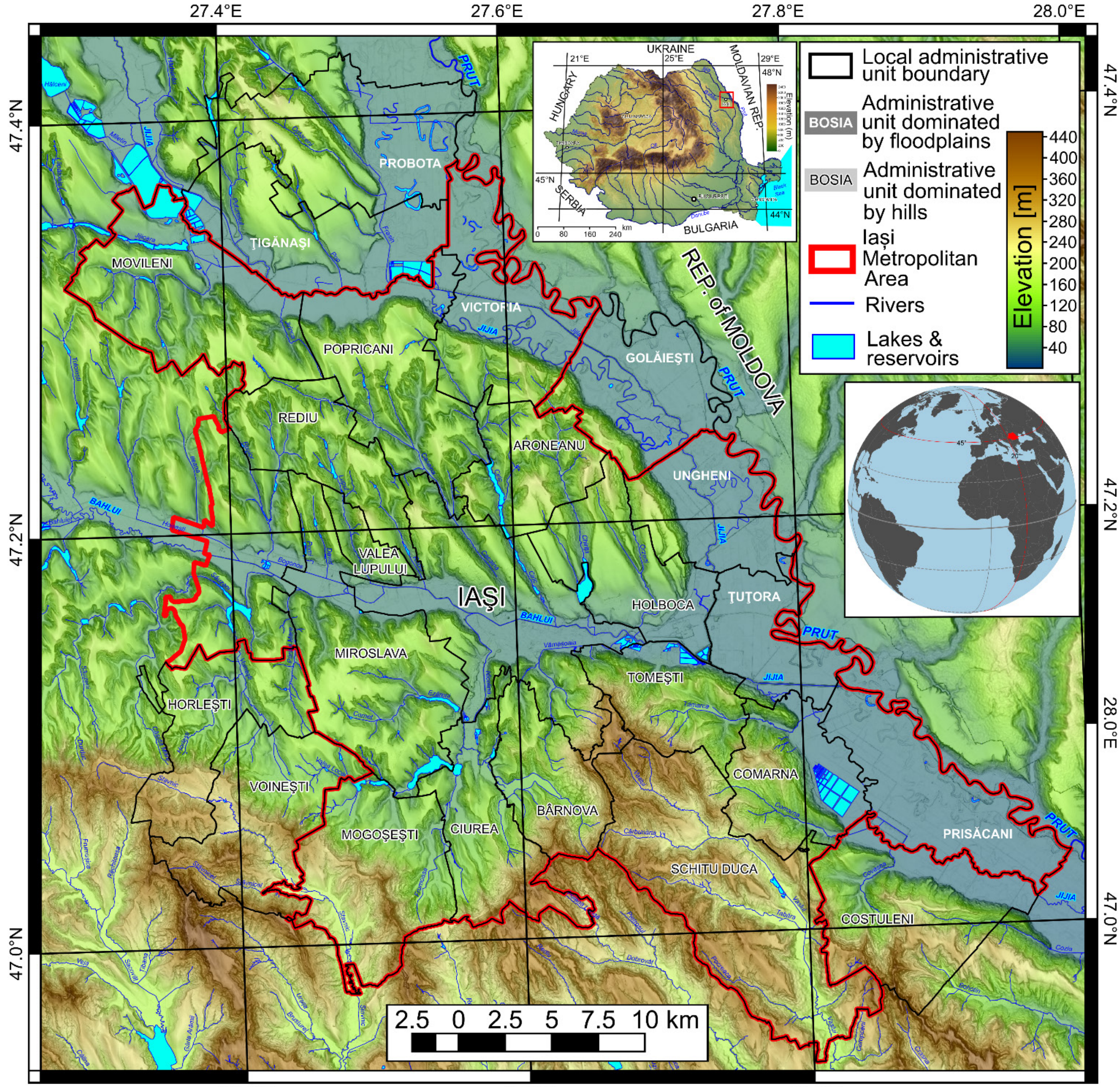

Figure 1: The geographical position of the study area.

A new peri-urban area is developing spontaneously around Iaşi City, which is growing rapidly but chaotically, generating severe problems related to the environment's quality and the future possibilities of landscape planning (Stoleriu, 2008). These complex changes in the recent past will create a greater degree of vulnerability of the population to natural hazards that have manifested in the study area in recent decades. A synthesis (Rotaru and Răileanu, 2009) of the damages caused in the 2000-2005 period by rains, hail, strong winds, and landslides in Iaşi County revealed losses estimated at 37 million RON (around 11.5 million Euro at that date). Also, a constant threat to the life of people and their dwelling stock is represented by earthquakes: Iaşi County was the most affected by the 7.1 MW subcrustal earthquake from 1977 in terms of total affected dwelling stock (Georgescu and Pomonis, 2008) and remain one of the most vulnerable to seismic hazard in Romania (Bunea and Atanasiu, 2014; Dutu et al., 2018)

To differentiate the administrative units and, as a consequence, different risk perception of the interviewees based on geographic location in the major landforms of the study area, the communes in which the present study was carried out have been split into two categories: (i) floodplain communes, located mainly on the major floodplains in the area (the Prut, Jijia and Bahlui floodplains) and (ii) hilly communes, with a large development of slopes and associated geomorphological processes: landslides and soil erosion (Fig. 1).

2.2 Natural hazards characterization and future climatic trends

Natural hazards considered in our study are droughts, rainstorms, heavy snowfall, floods, landslides, soil erosion, and earthquakes.

Droughts in NE Romania are associated with anticyclone conditions from summer and autumns, characterized by high temperature and low precipitation. The most frequent periods with drought appear in August, while the lengthiest appearing in October and the shortest in June (Mihăilă, 2006; Pelin, 2015). The impact of droughts on rural communities is high in NE Romania, and it can affect a wide range of activities (agriculture, forestry, livestock, water supply, industry), the quality of public health is considered as one of the main factors of rural poverty (Chiriac et al., 2005). Considering the intensity and multi-annual variability of droughts in the Moldavian Plateau, Cismaru et al. (2000) found that for the 1981-1998 period, the correlations between percentage losses of crops are logarithmically correlated with droughts intensity at the end of the vegetation period (usually October). In some parts of the Moldavian Plateau, for the mentioned period, these losses reached up to 41-50%, in the case of corn crops, and 40-43% in the case of sugar beet or alfalfa. The historical trends of droughts in NE Romania are of increasing frequency but decreasing magnitude (Minea and Croitoru, 2015, 2017; Minea et al., 2016; Spinoni et al., 2015), while the forecast is of slight increase (Stagge et al., 2015).

Rainstorms are frequent in late spring, summer, and at the beginning of autumn, especially during the summer, the majority of the precipitations coming from these events (Mihăilă, 2006). In Iași, the frequency of rainstorm is up to 40 times per year, the maximum 24-hour values were 136.7 mm (in June 1985 when in three days at Iași the rainstorm reached 193.8 mm), and the monthly cumulated values almost reached 300 mm (Mihăilă, 2006; Niculiță, 2020). In the proximity of Iași, toward the contact with the Central Moldavian Plateau, the 24-hour maximum value if even higher: at Sinești (30 km toward ESE) 185.3 mm in 12 hours, at Mogoșești (15 km toward SE) 154.4 mm and at Bârnova (10 km toward S) 167.9 mm (Minea, 2013). Hail is a common phenomenon, associated with rainstorms, with an aleatory distribution in space and time, but with important events in 1950 and 1984, which produced important damages to agriculture (Mihăilă, 2006).

The mean yearly number of snowfall days is 45 at Iași, but the annual variation is between 16 and 70 (Mihăilă, 2006). Heavy snowfall can negatively affect agriculture and society when they happen very late, in April or even May, or when the intensity is extreme during winter (Mihăilă, 2006). Blizzards usually manifest from December to February (in February being the most frequent), but early (November) or late (April) events can appear (Mihăilă, 2006; Niacşu et al., 2019). At Iași, there is a mean of 9 days per year, but the variation is between 0 and 22 days per year. During this phenomenon, the wind has a mean speed of 50-75 km/h, with a predominant direction from NW and N, the maximum speed registered being 200 km/h in 1966 (Mihăilă, 2006).

Floods are widespread on Prut River, where the two remarkable ones occurred in 2008 and 2010 when thousands of hectares were covered by water and many settlements were threatened and partially evacuated (Romanescu et al., 2011a, 2011b; Romanescu, 2015). Much earlier, another event dated to 1991 has marked some great damages in Jijia River's floodplain (Romanescu et al., 2017). In the Bahlui catchment, the hydro-technical infrastructure has diminished the frequency and the severity of floods (Minea, 2013), which had critical negative impacts on the populations from Iaşi city before 1960 (Tufescu, 1935). The effect of major floods in the last century on settlements from NE Romania was recently depicted using detailed topographic maps: dozens of villages were partially or entirely displaced in the Moldavian Plateau (Văculișteanu et al., 2019) in the last 100 years. In NE Romania, climate change is expected to increase precipitation extremes in both wet and dry regions as it happened in the past (Donat et al., 2016; Donat et al., 2017; Ingram, 2016; Jacob et al., 2014; Kurnik et al., 2017). This is predicting that the flood magnitude will increase in the region (Alfieri et al., 2015; Reker et al., 2017), so probably the number of deaths in Romania would continue to be one of the biggest in Europe (Vanneuville et al., 2017).

Landslides and soil erosion are common natural hazards in the study area. In the last decades, landslides have been slow movement reactivations that generated household displacements and infrastructure destructions (Niculiță et al., 2017, 2018). One of the most destructive recent events that took place near our study area was the reactivation of the Pârcovaci landslide in December 1996, triggered by heavy rains and snow melting: 97 households were destroyed or heavily damaged, affecting up to 400 inhabitants (Cioacă and Dinu 2002; Rotaru and Răileanu, 2009). In a recent study, Niculiţă et al. (2018) have identified and mapped a total number of 518 landslides that happened in the last century in the Iaşi Metropolitan Area. They are usually reactivations of old landslides and present an obvious temporal pattern in a strong relationship with the precipitations' variability. Their low magnitude and the fact that almost all the identified landslides happened outside populated areas show that landslides could be perceived as not so dangerous by the inhabitants. But the situation could change in the future, considering permanent expansion of the built-up area (Cîmpianu and Corodescu, 2013; Iaţu and Eva, 2016) and future changes in climate evolution (Niculiţă, 2020). Soil erosion is favored by the increased tendency of extreme meteorological events, fragmented topography, and the land use of the study area. These characteristics frame our study area in the most critical hotspots of soil erosion in Romania (Prăvălie et al., 2020).

Earthquakes are geological hazards that are quite present in Romania. Iaşi city is located about 200 km distance to the Vrancea region, one of the European seismic hotspots. Since 1800, seven earthquakes with moment magnitudes (MW) above seven were registered, while four major events marked the last 120 years, measuring 7.1 MW (1908, 1986), 7.4 MW (1977), and 7.7 MW (1940) (Lungu et al. 2007; Mărmureanu et al., 2011). The last strong earthquake (March 4, 1977, 7.4 MW, 109 km hypocentre depth) was the cause of many socio-economic damages in Romania (exceeded 2 billion USD at that time), claiming the death of 1,578 people and injuring another 11,300 persons. At a national scale, the impact was huge: 32.897 collapsed or demolished dwellings, 34,582 homeless families, 763 industrial units affected, and many other damages in all sectors of the economy (Georgescu and Pomonis, 2008). Although located relatively far from the epicentral zone, Iaşi county was the most affected in Romania in terms of percentage of dwelling stock affected: 47% was affected, from which 11% destroyed, 13% of dwellings requiring strengthening, and 23% dwellings requiring repair (Georgescu and Pomonis, 2008). In the last decades, earthquakes of over 6Mw were those from 1986, 1990, and 2004 and minor damages were reported.

3 Questionnaire design and data collection

Local stakeholders have been selected representing different characteristics in terms of power, legitimacy, and urgency, following the stakeholder's salience theory of Mitchell et al. (1997). This model includes stakeholder powers of negotiation, their relational legitimacy with the organization, and the urgency in attending to stakeholder requirements (Mainardes et al., 2012). According to the mentioned classification, the dominant stakeholders (mayors, police officers), discretionary stakeholders (farmers), and dormant stakeholders (professors and priests) have been selected. Semi-structured in-depth interviews have been run from March 2017 until October 2018 involving 118 stakeholders: 23 mayors, 27 farmers, 25 priests, 21 police chiefs, and 22 school directors. (Fig. 1). As in many other countries, in Romania, public institutions are organized at administrative levels, village/town halls, schools, police headquarters. The leaders of these institutions (mayors, police chiefs, and school directors, and in few cases, their deputies) were recruited directly to participate in the present study. Priests and local entrepreneurs (farmers) were randomly selected and interviewed on-site.

The questionnaire (Table A1 from Appendix A) was organized into two parts: the first with pre-defined questions (with 5-point Likert scale) regarding the assessment of risk perception induced by natural hazards: level of threat, probability of occurrence, future frequency (dichotomic) personal experience (dichotomic), level of knowledge (dichotomic), level of preparedness, risk management, communication, and trust and a second part in which discussions have been focussed on environmental and hazardous phenomena that threaten the places where they live and work. Interviews were run from 30 to 50 minutes according to the participant's desire to expand the open questions with his/her personal experience. In most cases, there were constructive approaches, especially in the second part of the interview, where some majors considered as beneficial for other employees of the major's office to participate in the final discussion once the interview was concluded.

There is a clear gender imbalance in the sample of stakeholders considered for the interviews (Table 1). This is due to the specificity of certain professions in Romania (priests and are police officers are predominantly men) or the perpetuation of older mentalities regarding the occupation of positions at the top of public administration (the case of mayors who only men represent). Only for school directors, we found a balanced situation: 63% were women. The majority of the stakeholders have a university degree, a mandatory requirement for their role, priests, and police officers. A large proportion of stakeholders (88%) live in the area where they work (same community or neighborhood communities), and this could suggest an amplification of perception of high-probability risks and reducing low-probability ones (Bernardo, 2013). The age distribution is skewed toward older persons, especially in the case of mayors (mean age 53.6 years) and school directors (49.2 years) in contrast with a younger generation of police officers (39.4 years).

Table 1. Descriptive statistics of interviewees; FUA represents administrative units dominated by floodplain areas, and HUA represents administrative units dominated by hilly areas.

	Age	**Gender**	**%**	**Education**	**%**	**Profession**	**%**	**FUA%**	**HUA%**
Min.	23	**Male**	83	**Professional school**	1	**Mayor**	19	33	67
Mean	48.19	**Female**	17	**High School**	12	**Farmer**	23	30	70
Max.	66			**Post High School**	1	**School Director**	19	33	67
				University	86	**Priest**	21	40	60
						Police Officer	18	32	68

3.1 Statistical analysis

Data coding was performed using a tabular data application (Open Office) by assigning codes from 1 to 5 for the Likert scale data and from 0 to1 for dichotomous scale data. After the coding, the raw data was exported in R stat (R Core Team, 2018), where the data was manipulated to obtain the format required by the specific functions used to analyze the data.

There is a never-ending debate if Likert data is fit to be transformed to an interval scale by considering that the distance between ordinal scale elements is the same (Cliff, 1996). Some argue that Likert scale data typically do not meet the assumptions of the parametric tests (Baker et al., 1966; Stevens, 1968; Gaito, 1980; Knapp, 1990; Jamieson, 2004; Gardner and Martin, 2007; Mangiafico, 2016; Kero and Lee, 2016). Others argue (Amstrong, 1981; Kanpp, 1990; Pell, 2005; Norman, 2010) and prove with study cases (Carifio and Perla, 2007, 2008; de Winter and Dodou, 2010; Mircioiu and Atkinson, 2017) that while conceptually parametric statistics it is not fit, in practice the differences are not important, and in this regard using the parametric statistics brings into analysis their robustness and sensitivity.

While this issue is still disputed in regard to what methods are better for Likert scale data, parametric or non-parametric, we have chosen to comply with both approaches: the standard statistical assumptions (especially regarding the failure of parametric statistics in the case of extreme values of ordinal data and unequal interval scales: Baker et al., 1966, Armstrong, 1981) and the parametric statistical assumptions that allow the conversion of the ordinal scale to an interval one, and to compare the results. We avoided the consideration of Likert data as nominal categories since the ordering will be lost (Agresti, 2010; Mangiafico, 2016).

The statistical analysis was performed in three main steps (Openheim, 2001): (i) univariate analysis, (ii) bivariate analysis, and (iii) multivariate analysis.

In the case of a non-parametric scenario (ordinal scale), the univariate analysis was performed by plotting on the Likert scales the relative frequencies in order to have a first overview (descriptive statistics) of the data. This approach is straightforward in identifying the overall perception of the stakeholders toward a particular risk or factor and in ranking it by the majority of data (the likert R stat package is plotting the Top 2Box score percentages, which is another measure used for Likert scale data). Also, the mode of Likert scale perception was computed both for risks and factors and their break by stakeholder type, this statistic being seen by some as not useful (Mangiafico, 2016).

Further, the bivariate analysis consisted of applying various measures of association and independence between the variables to the cross-tabulations. First of all, we tested the association of the perceptions toward the risks/factors and stakeholder characteristics (stakeholder type, village, commune, flood vs. hilly, gender, and education) in two-way tables.

We used the Asymptotic Generalized Pearson Chi-Squared Test (chisq_test() function) from the R stat coin package (Agresti, 2002; Hothorn, 2008) to test the association of the observations of two variables in a contingency table, one ordinal and the other categorical (two-way cross-tabulation with the ordinal variable in the column). The null hypothesis is that the variables are not associated one to each other, so they are independent. If the null hypothesis is rejected, then the variables are having a certain degree of association, so not independent. This presence of independence is interpreted, for example, when the perception of different risks or factors of stakeholders is cross-tabulated as a lack of difference in perception, responding to the first research question. Vice-versa, the presence of dependence means that the perception of the stakeholders about a certain risk/factor is different from the other risk/factors. When the stakeholder type is cross-tabulated with the Likert scale responses for a certain risk/factor, the independence is interpreted as a lack of difference in perception due to stakeholder typology responding to the second research question. Vice-versa, the presence of dependence means that the perception of the stakeholder is influenced by its appurtenance to certain groups/typologies. This test can be applied to categorical and ordinal data, but the ordering is not considered, and the strength of association is not available.

Kruskal-Wallis rank sum test is more powerful because it uses the mean of the rank to assess if there are differences in the responses of different groups (Agresti 2002, Magnifiaco, 2016), not requesting further assumption about the distribution of the data, although the test is fit for small samples in which there are not normal distributions. The null hypothesis states that the groups represent populations stochastically equal (if the shape of the distribution is not considered to be known and of similar shape and spread), while the alternative hypothesis is that at least one sample stochastically dominates another sample. Post-hoc analysis can pinpoint which groups are different from other groups (Mangiafico, 2016). In the case of our research questions, this test is able to show if the perception of stakeholders is different by risk/factor (RQ1) or if the perception toward a certain risk/factor is significantly different as a function of stakeholder characteristics. The test was performed using the kruskal.test() function from R stat (R Core Team, 2018).

When the difference exists (the null hypothesis is rejected), the statistic Freeman's epsilon-squared was used to assess the strength of the difference between one ordinal variable and one nominal variable (Mangiafico, 2016). This statistic ranges from 0 to 1, with 0 indicating no association and 1 indicating perfect association. Values bigger than 0.26 were regarded in our case as a measure of powerful association in the presence of dependence (considering the values proposed by Mangiafico, 2016). This measure was computed using the epsilonSquared() function from the rcompanion R stat package (Mangiafico, 2021). A post-hoc analysis was performed in the cases where the Kruskal-Wallis test shows significant differences in the groups to show which groups are different from each other group. The post-hoc analysis uses pairwise Mann–Whitney U-tests that allow, based on the p-value, the identification of significantly different items (Mangiafico, 2016).

Finally, we applied a multivariate method, correspondence analysis for those questions and risks that were found conclusive in the bivariate analysis step. CA (Correspondence Analysis) is a graphical method applied for exploring the relationships between variables in contingency tables (Greenacre, 2007) by assessing the interaction (Jobson, 1992). The theory behind the method is straightforward, based on the singular value decomposition of the matrix data structure of the contingency table. We have chosen this method because it describes our data graphically to show the differences between stakeholder types or other categorical variables, especially for those with big Freeman's epsilon-squared values. The Likert scale with the answer to the question is considered the dependent variable, and the variants of the response or the categories of stakeholders or other associated categorical data (flooded or non-flooded communes) are the independent data.

We used mainly ordinal versus categorical cross-tabulation tables and CA contribution biplots (with ca R stat package, Nenadic and Greenacre, 2007, Greenacre, 2013), which display the data in a two-dimensional space using the first two extracted principal coordinates (and which should contribute to the majority of the variance) from both rows and columns, in order to get an idea of the association between rows and columns variables of the two dimensions. The plot is asymmetric, the values of the axes corresponding to the standardized residuals and the points that are contributing very little to the components are located close to the center of the biplot. The column variables (e.g., stakeholder type) are displayed as oriented vectors, while the Likert scale counts are displayed as dots with size proportional to the count. The orientation of the stakeholder type vector toward one of the axes shows its contribution to the variance of that axis. If the angle between the vector and the lines is 45°, then the contributions to the two axes are the same, while if the angle is smaller toward a certain axis, the greater the contribution to the variance of that axis is. The length of the arrow vectors is proportional to their contribution to the two-dimensional solution. Since we have an ordered variable, and the distances between the categories are not the same, there is no logic to take into account the distances along the axes of the CA plot and to make comparisons (although this type of plot allow this, in the sense that the axes are scaled to a common scale). The points that are close to the center of the biplot contribute very little to the solution, while those which are too far might be considered outliers.

Usually, the differences between the responses of different stakeholder types are either striking and showing the overall importance of every stakeholder type, either non-significant, so we have chosen the CA plots because these show us graphically easily the associations. The circles have the color intensity and the size (of the diameters of the circle) depending on the relative frequency, while the arrows have only the color intensity proportional to relative frequency. In this way, low-frequency categories located on the periphery that give the false impression that are important can be identified because they are pulled toward the center of the biplot (Greenacre, 2013). These can also be seen on other types of plots (Likert plots, bubble plots, mosaic plots, etc.) but often require more attention to be spotted.

For the scenario in which the Likert data is considered on an interval scale, and the parametric statistics can be used in the first step, the descriptive statistics were computed in terms of mean and standard deviation. Bubble plots, heat plots, and density plots are also good for having a view on the ranking of the perception and were generated. Normality testing was not performed since we cannot expect this from Likert scale data, but considering the size of the dataset, the linearity of the data can be assumed (the density plots revealing also skewed distributions).

Cronbach's alfa, Guttman's Lambda 6, and omega coefficient (Zinbarg et al 2006) were used to assess the reliability (strength of internal consistency) of the Likert scale items for every question that has them and is computed as a function of numbers of items in the question, the average covariance between pairs of items, and the variance of the total score of each item. The values of these coefficients range between 0 (independence, no correlation, no covariance) and 1 (high covariance). R stat psych package alpha function was used to compute Cronbach's alfa and Guttman's Lambda 6, while scaleReliability() function (Peters, 2014) from userfriendlyscience package was used for omega coefficient.

One-way and two-way ANOVA were applied for every question and its items to test if there is a significant effect of the factor/risks or stakeholder characteristics (independent variable) on their perception (dependent variable). The lm() from base R stat was used to obtain a linear model, and the Anova() function from car R stat package (Fox and Weisberg, 2019) was used to conduct the one-way ANOVA of type II. This implementation of ANOVA is for analysis when an interaction is not significant (this is not a treatment experiment). The normality of the residuals of the linear model was tested, the ANOVA test statistic was F, and the post-hoc analysis was done using least-square means for multiple comparisons. The post-hoc analysis uses lsmeans (Russell, 2016) and multcompView (Piepho, 2004) R stat packages with marginal() and cld() functions to output for every least square mean a code that if is shared by the categories is showing that these categories are not significantly different from one another. We used ANOVA and not logistic regression as a parametric method of multivariate analysis because we believe that ANOVA is better suited to show differences between categories compared to logistic regression, which is mainly used for classification and prediction.

4 Results

The extended statistical analysis results are comprised in Appendix A (Tables A2-A12), while for selected questions, the tables or the plots are presented in the results and discussion sections. In addition, the descriptive statistics are presented in Tables A2 and A3 for the non-parametric approach and Tables A4 and A5 for the parametric approach. Together with the plots, these tables helped us to synthesize the main results and to respond to the main research questions.

In Table 2, the Asymptotic Generalized Pearson Chi-Squared and Kruskal-Wallis rank sum tests results are shown for the question items. In Table A6 from Appendix A, the same is shown for stakeholder types, administrative units, and floodplain vs. hilly areas. It can be seen that in the case of all the question items (Table 2), the null hypothesis is rejected, and there is association present, at least one sample being dominant, thus the response to RQ1 is affirmative. In the case of stakeholder types, administrative units, and flood vs. hilly (Table A6 from Appendix A), for some questions in the case of the first two, the null hypothesis is rejected, while for the last, the majority. The strength of dominance is indicated by Freeman's epsilon-squared statistics (Table 2), which show moderate strength for the first questions (Q1-Q4) and low strength for the rest. Thus the response to RQ2 is affirmative for the majority of the questions, while for RQ3, the response is affirmative for some relevant questions only. Question by question results and interpretations based on the non-parametric tests are introduced further in the article.

Table 2 The non-parametric tests results for question items

items	**Chi-sq**	**df**	**p sig.**	**K-W**	**df**	**p sig.**	**epsilon**
Q1	189.40	20	****	144.17	5	****	0.20
Q2	296.91	20	****	187.83	6	****	0.23
Q3	292.14	20	****	203.30	6	****	0.25
Q4	271.22	20	****	193.02	6	****	0.23
Q5	78.13	20	****	78.04	6	****	0.09
Q6	81.49	20	****	81.39	6	****	0.10
Q7	113.44	20	****	113.32	7	****	0.11
Q9	45.42	20	***	26.22	6	***	0.03
Q10	63.83	20	****	51.25	6	****	0.06
Q12	118.11	20	****	80.35	6	****	0.09
Q13	268.71	20	****	164.33	6	****	0.17
Q14	108.11	20	****	64.03	5	****	0.09
Q16	100.53	20	****	80.27	5	****	0.11

P sig. is the level of significance: ns >0.05, * <=0.05, ** <=0.01, *** <=0.001, **** <=0.0001

The post-hoc analysis results using pairwise Mann–Whitney U-tests are represented in Table 3 only for the question items, the items sharing a coded letter (u-z) being not significantly different. This table is showing synthetically the situation that can be extracted from the Likert plots, and it is responding affirmatively to RQ1.

Table 3 Post-hoc analysis results using pairwise Mann–Whitney U-tests for the questions items (a-h); u-z values sharing a letter are not significantly different; a-h correspond to the question items shown in Table A1

Question/items	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**

Q1	z	x	w	z	y	xy		
Q2	w	yz	w	y	z	x	w	
Q3	zw	y	z	u	u	x	w	
Q4	z	y	z	yw	y	x	z	
Q5	y	yz	y	w	zw	x	y	
Q6	yzw	yz	y	w	zw	x	y	
Q7	xy	xy	x	z	z	x	x	y
Q9	x	x	x	x	y	x	x	
Q10	x	xyz	yz	xy	w	xy	z	
Q12	x	y	xz	x	w	yz	y	
Q13	y	x	yz	z	yz	yz	w	
Q14	y	x	z	x	z	z		
Q16	xz	z	y	x	xz			

In Table A7 from Appendix A, the same test results as above are shown for various categories for every question item. Besides the stakeholder type, administrative unit, and floodplain vs. hilly area, the age category (young, mature, old), gender, and education were considered. The results are a synthetic version of the Likert barplots where the associations can be seen graphically and confirmed by the Top 2Box score of the proportions.

The reliability of the question items measured by Cronbach's alfa, Guttman's Lambda 6, and omega coefficient is shown in Table 4, the results indicating that the question items are consistent and reliable.

Table 4 The reliability of the questionnaire questions

	Cronbach std. alpha*	**G6(smc)****	**Omega*****
Q1	0.76	0.77	0.77
Q2	0.6	0.67	0.68
Q3	0.74	0.77	0.74
Q4	0.71	0.77	0.72
Q5	0.58	0.64	0.61
Q6	0.6	0.59	0.62
Q7	0.5	0.52	0.49
Q9	0.88	0.88	0.88
Q10	0.84	0.85	0.86
Q12	0.8	0.82	0.83

Q13	0.68	0.7	0.65
Q14	0.82	0.81	0.82
Q16	0.57	0.54	0.59

*The standardized alpha based upon the correlations, **Guttman's Lambda 6 reliability, ***McDonald's omega estimate of the general factor saturation of a test

In Table A8 from Appendix A, the one-way ANOVA eta squared, the significance level, and the post-hoc analysis using least-square means results are shown; the sharing of a code between question items means that are not significantly different from one another. For the questions with a dichotomic response, the logistic regression results are shown in Table A9 from Appendix A.

4.1 The level of threat

The first question addressed to the interviewees was designed to investigate which main socio-economic and environmental factors could affect the communities' quality of life (Fig. 2). The majority of stakeholders (61%) consider that the level of development is the main factor that can threaten the quality of life in their territory (Fig. 2). It follows the risks induced by natural hazards (57% of responses), climate change (40%), criminality (37%), environmental pollution (27%), and technological risks (8%).

The level of development and natural risks are perceived similarly as important threats, while criminality, environmental pollution, and climate changes are likewise lower (Table 3 and A8).

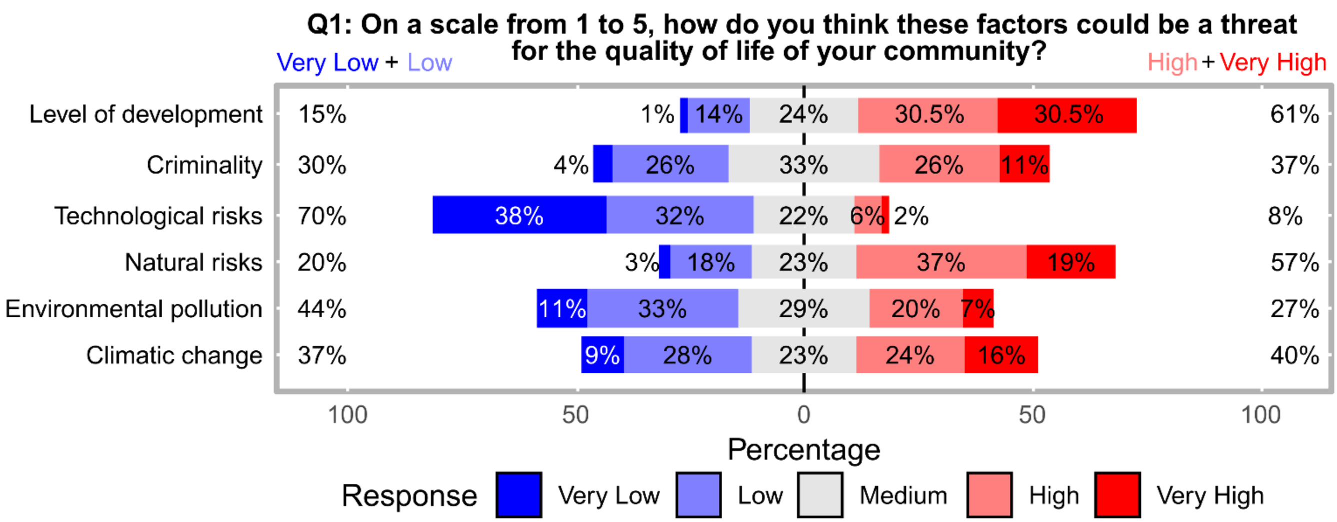

Figure 2: The Likert plot of the stakeholders' responses regarding the perception of the factors that can threaten the local community.

Generally, the stakeholders who participated in the present survey consider droughts as the most threatening natural hazard for their communities and personally (Fig. 3and 4).

Water scarcity is a direct consequence of the continental climate of the region that affected the agricultural economy of North-Eastern Romania for centuries (Mărgărint et al., 2021; Niculiţă, 2020). Many stakeholders reported a drastic reduction in the number of cattle, which, in the driest years, can reach 80% of the total animals of the households in the villages: “There are ten years since I had serious problems every year. I achieved a special car tanker to get water for livestock. And very little remains for vegetable crops. I get water from the reservoir (5 kilometers away), and I don’t know what will happen when it disappears.” (a farmer, 35 years old, managing 300 hectares of agricultural land and 35 cows). They also consider that this hazard will affect their communities for many years from now. Alongside the dramatic reduction of agricultural production, the most dangerous problems occur regarding livestock).

Earthquakes represent the second threatening hazard. The memory of the 1977 Vrancea earthquake, when Iaşi County registered the highest number of buildings affected in Romania (Georgescu and Pomonis, 2008), is still vivid in many stakeholders' memory. Although the norms in constructions were strongly upgraded after this event, the discipline in buildings decreased suddenly due to the lack of legislation after 1989. How many dwellings have been built up in the last years is not far from the interviewees' knowledge and, from this point of view, many raised serious questions regarding the resistance of the new constructions: “Many who bought new homes think they are new and strong, but at the next big earthquake, they will find that they were built just to be sold.” (a mayor, 58 years old, personally affected by the 1977 earthquake). The population’s level of dissatisfaction is constantly increasing concerning public works, transportation, and the environment. Considering that any significant event did not trigger these permanent stressors, the actual situation of risks associated with natural hazards can be much more profound, almost unknown to many of the inhabitants and their leaders.

Regarding the differences between the perception of the threat to the community versus themselves (Fig. 3), the stakeholders' perception is similar, except for snowstorms, rainstorms, and earthquakes, where the community threat is perceived as higher than the personal threat.

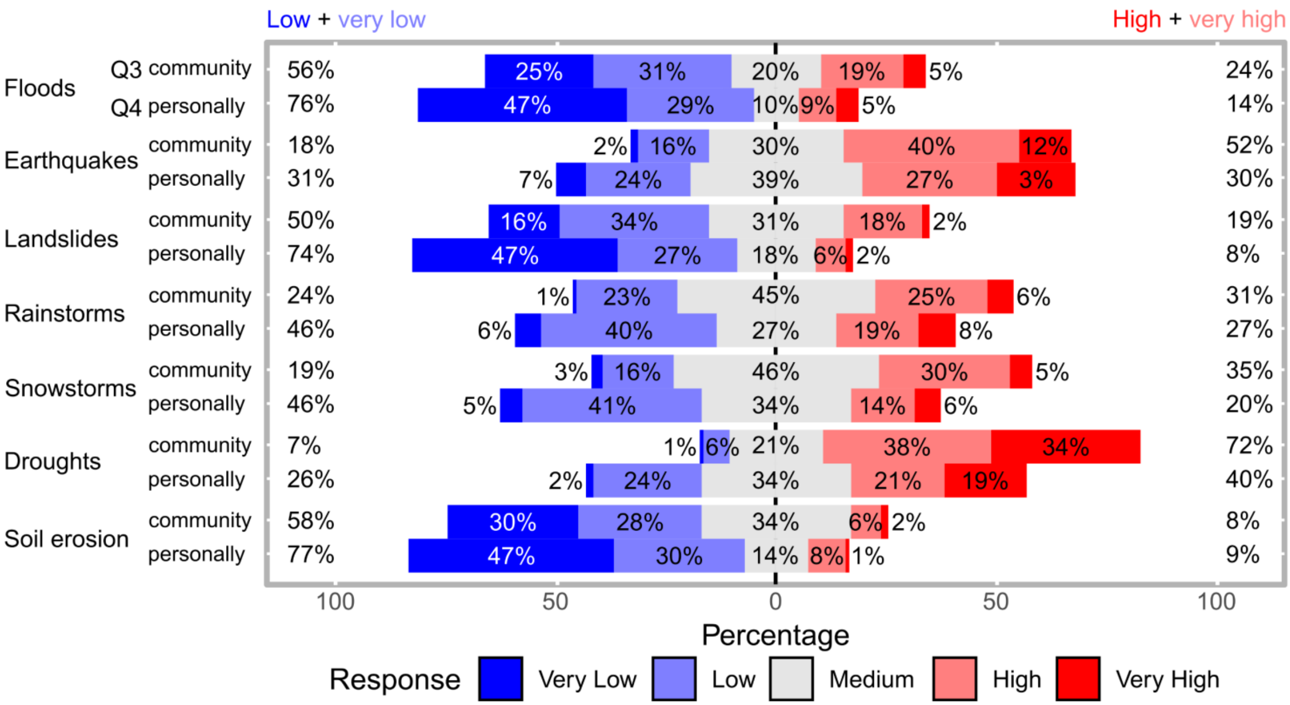

Figure 3. The Likert plot of the stakeholders' responses regarding the perceived threat of natural hazards for the community (Q3) and own person/household/income (Q4).

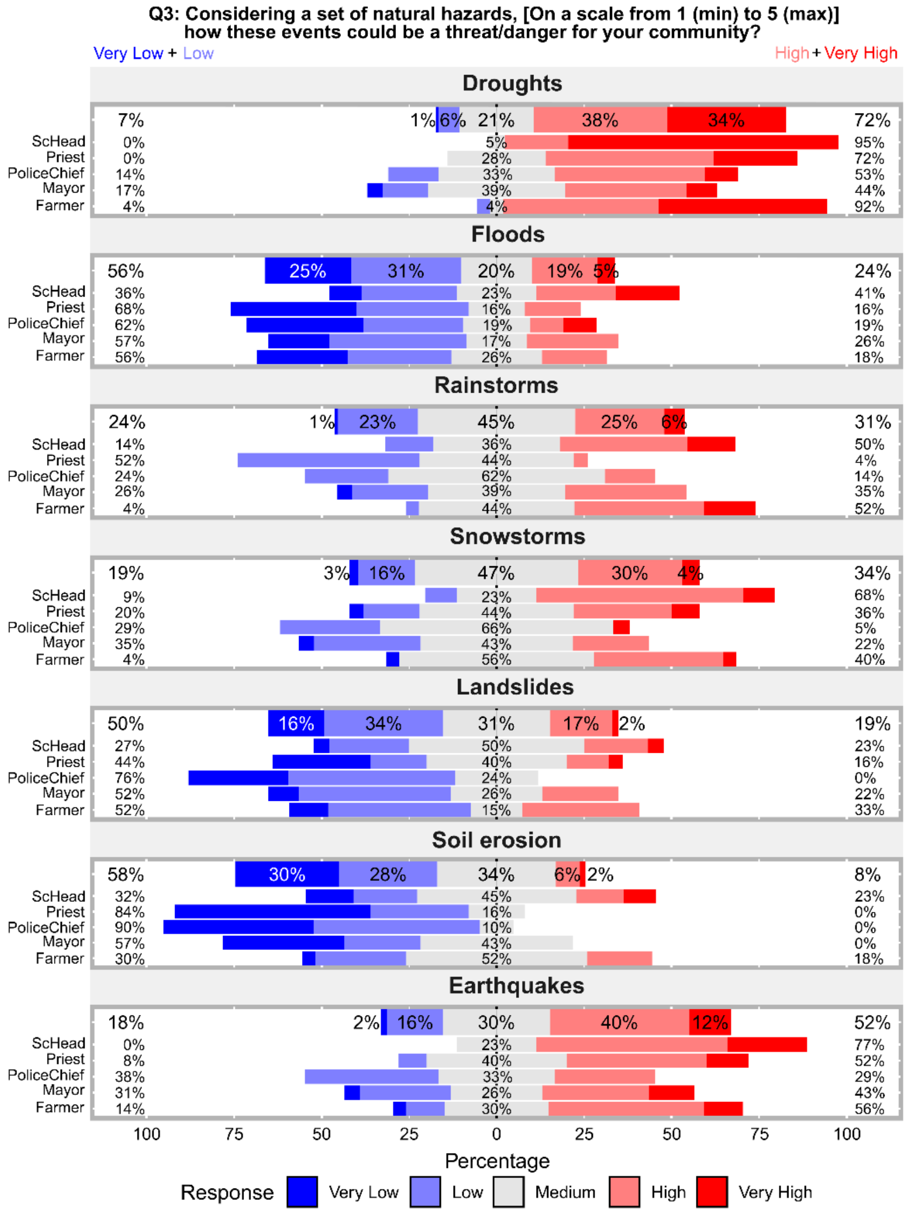

Figure 4: The Likert plot of the stakeholders' responses regarding the perception of the natural hazards that can be a threat to the local community, split by natural hazard and stakeholder type.

A middle position is occupied by the hazards that registered a higher frequency: rainstorms and snowstorms had an increasing trend in the last decade in the study area. Consequently, their impact on communities is quite essential. During the year, the strongest storms occur in late spring and summer. In some cases accompanied by hail, the most significant damages are recorded in agriculture and newly built areas with insufficient drainage infrastructure. When these phenomena occur in large areas, they can affect the transports, trigger soil erosion, and generate high flows along fluvial channels, leading to the destruction of the bridges, the erosion, and siltation of the drainage and fluvial channels, etc. These issues were invoked as the most pressing by farmers and mayors, and police chiefs: “I am here for few years. In the center of the locality, there are no problems, there is asphalt on the street, but towards the valley, those who have moved to the house in the last four years live a nightmare every time it rains. The road is muddy and becomes impassable.” (a police officer in a settlement with many new dwellings, 34 years old).

Climate-related hazards that have a relatively low temporal frequency, like floods, landslides, and soil erosion, are perceived as imposing a low threat in general. The landslide risk is high in hilly regions of NE Romania (Micu et al., 2017, Mărgărint and Niculiţă, 2017, Bălteanu et al., 2020). In the last century, one of the most significant events inside the settlements took place 50 years ago in a succession of years with high precipitations (Pujină, 2008). With few exceptions, the memory of those events seems to erase. But the risk is still high, and people will face again with landslide reactivations in the years with the same increased pattern of precipitations (Niculiţă, 2020). There is a lack of prevention behavior in terms of recent expansions of built areas due to several factors: investors’ desire to build and sell, lack of knowledge and awareness of the danger of those who buy, and those who should take decisions regarding the expansion of built-up areas. “In our commune, the landslide risk has been solved: we have the study regarding landslide hazard and risk in an updated form, so we are in line with the legislation.” (the mayor of a commune affected by landslides in 1969-1972, 66 years old).

The outputs of The Kruskal-Wallis rank-sum test and Freeman’s epsilon-squared statistics (confirmed by the ANOVA and logistic regression) show correlations among every category of natural risks and a set of socio-economic and geographic variables (for further results, see Tables A7, A8, and A9 of Appendix A). The most significant differences are in stakeholder type (answering the RQ2), gender, age, and spatial localization, and geomorphological context. At the same time, education does not influence the response. The results indicate that the risk perception is dependent on stakeholder types, which respond affirmatively to RQ2. Also, it has been found that the age of the respondents is an essential factor regarding certain risks (Table 5) because some of them might be born after certain important hazard events such as the 1977 earthquake, 43 years ago, or the landslides events such as those between the ’70 and the ’80 (Niculiță et al., 2017, 2018). For floods, climatic hazards, and soil erosion, it seems that younger respondents are more aware.

Table 5 The mean age of the stakeholders by the response to the questions if the natural hazards have produced direct damage to the stakeholder

		No	**Yes**
Q6	**a**	48.5	47.3
	b	47.9	49.2
	c	47.9	49.7
	d	48.7	47.4
	e	48.4	47.8

	f	48.9	47.7
	g	48.7	45.6

The CA contribution biplot for Question 1 from Fig.4 shows the correspondence between the perceived role of natural hazards as threats to the local community by different stakeholder types, considering the first two dimensions, that sum 96,8% of the variance. The plot shows striking differences in the stakeholder type perception toward natural hazards (which overall are considered as threats to the quality of life – there is a significant strong association of stakeholders' type perception as is shown in Table A7 from Appendix A for Q1 item d), by their different contributions to variance axis; if no difference would be present, the arrows will point to one main axis and will be very close to the center. Police chiefs and priests who perceive natural hazards as low and medium threats, mayors and farmers perceive them as high threats, and school directors that perceive them as very high threats. The explanation of the low perception of hazards as threats to the community's quality of life in the case of priests and police chiefs is given by their relative low knowledge of natural hazards provided by their profession. School directors, mayors, and farmers have a high level of awareness associated with the threats for the quality of life of the following factors: level of development (91% of school directors), natural risks (82% of school directors and 81 % of farmers) and climatic change (78% of farmers, 55% of school directors). The exception is related to technological risks, given the predominant rural background of the communities. Priests and police chiefs, in general, expressed a low level of perception regarding the threats to local communities, with some exceptions: e.g., police chiefs regarding criminality, which is their duty (the same threat is seen by school directors, in association with their high level of childcare).

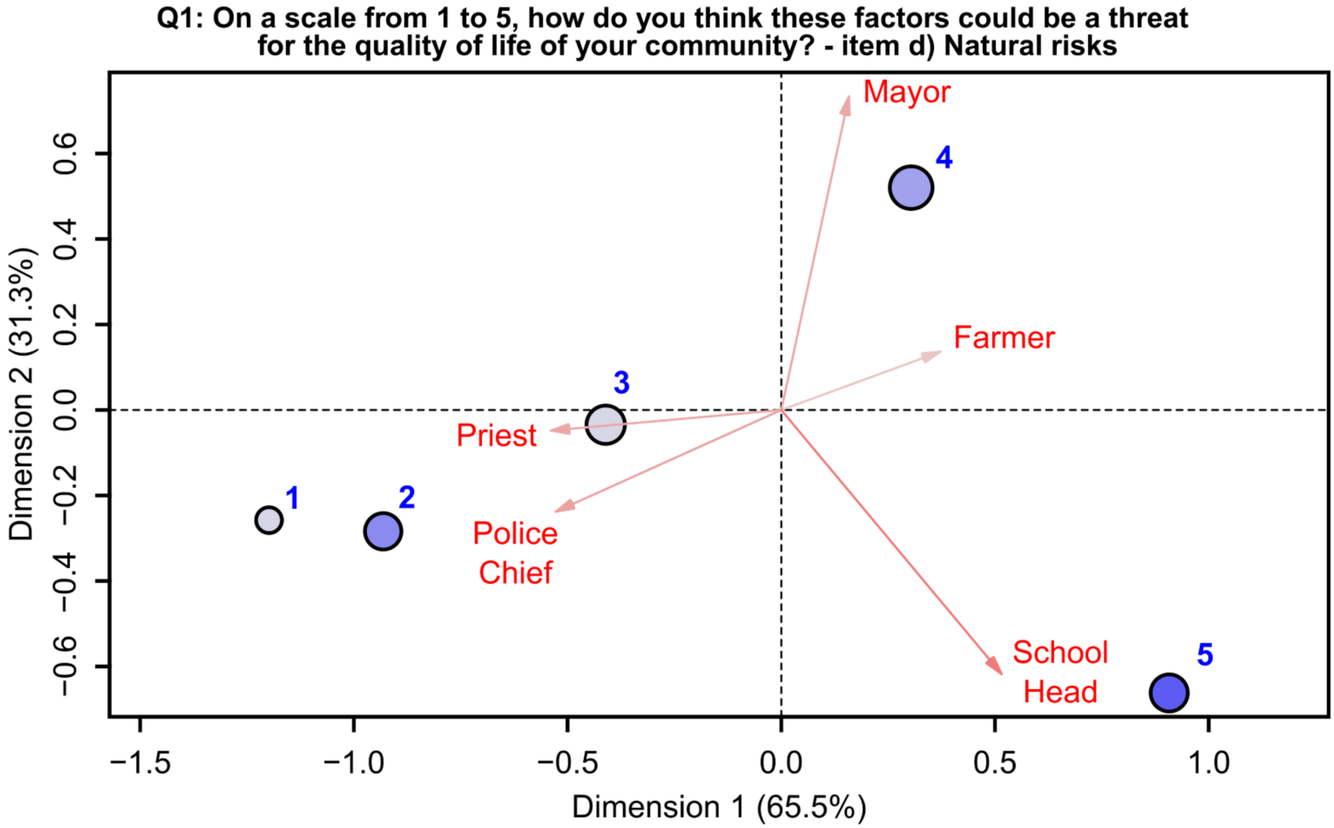

Figure 5: The CA contribution biplot for the natural risks' role as threats for the community's quality of life as perceived by the stakeholders according to their type; the orientation of the stakeholder type vector toward one of the axes show its contribution to the variance of that axis, while the arrow length is proportional with their contribution to the two-dimensional solution; the circles have the color intensity and the size (of the diameters of the circle) depending on the relative frequency of the responses on the Likert scale.

The highest values of the perceived threat associated with droughts (Fig. 4) have been registered for school directors (95%) and farmers (93%) who expressed a great concern compared to the other stakeholders. Also, the earthquakes are seen as a significant threat by school directors (77%), farmers (56%), and priests (52%). By interpreting the enlarged discussions during the interview, this could be considered as a consequence of still lively memories of the 1977Vrancea earthquake (Armaş, 2006), a social trauma of the Romanian people, but also to present-day other factors: (i) a high vulnerability characterizes the majority of institutional buildings (especially schools and churches) to earthquakes (Mosoarca and Gioncu, 2013; Albulescu et al., 2020) and (ii) the frequent exercises for the improvement of the earthquake preparedness (in schools usually these exercises take place annually). The problem of the vulnerability of old buildings in Romania represents a constant public and scientific debate (Armaş, 2012; Banica et al., 2017) and, in this sense, we also raise on this occasion an alarm signal regarding the need for essential investments in the modernization of public spaces in urban and rural areas in Romania.

From these general results, significant differences have been recorded among the two geomorphological types of the administrative units (Fig. 1 and Fig. 6): floodplain administrative units (FAU) and hilly administrative units (HAU).

The results highlight that stakeholders have different levels of perception related to different hazards, according to the main past events that have been recorded in the last decades: in the floodplain administrative units (FAU in Fig. 6), there is a significantly higher degree of awareness concerning flood risk and possible threats, while in the hilly administrative units (HAU) the level of threat associated to landslides and soil erosion is higher than in the FAU.

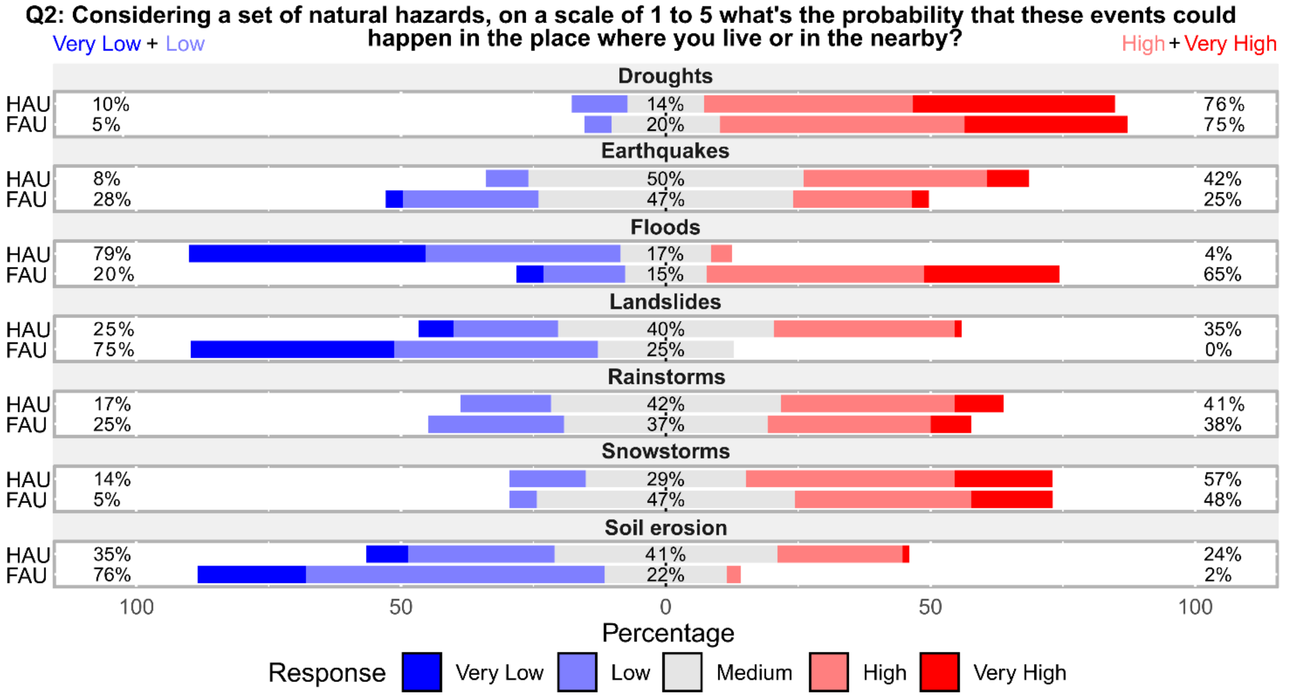

Figure 6: The Likert plot of the stakeholders' perception of the probability of natural hazards occurrence concerning the dominant geomorphological landforms of administrative units (AU): floodplains (FAU) and hills (HAU).

Again, droughts are the most life-changing natural hazards with the highest likelihood of occurrence. Rainstorms, snowstorms, and earthquakes follow them. A lower level of probability was assigned to soil erosion, landslides, and floods (Fig. 6). But here, there are essential differences, depending on the geomorphological type of the locality. The stakeholders who come from floodplain settlements have indicated a higher probability for floods than the others (HAU stakeholders) and a lower probability for landslides and soil erosion. This finding responds affirmatively to RQ3.

The main geomorphological characteristics which can influence different hazardous processes and the distance to the potential risk areas constitute essential factors of how different people perceive different risks (Bickerstaff and Walker, 2001; Heitz et al., 2009; Gao et al., 2020). Some natural hazards affect large areas (droughts, earthquakes, or snowstorms), while others (e.g., landslides, floods) are spatially concentrated in direct relation to topography characteristics at the local scale. From this point of view, the settlements from the study area, as part of the Moldavian Plateau, have been constantly affected by landslides and floods (Văculişteanu et al., 2019) and their consequences are found in the answers given by the interviewees. Table 2 and A7 of Appendix A and Fig. 6 shows that the geomorphological context of the area where the stakeholder works is important in its perception regarding floods and landslide risk (although the investigation of the Likert plot is much more intuitive than the statistical tests or ANOVA), responding affirmatively to RQ3. These results are seen in the context of a social trauma of the inhabitants managed by the stakeholders during the evacuations of some settlements along Prut Valley in 2008 and 2010. Due to the risk of flooding of the inhabited areas, in July 2008, over 3000 inhabitants from Iaşi County, including Victoria, Ungheni, and Ţuţora communes (Fig. 1), were evacuated (Ziarul de Iaşi, 2008).

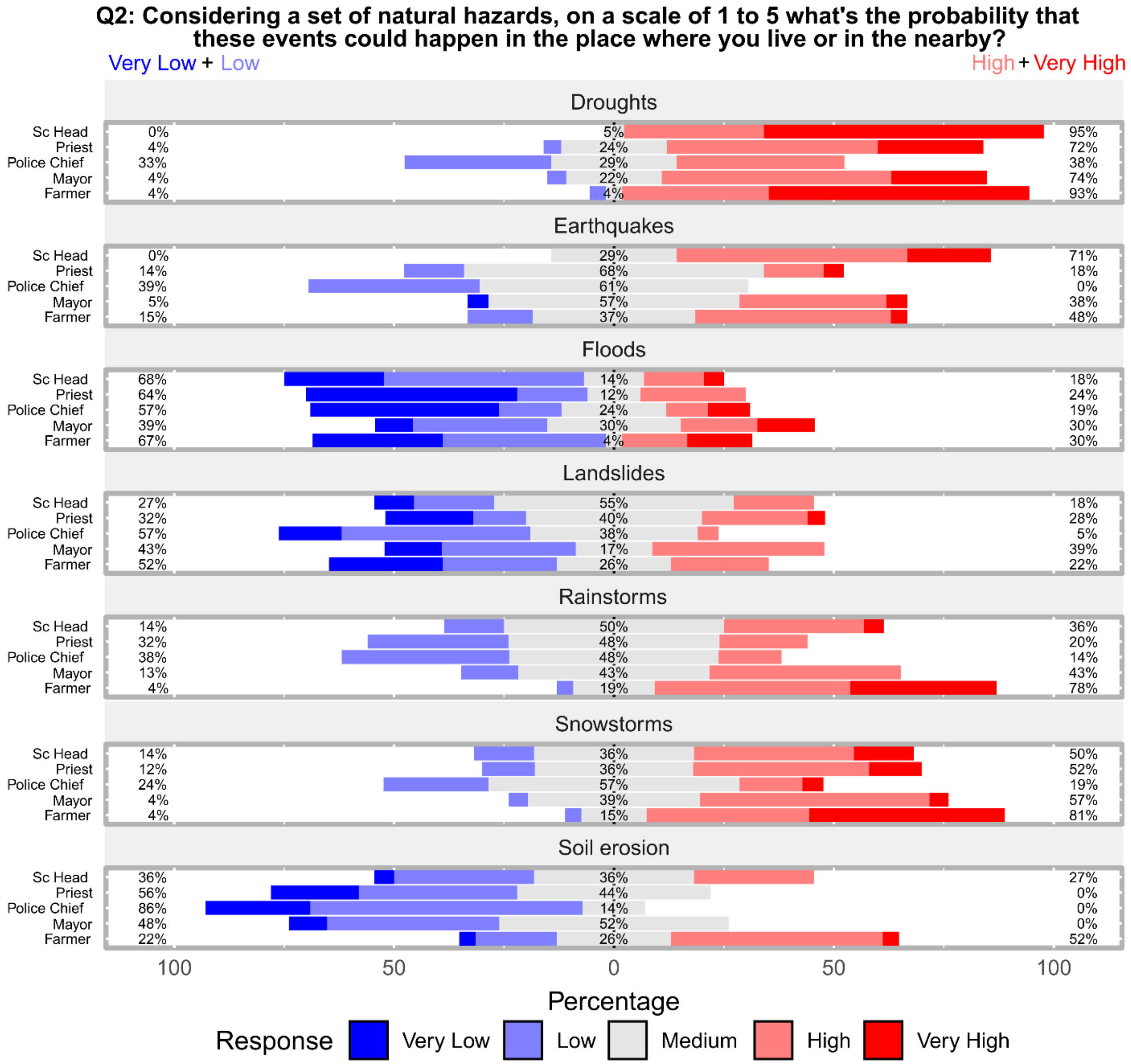

Figure 7: The Likert plot of the stakeholders' responses regarding the perceived likelihood of different natural hazards.

Concerning the likelihood of occurrence of natural hazards (Fig. 7), some types of natural hazards are perceived to increase in the near future, especially climatic-induced hazards: droughts (86%), rainstorms (68%), and snowstorms (64%). Landslides and soil erosion are perceived as not increasing, while for earthquakes, the results are balanced.

4.2 Personal experience and knowledge

Personal experience is one of the most critical factors influencing risk perception (Weber, 2006; Van der Linden, 2014; Knuth et al., 2015; Öhman, 2017). The study participants indicated that they were affected mainly by droughts, rainstorms, and snowstorms, with farmers bearing high costs (Fig. 8). A large proportion of them was affected by droughts (93%), rainstorms (78%), snowstorms, and soil erosion (48%). According to their activities and responsibilities, stakeholders are affected by natural hazards in their daily life, exposing them to different vulnerabilities. Also, the knowledge about the community's past events makes them aware of the natural hazard threat at the community level but not at a personal level, especially in natural hazards that are not related to certain physiographic conditions (earthquakes, rainstorms, and snowstorms – see Figure 9).

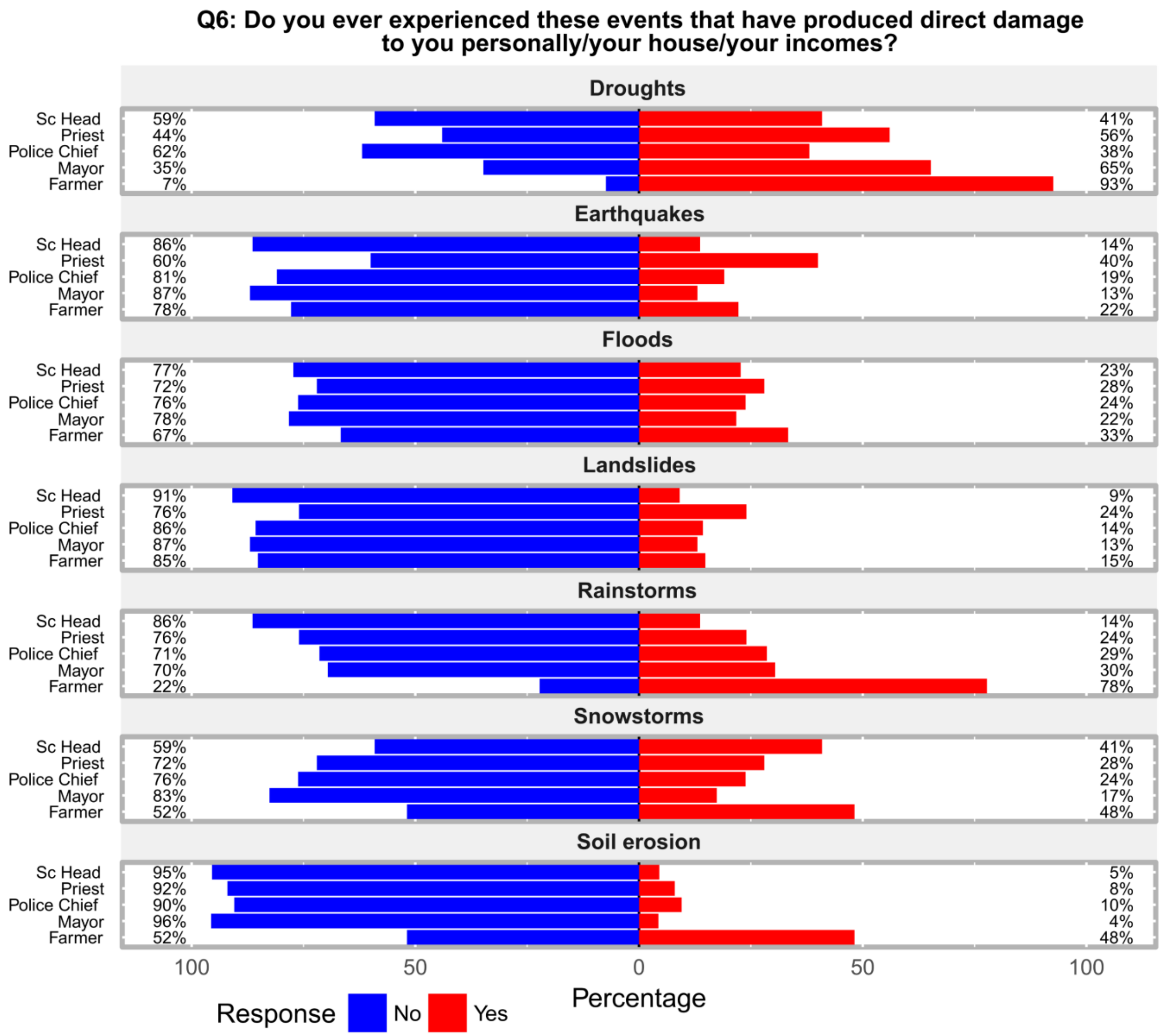

Figure 8: The Likert plot of the stakeholders' past experiences of natural hazards.

The other stakeholders were affected in a smaller measure by soil erosion. This process can generally pose problems only to those who directly connect with the land, which affects lesser the build-up areas. It is shown that experience is higher with age (Table 5), especially for the analysis with the earthquake occurrence (the mean age is lower for those that reported no damage due to earthquakes – Table 5 Q6 b), but also for landslides (Table 5 Q6 c). These are disasters that, for their high magnitude, can be impressed vividly in people's memory. Their role in disaster risk management and coordination allows them to remember the most significant events they served the community. In contrast, slow onset events (e.g., droughts or soil erosion) can disappear quickly.

The knowledge of participants about natural hazards has been asked through several sub-questions. Stakeholders get information differently about the probability of occurrence and the severity of these events. The majority get information from the TV/radio (82%), friends/family and community peers (60%), and social networks on the internet (53%). The more official channels are the least represented with national information initiatives (47%), school (44%), local administration (41%), and volunteer associations (40%). Looking at the triggering factors of those events, stakeholders mentioned all sub-sections from the questionnaire (Table A1 from Appendix A) that they consider to have an important influence on the negative impact of natural hazards. Some exceptions have been registered for 57% of mayors who responded that uncontrolled urbanization and unmanaged land use planning are not influencing the occurrence of any hazard. Local administration is controlling the land use planning, and, in any case, this might be the cause of negative consequences derived by climate extremes and geological movements.

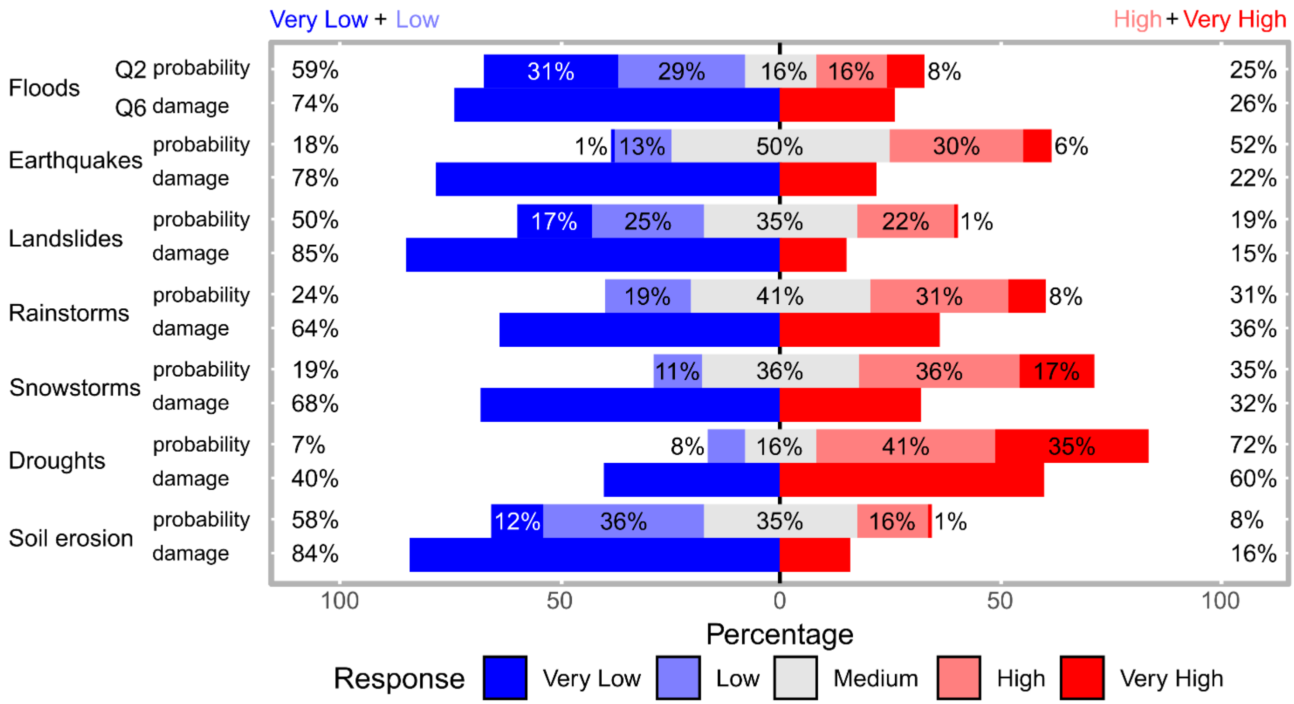

Figure 9 Likert plot of the stakeholders' responses regarding the perception of the probability of natural hazards appearance in the local community (Q2) and the experience of them producing damage to the person/household/income (Q6).

The majority of priests and mayors do not consider that climate change can exacerbate the negative consequences of natural hazards (56% and 22% of them indicated "low" and "very low" respectively). Among the solutions to avoid the negative consequences of natural hazards, results showed a uniform answer among all stakeholders, except the victims' compensation scheme, specially marked by mayors. Financial compensation schemes represent a particularly neuralgic issue in the post-communist society of Romania. Many interviewees highlighted that these compensations could encourage non-compliance with the law, especially regarding unauthorized constructions on lands at risk of floods and landslides.

4.3 The level of preparedness

The level of preparedness was investigated individually and regarding the community, they belong. Overall, the results indicate a low level of preparedness in the case of all the natural hazards discussed (Tables A2, A3, A4, and A5 from the Appendix). The lowest ranks were given to soil erosion (64%), droughts (58%), earthquakes and landslides (55%), floods (52%), rainstorms (50%), and snowstorms (35%). It seems that, despite a low level of readiness, stakeholders feel a bit more prepared to withstand the consequences of storms and floods. Snowstorms affect the communities in winter (and exceptionally in spring, the case of April 2018), and agriculture do not suffer. Life in rural areas can be more comfortable compared with urban areas. In Romania, after the recent intense snowstorms such as those from January 2008 (Georgescu et al., 2009) or January-February

2012 (Bălteanu et al., 2013), rural settlements have been endowed with specialized equipment in rapid intervention, especially in the case of roads, and these endowments seem to improve the respondents' concerns.

Similarly, the existing embankments along rivers (Prut, Jijia, and Bahlui) have often been invoked during discussions as ensuring a relatively good level of protection, especially of built-up areas. The lower level of preparedness is associated with soil erosion and landslides, for which many stakeholders declared their lack of knowledge concerning the processes themselves and related protective measures. The survey results made us respond affirmatively to RQ2, which states that the level of preparedness depends on the risk type.

The same pattern of the answers has been registered in the assessment of the communities' preparedness level. However, preparedness was low, and stakeholders affirmed strongly that their and community preparedness could increase by good training and knowledge of natural hazards occurrence and mitigation practices. Asking the stakeholders how much do they think that their personal knowledge might increase the level of preparedness of the community (Q11 from Table A1 from Appendix A) reveals significant differences among stakeholders. Simultaneously, in the case of school directors, "high" and "very high" responses reached 95%, for police chiefs, the percentage of the same responses dropped to 14%. Intermediate values have been recorded for the other stakeholders: "high" and "very high" answers were given by 67% of farmers, 56% of priests, and 39% of mayors. Police chiefs and mayors are responsible for risk management during an emergency, and for them, preparedness is at the base of the training.

For this reason, they might think that their role is the management of situations and, in any case, is the responsibility of individuals. School directors who have the obligation of small infants feel that individual preparedness is the key to successful disaster management, evacuation, and recovery. In this regard, participation in simulation evacuations is a crucial step for a positive disaster outcome. Most of the stakeholders declared that they had participated, especially in the simulations concerning earthquakes, and few of them indicated other specific hazards (e.g., fires). Seventy-two stakeholders (61%) declared that they participated in simulations in the last years, most of them to earthquake simulations (especially school directors and mayors). Stakeholders from floodplains communes stated participation in flood simulations. In a particular case (Aroneanu settlement, located close to Iaşi International Airport), stakeholders participated in a technological disaster exercise (aircraft crash). The period elapsed since the last simulation varies from few months to over ten years, the most recent being mostly declared by the school directors.

The same differentiated pattern of the stakeholder responses was recorded in the case of the level of their communities' preparedness.

4.4 Risk management, trust, and communication

Several factors have been listed (Fig. 10) and discussed as representing long-term solutions to improve current risk management plans.

Most of the participants agreed with all the items proposed. On the other side, priests seemed to be the most pessimistic, especially in terms of predictability, people's preparedness, intervention, and recovery capacity. Again, the role of trust in depicting a negative situation in which stakeholders evidenced low trust on mitigation and management measures (Fig. 11). As mayors followed the same trend, it is plausible to think that they delegate the responsibility during emergencies to other institutions, imputing ineffective planning and organization.

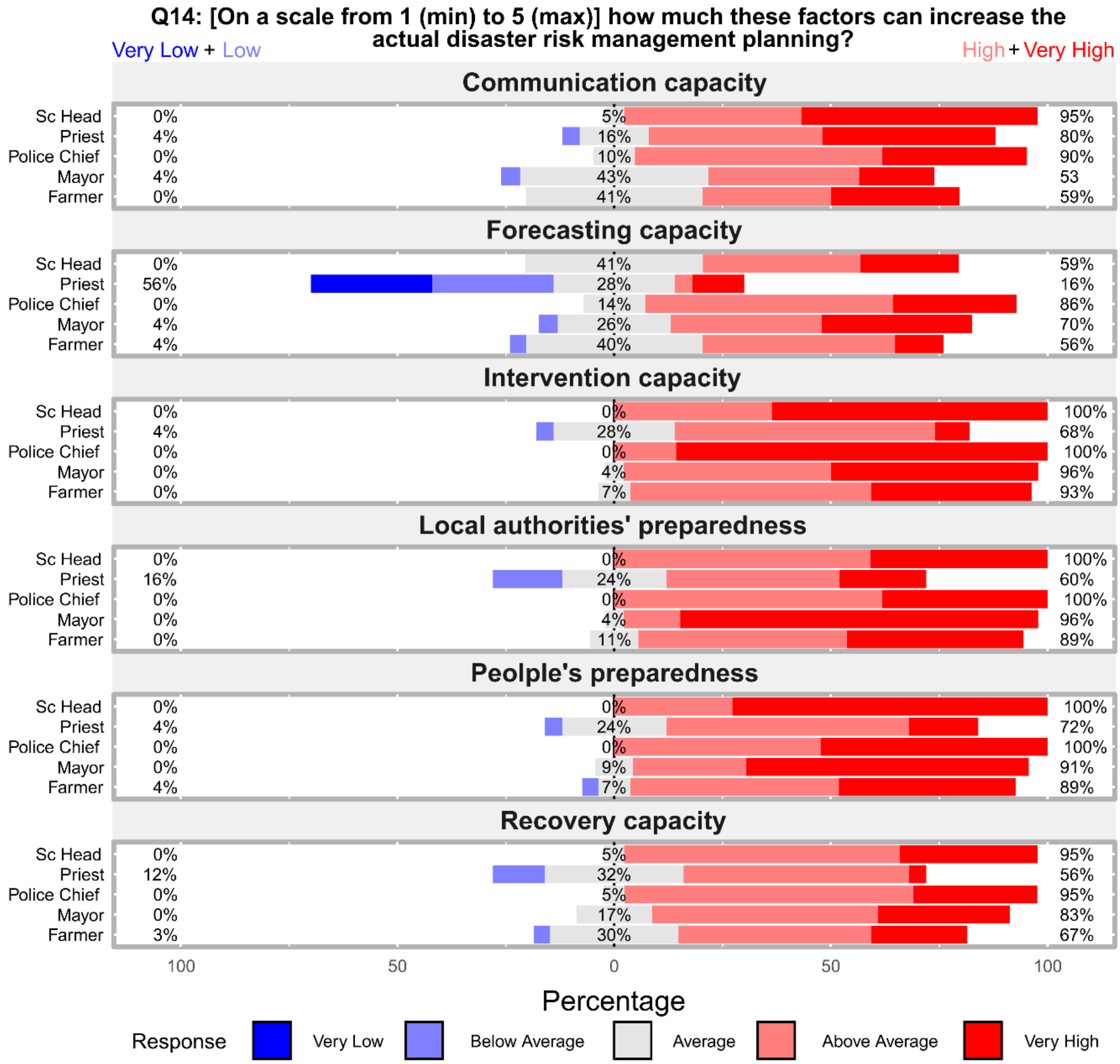

Figure 10: The Likert plot of the stakeholders' responses regarding the factors which can increase the actual disaster risk management planning.

Question 16 ("In your judgment, how much are the opinions of the following actors taken into account in the decisions about measures to adopt for preventing or reducing damage from natural hazards phenomena?") presents a grouping of "high" and "very high" responses around 70% for followings sub-sections: local communities, technicians/engineers, elective representatives at local and national levels. A lower percentage (34% of "high" and "very high" responses) has been registered for the sub-section "environmental organizations." Among stakeholder types, we should highlight the higher percentages of "low" and "very low" responses in the following cases: priests for "elective representatives at the local level" (16%) and "technicians/engineers" (16%), school directors (50%) and mayors (43%) for "environmental organizations," farmers for "local communities" (16%), and "state elective representatives" (26%).

The stakeholders' role as leaders of their institution during the events generated by natural hazards is critical. They refer to direct intervention in the affected areas and the management and communication with the community's entire population. These issues were addressed in the following question (Q17 from Table A1 from Appendix A). The gathered answers are generally in line with the level of social responsibility of the institutions that stakeholders represent according to the legislation but also to the moral leadership in the community. "high" and "very high" responses were acquired as follows: priests (88%), police chiefs (86%), mayors (74%), school directors (64%), and farmers (52%). There are interesting absences of "low" and "very low" responses in the case of mayors, school directors, and priests, and the low proportion of these responses in the case of police chiefs (5%) and farmers (7%).

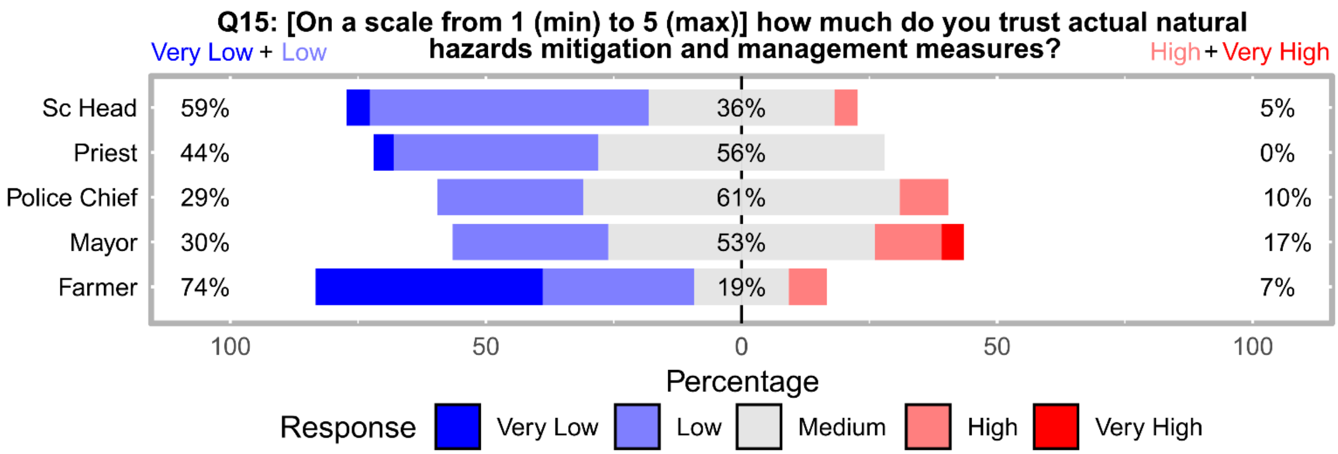

Figure 11. The Likert plot of the stakeholders' responses regarding the trust in the actual measures for natural hazards mitigation and management.

5. Discussions and conclusions

The current study's importance lies in the intrinsic characteristics of the Iaşi area, being exposed and vulnerable to major natural hazards and overlapped with recent and historical contradictory socio-economic dynamics of Romania (Ignat et al., 2014). In line with a competitive European economy with increasing educational level and income of the last 20 years, the Romanian society tried to follow the positive trends and numbers, with a rapid urban sprawl. The fast development was characterized by a lack of planning and infrastructural investments leading to an increased vulnerability to natural hazards. At the same time, the dissatisfaction and the feeling of the danger of people were felt even at the political level that, since 1989, has led to a constant decrease of trust in national institutions and their leaders. In this fragile socio-economic and political environment, local stakeholders were involved in national programs to help communities (primarily rural areas) to prevent, manage and recover from emergencies, including weather extremes or natural hazards, because, very often, media, politicians, or other public actors demonstrated to discredit these phenomena and their potential negative impact. However, history showed that disaster communication was poorly managed, and local stakeholders lacked in coordinating people in all phases of risk management. The lacking knowledge and preparedness understanding of stakeholders pushed the need to investigate their actual perception of natural hazards occurrence to set the scene for improved management at the local level.

The results found with 118 interviews in Iaşi Metropolitan Area showed that, in general, there is a moderate level of threat toward the negative influence of climate-related hazards and earthquakes with different levels. The three main themes that are resumed in the research questions posed (RQ1, RQ2, and RQ3) reveals differences in risk perception concerning various stakeholders' types and risks and an obvious specific behavior related to the local geomorphological settings which favor local scale hazards (e.g., landslides and floods). These differences are shown both by the graphic statistic data and the statistic test and analyses, the post-hoc analysis being also able to pinpoint grouping among perception of different natural risks and stakeholder characteristics. Farmers are more concerned, especially with climate-related hazards, that can directly affect their livelihood and income source. The literature has found that they might already receive incentives to protect the economic sector from the threat of natural hazards and/or invest in insurance products to safeguard household income (Saldaña-Zorrilla, 2008).

Majors, school directors, and priests displayed a greater level of risk awareness on droughts and earthquakes, which are the major and long-lasting events for which planning, evacuation, and recovery are needed to manage the outcome of those events efficiently. Police officers were the only stakeholders recognizing the threat of floods because they were directly involved in recent flooding and rescue activities. Despite recognizing the probability of a broad set of natural hazards, the level of preparedness is perceived to be low. The poor vertical dialogue among stakeholders, the lay public, and higher authorities have scattered communication and proactive behaviors of citizens, rising low levels of trust, and on some occasions, discarding hazard warnings. Stakeholders highlighted great interest in information and education programs to reconstruct their network with the population and reduce natural hazards' adverse effects. The same results have been found in France, where a national concern is the need to find solutions and economic investments at the local scale with poor transparency and trust, leading to unmanaged and inefficient solutions and actions (Heitz et al., 2009). Mayors in Iaşi County need to be involved in the discussions and negotiations at the national level, exposing different interests of the community's representativeness and the lay public to promote a horizontal dialogue that gradually would include people in the disaster risk planning. In this regard, stakeholders network needs to be established at the local level, share knowledge and how-how, enhance communication, and re-build a trust culture. Networked governance is also highlighted by VanWell et al. (2018) that evidence the virtuous example of the Nordic Centre of Excellence on Resilience and Societal Security network, which includes Denmark, Finland, Iceland, Norway, and Sweden and the synergy of communities, institutions, individuals and infrastructures for societal resilience and community development; similar approaches have been conducted in Central Europe with representative examples for local communities (Gamper, 2008; Holub and Fuchs, 2009; Fleischhauer et al., 2012; Leitner et al., 2020). The perspective beyond the disaster response framework must "give affected communities a voice and recognize their risk perception as well as their active role in exploring strategies that ensure livelihood security on the long-term" (Heijmans, 2001). In that sense, Walker et al. (2014) characterized the "new governance" related to natural hazard threats and risk management strategies across several countries in Europe, emphasizing the "sometimes strikingly" political context in handling the threats of natural hazards. Simultaneously, the political agenda can help those networks implementing monitoring systems of vulnerable buildings facilitating the knowledge of local stakeholders, their safety, and their relationship with the population moving from a self-centered approach to a community-based approach. An objective level of preparedness of the communities seems to be achieved by the interviewed stakeholders. The need for a "culture of preparedness and prevention" (Ozmen, 2006; Adame, 2018) that is nowadays underestimated should be addressed as a long-term educational, behavioral, and knowledge-based approach. Another essential issue in disaster risk reduction and management is represented by the involvement of scientists in local committees for emergencies, with specific roles (Gill et al., 2020), such as identification and characterization of potential multi-hazard areas, prioritize effective, positive, long-term partnerships, sharing the experiences of others communities in best practices risk management through improved access to hazard information and embedding cultural understanding into local natural hazard environment.

As a limitation of the current study, we highlight the lack of an analysis of socio-demographic factors influencing the interviewees' risk perception, which is due to how the participants were selected. Another limitation of this study concerns the multiple hazards risk perception assessment, and the different nature, cycle, and management measures and costs of the natural hazards selected can find difficult comparisons and conclusions. In the meantime, the need to incorporate multiple hazards is based on the necessity to avoid bias of a single hazard and approach local stakeholders with the most and least frequent ones, without cognitive or experiential biases.

The perspectives of this study should be continued in the next years to assess the changes of the behavior of the stakeholders regarding the awareness of the threats posed by natural hazards induced risks in a dynamic perspective, taking into consideration the future events and their adverse effects as well as the changes that the citizens will register at the level of increasing (or not) the inter-community cooperation and the compliance with legislation.

Author contribution

Conceptualization and methodology, MCM, MN, GR and PT; investigation, MCM and MN; formal analysis, MCM, MN, GR; writing—original draft preparation, MCM; writing—review and editing, MCM, MN, GR and PT; project administration MCM. All authors have read and agreed to the published version of the manuscript.

Competing interests

The authors declare that they have no conflict of interest.

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Appendix A – Extended tables of statistical results

Table A1. Questionnaire sample and variables' units of measurement.

Section	Question	Items	Responses
The level of threat	Q1: On a scale from 1 to 5, how do you think these factors could be a threat for the quality of the life of your community?	a - Level of development; b - Criminality; c - Technological risks; d - Natural risks; e - Environmental pollution; f - Climatic changes	5-point Likert scale*
	Q2: Considering a set of natural hazards, how these events could be a threat/danger for your community?	a - Floods; b - Earthquakes; c - Landslides; d - Rainstorms; e - Snowstorms; f - Droughts; g - Soil erosion	5-point Likert scale*
	Q3: Considering a set of natural hazards, how these events could be a threat/danger for your personally?	a - Floods; b - Earthquakes; c - Landslides; d - Rainstorms; e - Snowstorms; f - Droughts; g - Soil erosion	5-point Likert scale*
	Q4: Considering a set of natural hazards, what's the probability that these events	a - Floods; b - Earthquakes; c - Landslides; d - Rainstorms; e - Snowstorms; f - Droughts; g - Soil erosion	5-point Likert scale*

	could happen in the place where you live or nearby?		
	Q5: Do you think that these events could be more a frequent threat/danger for the next generations?	a - Floods; b - Earthquakes; c - Landslides; d - Rainstorms; e - Snowstorms; f - Droughts; g - Soil erosion	dichotomic
Past experiences	Q6: Do you ever experienced these events that have produced direct damage to you personally?	a - Floods; b - Earthquakes; c - Landslides; d - Rainstorms; e - Snowstorms; f - Droughts; g - Soil erosion	dichotomic
Knowledge about hazards	Q7: Which of the following have contributed to your personal knowledge about natural hazards?	a - National awareness campaign; b - Social networks on internet; c - Local administration campaigns; d - TV/radio; e - Personal interest; f - School; g - Participation to volunteerism activities; h - Friends/family members/neighbours	dichotomic
	Q8: It would be interesting for you to be more informed about natural hazards in order to be more prepared in the case they will happen here?	a - Floods; b - Earthquakes; c - Landslides; d - Rainstorms; e - Snowstorms; f - Droughts; g - Soil erosion	5-point Likert scale*
	Q12: Which factors do you think might exacerbate the negative consequences of natural hazards?	a - Climate change; b -deforestation; c - Lack of protective structural device's; d - Lack of protective structural device's maintenance; e - Uncontrolled urbanization and unmanaged land use planning; f - Construction of buildings in areas at high risk; g - Unsafe infrastructure buildings	5-point Likert scale*
	Q13: Which factors do you think might reduce the negative consequences of natural hazards and must be taken as a priority in the place where you live?	a - A proper legislation for land and urban planning; b - A proper compensation scheme for natural hazards victims; c - Build new protection works; d - Ensure more investments on controlling, monitoring and maintaining actual protection works; e - Increasing the level of awareness and preparedness of inhabitants; f - Increasing communication with the community; g - Increase hazards education of children at school	5-point Likert scale*

Preparedness	Q9: Considering a set of natural hazards, how much do you feel prepared to cope with these events?	a - Floods; b - Earthquakes; c - Landslides; d - Rainstorms; e - Snowstorms; f - Droughts; g - Soil erosion	5-point Likert scale*
	Q10: Considering a set of natural hazards, how much your community is prepared to cope with these events?	a - Floods; b - Earthquakes; c - Landslides; d - Rainstorms; e - Snowstorms; f - Droughts; g - Soil erosion	5-point Likert scale*
	Q11: How much do you think that your personal knowledge might increase the level of preparedness of your community?		5-point Likert scale*
	Q18: Do you participated to a simulation of a specific natural hazard, If you did, please specify the type of hazard and when (years ago)?		Multiple choice
Risk management, trust and communication	Q14: How much these factors can increase the actual disaster risk management planning?	a - Forecasting capacity; b - Communication capacity; c - Intervention capacity; d - recovery capacity; e - People's preparedness; f - Local authorities' preparedness	5-point Likert scale*
	Q15: How much do you trust actual natural hazards mitigation and management measures?		5-point Likert scale*
	Q16: In your judgment, how much are the opinions of the following actors taken into account in the decisions about measures to adopt for preventing or reducing damage from natural hazards phenomena?	a - Local communities; b - Technicians/engineers; c - Environmental organizations; d - Elective representatives at the local level; e - State elective representatives	5-point Likert scale*
	Q17: According to your position in the society, how much do you think that your institution could help in the communication/management of people during the events associated with natural hazards?		5-point Likert scale*
Place attachment	Q19: How much do you feel attached to the place where you live?		5-point Likert scale*
Interviewee person settings	PS1: Age		Open
	PS2: Gender		Dichotomic

	PS3: Education		Multiple choice
	PS4: Profession	Mayor; School Director; Police Officer; Priest; Farmer	
	PS5: Do you live in the locality where you are active?		Dichotomic
	PS6: The house you are living in is:	Your/your family property; Rented; Service house	Open
	PS7: Including yourself, how many people are there in your household? Number:		Open
	PS8: Are there any disabled or non self-sufficient persons in your household?		Dichotomic
	PS9: [On a scale from 1 (min) to 5 (max)] Do you estimate your household income sufficient to meet the family needs?		5-point Likert scale**
	PS10: How do you assess your level of the knowledge about things discussed (from 1 low to 5 high)?		5-point Likert scale*
	PS11: How do you assess your level of implication in the completion of the questionnaire (from 1 low to 5 high)?		5-point Likert scale*
	PS12: How do you assess your level of sincerity in the completion of the questionnaire (from 1 low to 5 high)?		5-point Likert scale*

*The 5-point Likert scale is: 1 - Very Low, 2 - Low, 3 - Medium, 4 - High, 5 - Very High

** The 5-point Likert scale is: 1 - Insufficient, 2 – Below moderate, 3 - Moderate, 4 - Sufficient, 5 – More than sufficient

Table A2 The most frequent value by question expressed as mode; a-h correspond to the question items shown in Table A1

	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**
Q1	5	3	1	4	2	2		
Q2	1	3	3	3	4	4	2	
Q3	2	4	2	3	3	4	3	
Q4	1	3	1	2	2	3	1	

Q5	N	Y	N	Y	Y	Y	N	
Q6	Y	Y	Y	Y	Y	N	Y	
Q7	N	Y	N	Y	Y	N	N	Y
Q9	3	2	2	2	3	2	2	
Q10	2	2	2	2	3	2	2	
Q12	4	4	4	4	3	4	4	
Q13	4	2	4	4	4	4	5	
Q14	4	4	5	4	5	5		
Q16	4	4	3	4	4			
Q8	5	**Q11**	4					
Q15	3	**PS8**	N					
Q17	4	**PS9**	4					
Q19	5	**PS10**	4					
PS5	Y	**PS11**	4					
PS6	1	**PS12**	5					

1 - Very Low, 2 - Low, 3 - Medium, 4 - High, 5 - Very High; N - No, Y - Yes

Table A3 The most frequent value (mode) by stakeholder type; a-h correspond to the question items shown in Table A1

		a	b	c	d	e	f	g	h
Q1	**F**	5	2	2	4	3	5		
	M	5	3	2	4	4	4		
	PO	4	4	2	5	2	2		
	P	2	2	1	3	2	2		
	SD	4	4	2	5	3	4		
Q2	**F**	2	4	1	4	5	5	4	
	M	2	3	4	3	4	4	3	
	PO	1	3	2	3	3	4	2	
	P	1	3	3	3	4	4	3	
	SD	2	4	3	3	4	5	3	
Q3	**F**	2	4	2	3	3	5	3	
	M	2	4	2	3	3	3	3	

	PO	1	2	2	3	3	4	2	
	P	1	3	3	2	3	4	1	
	SD	2	4	3	3	4	5	3	
Q4	**F**	1	3	1	4	3	5	3	
	M	1	3	3	2	2	2	1	
	PO	1	2	1	2	2	3	1	
	P	1	3	1	2	3	3	1	
	SD	1	4	1	3	2	2	1	
Q5	**F**	Y	Y	Y	Y	Y	Y	Y	
	M	N	Y	N	Y	Y	Y	Y	
	PO	Y	N	N	Y	Y	Y	N	
	P	Y	N	N	N	N	Y	N	
	SD	N	Y	Y	Y	Y	Y	N	
Q6	**F**	N	N	N	Y	N	Y	N	
	M	N	N	N	N	N	Y	N	
	PO	N	N	N	N	N	N	N	
	P	N	N	N	N	N	Y	N	
	SD	N	N	N	N	N	N	N	
Q7	**F**	N	Y	N	Y	Y	N	N	Y
	M	Y	N	Y	Y	Y	N	N	Y
	PO	Y	Y	N	Y	Y	Y	N	Y
	P	N	N	N	Y	Y	N	N	N
	SD	N	Y	N	Y	Y	Y	N	Y
Q9	**F**	3	3	3	2	3	2	2	
	M	3	2	2	2	3	2	2	
	PO	3	2	3	3	4	3	3	
	P	2	2	3	3	2	2	2	
	SD	2	2	2	2	2	2	2	
Q10	**F**	2	1	2	2	3	2	2	
	M	3	2	2	3	3	3	2	
	PO	2	2	2	2	2	3	2	
	P	2	3	2	2	3	2	2	

	SD	2	2	2	2	3	2	2	
Q12	**F**	5	4	4	4	4	4	5	
	M	4	4	4	4	2	4	4	
	PO	4	4	4	4	4	4	4	
	P	2	4	4	3	3	4	4	
	SD	4	5	4	4	3	5	5	
Q13	**F**	4	2	4	4	5	4	5	
	M	4	2	5	5	3	3	4	
	PO	5	4	4	4	4	4	5	
	P	3	4	4	4	4	4	5	
	SD	4	3	4	5	4	4	5	
Q14	**F**	4	3	4	4	4	4		
	M	5	3	5	4	5	5		
	PO	4	4	5	4	5	4		
	P	1	4	4	4	4	4		
	SD	3	5	5	4	5	4		
Q16	**F**	4	4	4	4	3			
	M	4	4	2	5	4			
	PO	4	5	4	5	5			
	P	5	3	3	4	4			
	SD	3	5	3	3	5			
Q8	**F**	5	**Q11**	**F**	4	**Q15**	**F**	1	
	M	4		**M**	3		**M**	3	
	PO	4		**PO**	3		**PO**	3	
	P	3		**P**	4		**P**	3	
	SD	5		**SD**	4		**SD**	2	
Q17	**F**	4	**Q19**	**F**	5				
	M	4		**M**	5				
	PO	4		**PO**	4				
	P	4		**P**	5				
	SD	4		**SD**	4				

1 - Very Low, 2 - Low, 3 - Medium, 4 - High, 5 - Very High; F - Farmer, M - Mayor, PO - Police officer, P - Priest, SD - School Director; N - No, Y - Yes

Table A4 The descriptive statistics for every question expressed as mean and standard deviation (the last is in parentheses); a-h correspond to the question items shown in Table A1

	a	b	c	d	e	f	g
Q1	3.75(1.1)	3.14(1.1)	2.01(1.0)	3.53(1.1)	2.79(1.1)	3.09(1.2)	
Q2	2.43(1.3)	3.28(0.81)	2.64(1.03)	3.29(0.88)	3.59(0.9)	4.02(0.92)	2.58(0.93)
Q3	2.48(1.2)	3.44(0.96)	2.55(1.02)	3.13(0.86)	3.19(0.86)	3.98(0.93)	2.23(1.01)
Q4	1.95(1.18)	2.97(0.96)	1.90(1.03)	2.84(1.07)	2.75(0.97)	3.31(1.09)	1.87(1.01)
Q9	2.44(0.9)	2.50(1.01)	2.39(0.93)	2.54(0.90)	2.82(0.95)	2.36(1.01)	2.30(0.94)
Q10	2.39(0.81)	2.18(0.85)	2.10(0.79)	2.25(0.75)	2.65(0.83)	2.25(0.84)	1.94(0.77)
Q12	3.62(1.10)	4.14(0.72)	3.90(0.80)	3.84(0.81)	3.33(1.00)	4.08(0.85)	4.26(0.77)
Q13	3.96(0.89)	2.94(1.10)	4.15(0.72)	4.24(0.74)	4.15(0.77)	3.97(0.87)	4.57(0.62)
Q14	3.58(1.09)	4.08(0.81)	4.36(0.68)	3.97(0.74)	4.36(0.71)	4.29(0.76)	
Q16	3.90(0.88)	4.11(0.86)	3.01(1.04)	3.82(0.91)	3.98(1.00)		
Q8	4.01(0.98)						
Q11	3.63(0.75)						
Q15	2.48(0.82)						
Q17	3.92(0.76)						
Q19	4.54(0.67)						

Table A5 The parametric descriptive statistics by stakeholder type; a-h correspond to the question items shown in Table A1

		a	b	c	d	e	f	g
Q1	**F**	4.11(0.89)	2.85(0.86)	2.11(0.93)	4.07(0.78)	2.59(1.01)	4.19(0.88)	
	M	4.26(0.92)	2.91(0.9)	2.17(1.07)	3.78(0.6)	3.61(0.99)	3.39(0.99)	
	PO	3.29(1.15)	4.05(0.86)	2.33(1.02)	2.67(0.97)	2.38(0.86)	2.43(0.87)	
	P	2.84(1.03)	2.4(0.87)	1.36(0.86)	2.72(0.89)	1.92(0.91)	1.76(0.78)	
	SD	4.23(0.61)	3.73(0.94)	2.14(0.89)	4.36(0.9)	3.55(0.6)	3.59(0.85)	
Q2	**F**	2.48(1.45)	3.37(0.79)	2.44(1.12)	4.07(0.83)	4.22(0.85)	4.48(0.75)	3.3(0.95)
	M	2.96(1.19)	3.33(0.8)	2.83(1.11)	3.3(0.7)	3.57(0.66)	3.91(0.79)	2.43(0.66)
	PO	2.29(1.38)	2.61(0.5)	2.33(0.8)	2.76(0.7)	3(0.77)	3.05(0.86)	1.9(0.62)

	P	2.12(1.27)	3.09(0.68)	2.8(1.15)	2.88(0.73)	3.52(0.87)	3.92(0.81)	2.24(0.78)
	SD	2.32(1.13)	3.9(0.7)	2.82(0.85)	3.27(0.77)	3.5(0.91)	4.59(0.59)	2.86(0.89)
Q3	**F**	2.37(1.08)	3.48(0.98)	2.7(1.07)	3.63(0.79)	3.37(0.74)	4.37(0.74)	2.85(0.77)
	M	2.52(1.08)	3.22(1.13)	2.61(0.94)	3.04(0.88)	2.83(0.83)	3.3(0.97)	2.09(0.9)
	PO	2.33(1.32)	2.9(0.83)	1.95(0.74)	2.9(0.62)	2.81(0.68)	3.48(0.87)	1.67(0.66)
	P	2.12(1.09)	3.56(0.82)	2.48(1.16)	2.52(0.59)	3.2(0.96)	3.96(0.73)	1.6(0.76)
	SD	3.14(1.28)	4(0.69)	2.95(0.9)	3.5(0.91)	3.68(0.78)	4.73(0.55)	2.86(1.13)
Q4	**F**	2.41(1.5)	2.74(0.94)	1.63(0.74)	4.15(0.77)	3.22(0.97)	4.44(0.75)	3(0.92)
	M	1.65(0.78)	2.78(0.8)	2.22(1.13)	2.22(0.67)	2.3(0.76)	2.83(0.89)	1.61(0.66)
	PO	1.62(1.02)	2.33(1.06)	1.38(0.8)	2.38(0.86)	2.29(0.85)	2.95(0.97)	1.33(0.58)
	P	1.6(0.87)	3.32(0.75)	1.84(0.85)	2.4(0.65)	3(0.91)	2.96(0.84)	1.4(0.58)
	SD	2.41(1.26)	3.64(0.73)	2.45(1.3)	2.82(0.96)	2.82(1.01)	3.14(1.08)	1.82(1.1)
Q9	**F**	2.56(0.8)	3.26(1.02)	2.85(0.86)	2.59(1.01)	2.93(0.96)	2.52(1.01)	2.37(0.79)
	M	2.87(0.97)	2.04(0.82)	2.35(0.88)	2.39(0.99)	3(0.9)	2.17(1.15)	2.43(1.04)
	PO	2.62(0.86)	2.62(0.92)	2.57(0.98)	2.95(0.67)	3.52(0.51)	3.1(0.77)	2.76(0.94)
	P	2.28(0.68)	2.24(0.72)	2.2(0.82)	2.48(0.65)	2.12(0.78)	2.12(0.78)	1.92(0.86)
	SD	1.86(0.94)	2.23(1.07)	1.91(0.92)	2.32(1.04)	2.64(0.95)	1.95(0.95)	2.05(0.9)
Q10	**F**	2.19(0.74)	1.78(0.75)	1.93(0.73)	2.11(0.8)	2.89(0.97)	1.89(0.85)	1.85(0.82)
	M	2.78(0.6)	2.39(0.58)	2.13(0.69)	2.39(0.72)	2.65(0.88)	2.43(0.84)	2.09(0.67)
	PO	2.76(0.94)	2.29(1.01)	2.29(0.96)	2.38(0.67)	2.38(0.67)	2.57(0.81)	2.19(0.87)
	P	2(0.76)	2.4(0.91)	1.96(0.79)	2.04(0.84)	2.44(0.87)	2.16(0.75)	1.8(0.71)
	SD	2.32(0.72)	2.09(0.87)	2.27(0.77)	2.36(0.66)	2.86(0.56)	2.27(0.83)	1.82(0.73)
Q12	**F**	4.54(0.58)	4.19(0.62)	4.33(0.62)	4.22(0.64)	4(0.73)	4.22(0.64)	4.48(0.58)
	M	3.22(0.95)	3.96(0.88)	3.74(0.81)	3.57(0.66)	2.52(0.95)	3.65(1.07)	3.83(0.94)
	PO	3.71(0.78)	4.38(0.5)	3.9(0.54)	4.14(0.65)	3.48(1.08)	4.19(0.87)	4.05(0.8)
	P	2.56(1)	3.72(0.74)	3.36(0.91)	3.2(0.87)	3.16(0.85)	3.8(0.71)	4.28(0.68)
	SD	4.05(0.9)	4.55(0.51)	4.14(0.71)	4.09(0.68)	3.41(0.85)	4.55(0.67)	4.64(0.58)
Q13	**F**	3.93(0.87)	2.56(1.15)	4.22(0.7)	4.33(0.62)	4.48(0.64)	4.15(0.77)	4.56(0.58)
	M	3.96(0.93)	2.39(0.99)	4.3(0.76)	4.17(0.89)	3.83(0.98)	3.78(1)	4.39(0.72)
	PO	4.38(0.74)	3.57(0.81)	4.14(0.57)	4.33(0.66)	4.33(0.58)	4.1(0.77)	4.67(0.48)
	P	3.72(1.06)	3.6(0.91)	3.76(0.78)	3.76(0.66)	3.84(0.75)	4(0.71)	4.44(0.77)
	SD	3.86(0.71)	2.64(1)	4.36(0.66)	4.64(0.58)	4.27(0.63)	3.77(1.07)	4.82(0.39)

Q14	**F**	3.63(0.74)	3.89(0.85)	4.3(0.61)	3.85(0.82)	4.26(0.76)	4.3(0.67)	
	M	4(0.9)	3.65(0.83)	4.43(0.59)	4.13(0.69)	4.57(0.66)	4.78(0.52)	
	PO	4.14(0.65)	4.24(0.62)	4.86(0.36)	4.24(0.54)	4.52(0.51)	4.38(0.5)	
	P	2.44(1.29)	4.16(0.85)	3.72(0.68)	3.48(0.77)	3.84(0.75)	3.64(0.99)	
	SD	3.82(0.8)	4.5(0.6)	4.64(0.49)	4.27(0.55)	4.73(0.46)	4.41(0.5)	
Q16	**F**	3.78(1.05)	4.04(0.76)	3.11(1.22)	3.63(0.74)	3.22(1.05)		
	M	4.04(0.71)	4.09(0.85)	2.87(1.06)	4.39(0.78)	4.04(0.98)		
	PO	3.86(0.96)	4.38(0.67)	3.38(0.8)	4.05(0.92)	4.62(0.8)		
	P	4.04(0.89)	3.56(1.04)	3.16(0.9)	3.52(1.12)	3.88(0.83)		
	SD	3.77(0.75)	4.59(0.5)	2.5(1.01)	3.59(0.67)	4.36(0.66)		
Q8	**F**	4.52(0.7)	**Q11**	**F**	3.7(0.67)	**Q15**	**F**	1.89(0.97)
	M	3.91(0.85)		**M**	3.52(0.85)		**M**	2.91(0.79)
	PO	3.95(0.8)		**PO**	3(0.55)		**PO**	2.81(0.6)
	P	2.92(0.86)		**P**	3.6(0.58)		**P**	2.52(0.59)
	SD	4.77(0.43)		**SD**	4.27(0.55)		**SD**	2.41(0.67)
Q17	**F**	3.48(0.7)	**Q19**	**F**	4.89(0.32)	-	-	-
	M	4(0.74)		**M**	4.91(0.29)	-	-	-
	PO	4.19(0.81)		**PO**	3.86(0.91)	-	-	-
	P	4.28(0.68)		**P**	4.52(0.59)	-	-	-
	SD	3.73(0.63)		**SD**	4.41(0.59)	-	-	-

1 - Very Low, 2 - Low, 3 - Medium, 4 - High, 5 - Very High; F - Farmer, M - Mayor, PO - Police officer, P - Priest, SD - School Director

Table A6 The non-parametric tests results for stakeholder types (ST), administrative unit (AU) and flood vs hilly (FAU vs. HAU)

AU	**Chi-sq**	**df**	**p sig.**	**K-W**	**df**	**p sig.**	**epsilon**
Q1	136.24	88	****	33.88	23	ns	0.05
Q2	101.79	88	ns	21.56	23	ns	0.03
Q3	126.44	88	***	36.15	23	*	0.04
Q4	130.04	88	***	25.14	23	ns	0.03
Q5	50.76	22	***	51.33	23	***	0.06
Q6	40.82	22	**	41.26	23	*	0.05

Q7	39.48	22	*	39.57	23	*	0.04
Q8	48.39	66	ns	14.57	23	ns	0.13
Q9	450.92	88	****	128.58	23	****	0.16
Q10	256.37	88	****	103.08	23	****	0.13
Q11	79.78	66	ns	30.12	23	ns	0.26
Q12	126.05	88	***	47.23	23	**	0.06
Q13	139.47	88	***	49.34	23	***	0.07
Q14	125.06	88	***	53.51	23	***	0.06
Q15	85.93	88	ns	44.48	23	****	0.38
Q16	147.07	88	****	60.84	23	****	0.10
Q17	54.71	88	ns	17.78	23	ns	0.15
Q19	61.83	66	ns	24.37	23	ns	0.21
ST	**Chi-sq**	**df**	**p sig.**	**K-W**	**df**	**p sig.**	**epsilon**
Q1	154.55	16	****	125.02	4	****	0.18
Q2	109.55	16	****	61.44	4	****	0.07
Q3	96.47	16	****	77.89	4	****	0.09
Q4	121.05	16	****	75.20	4	****	0.09
Q5	42.93	4	****	42.88	4	****	0.05
Q6	43.17	4	****	43.12	4	****	0.05
Q7	20.17	4	***	20.15	4	***	0.02
Q8	64.99	12	****	50.71	4	****	0.43
Q9	132.66	16	****	85.35	4	****	0.10
Q10	41.66	16	***	24.34	4	****	0.03
Q11	44.17	12	****	33.32	4	****	0.29
Q12	138.89	16	****	119.83	4	****	0.15
Q13	49.83	16	****	16.70	4	***	0.02
Q14	128.53	16	****	80.78	4	****	0.11
Q15	49.20	16	****	21.69	4	****	0.19
Q16	32.53	16	**	19.53	4	***	0.03
Q17	23.85	16	ns	19.12	4	****	0.16
Q19	49.37	12	****	33.69	4	****	0.29

FAU vs HAU	Chi-sq	df	p sig.	K-W	df	p sig.	epsilon
Q1	2.39	4	ns	1.42	1	ns	0.00
Q2	4.79	4	ns	0.36	1	ns	0.00
Q3	5.66	4	ns	0.41	1	ns	0.00
Q4	9.10	4	ns	1.69	1	ns	0.00
Q5	7.68	1	***	7.67	1	***	0.01
Q6	6.30	1	*	6.29	1	*	0.01
Q7	3.58	1	ns	3.58	1	ns	0.00
Q8	0.02	3	ns	0.01	1	ns	0.00
Q9	13.37	4	***	4.53	1	*	0.01
Q10	3.18	4	ns	0.85	1	ns	0.00
Q11	5.87	3	ns	0.02	1	ns	0.00
Q12	3.97	4	ns	0.22	1	ns	0.00
Q13	7.86	4	ns	0.43	1	ns	0.00
Q14	0.49	4	ns	0.08	1	ns	0.00
Q15	2.39	4	ns	0.84	1	ns	0.01
Q16	10.44	4	*	2.15	1	ns	0.00
Q17	1.65	4	ns	0.01	1	ns	0.00
Q19	7.52	3	ns	4.53	1	*	0.04

p sig. - level of significance: ns >0.05, * <=0.05, ** <=0.01, *** <=0.001, **** <=0.0001; df – degrees of freedom;

Table A7 The non-parametric tests results (the epsilon followed by the level of significance code) for question items by stakeholder types (ST), administrative unit (village and commune), flood vs. hilly (FAU vs. HAU) and demographic characteristics of stakeholders

		ST	Village	Commune	FAU vs. HAU	Age	Gender	Education
Q1	**a**	0.27^{ns}	0.35^{ns}	0.18^{ns}	0.02^{ns}	0.005^{ns}	0.02^{ns}	0.04^{ns}
	b	0.34^{ns}	0.34^{ns}	0.09^{ns}	$8E-05^{ns}$	0.04^{ns}	0.04*	0.02^{ns}
	c	0.16^{ns}	0.41^{ns}	0.27^{ns}	0.05^{ns}*	0.02^{ns}	0.01^{ns}	0.02^{ns}
	d	0.24*	0.33^{ns}	0.20^{ns}	0.014^{ns}	0.04^{ns}	0.09**	0.06^{ns}
	e	0.39^{ns}	0.36^{ns}	0.17^{ns}	0.017^{ns}	0.01^{ns}	0.05*	0.04^{ns}

	f	0.52**	0.3^{ns}	0.13^{ns}	0.004^{ns}	0.04^{ns}	0.03^{ns}	0.09*
Q2	**a**	0.06^{ns}	0.63***	0.55****	0.41****	0.007^{ns}	0.001^{ns}	0.006^{ns}
	b	0.13****	0.38^{ns}	0.17^{ns}	0.001^{ns}	0.003^{ns}	0.06***	0.02^{ns}
	c	0.04^{ns}	0.63***	0.57***	0.29****	0.008^{ns}	0.007^{ns}	0.02^{ns}
	d	0.28****	0.27^{ns}	0.10^{ns}	0.005^{ns}	0.02^{ns}	5E-04^{ns}	0.08*
	e	0.2****	0.30^{ns}	0.13^{ns}	0.001^{ns}	0.07*	0.03^{ns}	0.06^{ns}
	f	0.33****	0.25^{ns}	0.15^{ns}	0.002^{ns}	0.05*	0.01^{ns}	0.03^{ns}
Q3	**g**	0.27****	0.46^{ns}	0.36**	0.16****	2E-04^{ns}	0.005^{ns}	0.04^{ns}
	a	0.07^{ns}	0.59**	0.501****	0.37****	0.008^{ns}	0.02^{ns}	0.009^{ns}
	b	0.14**	0.37^{ns}	0.29**	8E-04^{ns}	0.07*	0.02^{ns}	0.01^{ns}
	c	0.01*	0.46^{ns}	0.36^{ns}	0.1***	6E-04^{ns}	0.02^{ns}	0.06^{ns}
	d	0.24****	0.31^{ns}	0.08^{ns}	0.005^{ns}	0.08**	0.01^{ns}	0.05^{ns}
	e	0.17***	0.35^{ns}	0.25^{ns}	0.004^{ns}	0.01^{ns}	0.03^{ns}	0.03^{ns}
	f	0.34****	0.25^{ns}	0.18^{ns}	6E-06^{ns}	0.06*	0.05*	0.02^{ns}
	g	0.31****	0.29^{ns}	0.22^{ns}	0.06*	0.02^{ns}	0.04*	0.06^{ns}
Q4	**a**	0.09*	0.63**	0.51****	0.39****	0.03^{ns}	0.014^{ns}	0.02^{ns}
	b	0.21****	0.33^{ns}	0.25^{ns}	0.001^{ns}	0.008^{ns}	0.03^{ns}	0.03^{ns}
	c	0.12**	0.43^{ns}	0.27^{ns}	0.06**	0.008^{ns}	0.01^{ns}	0.03^{ns}
	d	0.44****	0.23^{ns}	0.07^{ns}	5E-06^{ns}	0.03^{ns}	0.01^{ns}	0.16**
	e	0.15**	0.44^{ns}	0.26^{ns}	0.13^{ns}	0.06*	9E-04^{ns}	0.05^{ns}
	f	0.32****	0.27^{ns}	0.14^{ns}	0.002^{ns}	0.06*	7E-05^{ns}	0.07*
	g	0.37****	0.34^{ns}	0.17^{ns}	0.001^{ns}	0.01^{ns}	0.002^{ns}	0.11**
Q5	**a**	0.04^{ns}	0.51*	0.46***	0.14****	9E-04^{ns}	0.007^{ns}	0.02^{ns}
	b	0.02^{ns}	0.39^{ns}	0.32*	0.05*	0.01^{ns}	0.001^{ns}	0.02^{ns}
	c	0.12**	0.44^{ns}	0.32*	0.1***	0.05*	0.02^{ns}	0.03^{ns}
	d	0.22****	0.33^{ns}	0.16^{ns}	0.01^{ns}	0.01^{ns}	0.014^{ns}	0.05^{ns}
	e	0.13**	0.44^{ns}	0.25^{ns}	0.01^{ns}	0.03^{ns}	0.003^{ns}	0.06^{ns}
	f	0.05^{ns}	0.39^{ns}	0.12^{ns}	1E-04^{ns}	0.08*	6E-05^{ns}	0.009^{ns}
	g	0.22****	0.32^{ns}	0.23^{ns}	0.08**	0.002^{ns}	0.004^{ns}	0.04^{ns}
Q6	**a**	0.01^{ns}	0.63***	0.57****	0.4***	0.002^{ns}	2E-04^{ns}	0.02^{ns}
	b	0.06^{ns}	0.36^{ns}	0.14^{ns}	0.009^{ns}	0.02^{ns}	0.006^{ns}	0.005^{ns}
	c	0.02^{ns}	0.31^{ns}	0.21^{ns}	0.01^{ns}	0.01^{ns}	1E-05^{ns}	0.05^{ns}

	d	0.23****	0.32^{ns}	0.20^{ns}	2E-04^{ns}	0.009^{ns}	0.01ns	0.12**
	e	0.06^{ns}	0.37^{ns}	0.16^{ns}	2E-04^{ns}	0.008^{ns}	0.006^{ns}	0.01^{ns}
	f	0.17***	0.36^{ns}	0.20^{ns}	0.005^{ns}	0.01^{ns}	2E-06^{ns}	0.05^{ns}
	g	0.23****	0.36^{ns}	0.16^{ns}	0.01^{ns}	0.01^{ns}	2E-04^{ns}	0.06^{ns}
Q7	**a**	0.13**	0.41^{ns}	0.25^{ns}	0.01^{ns}	0.06*	9E-04^{ns}	0.04^{ns}
	b	0.23****	0.36^{ns}	0.17^{ns}	0.002^{ns}	0.1**	0.02ns	0.04^{ns}
	c	0.14**	0.29^{ns}	0.16^{ns}	0.02^{ns}	0.01^{ns}	4E-05^{ns}	0.01^{ns}
	d	0.13**	0.36^{ns}	0.2ns	3E-05^{ns}	0.01^{ns}	0.001^{ns}	0.005^{ns}
	e	0.11**	0.40^{ns}	0.21^{ns}	5E-04^{ns}	0.005^{ns}	0.03^{ns}	0.008^{ns}
	f	0.18***	0.26^{ns}	0.14^{ns}	0.009^{ns}	0.03^{ns}	0.14****	0.06^{ns}
	g	0.01^{ns}	0.47^{ns}	0.38**	0.11***	0.01^{ns}	0.002^{ns}	0.01^{ns}
	h	0.1*	0.38^{ns}	0.28^{ns}	0.001^{ns}	0.005^{ns}	0.002^{ns}	0.04^{ns}
Q9	**a**	0.16***	0.21^{ns}	0.14^{ns}	0.007^{ns}	0.015^{ns}	0.02^{ns}	0.04^{ns}
	b	0.2****	0.37^{ns}	0.29^{ns}	0.016^{ns}	0.01^{ns}	0.008^{ns}	0.09*
	c	0.14**	0.43^{ns}	0.32*	0.004^{ns}	0.004^{ns}	0.01^{ns}	0.03^{ns}
	d	0.08*	0.40^{ns}	0.26^{ns}	0.03^{ns}	0.008^{ns}	0.004^{ns}	0.01^{ns}
	e	0.26****	0.41^{ns}	0.24^{ns}	0.003^{ns}	0.03^{ns}	1E-06^{ns}	0.002^{ns}
	f	0.19***	0.39^{ns}	0.25^{ns}	0.03^{ns}	0.02^{ns}	0.007^{ns}	0.02^{ns}
	g	0.12**	0.36^{ns}	0.23^{ns}	1E-04^{ns}	0.03^{ns}	0.008^{ns}	0.04^{ns}
Q10	**a**	0.15**	0.39^{ns}	0.24^{ns}	0.03^{ns}	0.007^{ns}	0.003^{ns}	0.01^{ns}
	b	0.08*	0.38^{ns}	0.24^{ns}	0.003^{ns}	0.03^{ns}	9E-04^{ns}	0.02^{ns}
	c	0.03^{ns}	0.43^{ns}	0.27^{ns}	0.01^{ns}	0.03^{ns}	0.01^{ns}	0.03^{ns}
	d	0.04^{ns}	0.34^{ns}	0.20^{ns}	0.002^{ns}	0.01^{ns}	0.005^{ns}	0.003^{ns}
	e	0.07^{ns}	0.28^{ns}	0.20^{ns}	9E-04^{ns}	0.02^{ns}	0.03^{ns}	0.02^{ns}
	f	0.08*	0.41^{ns}	0.28^{ns}	0.003^{ns}	0.04^{ns}	0.003^{ns}	0.02^{ns}
	g	0.04^{ns}	0.42^{ns}	0.24^{ns}	0.01^{ns}	0.04^{ns}	4E-05^{ns}	0.01^{ns}
Q12	**a**	0.02^{ns}	0.26^{ns}	0.15^{ns}	0.001^{ns}	0.05^{ns}	0.03^{ns}	0.05^{ns}
	b	0.16**	0.41^{ns}	0.27^{ns}	5E-04^{ns}	0.07*	0.03*	0.02^{ns}
	c	0.17***	0.36^{ns}	0.24^{ns}	0.009^{ns}	0.03^{ns}	0.03*	0.005^{ns}
	d	0.24****	0.26^{ns}	0.1^{ns}	0.003^{ns}	0.03^{ns}	0.02^{ns}	0.02^{ns}
	e	0.24****	0.29^{ns}	0.18^{ns}	0.002^{ns}	0.02^{ns}	0.04*	0.04^{ns}
	f	0.15**	0.26^{ns}	0.19^{ns}	0.008^{ns}	0.02^{ns}	0.07**	0.04^{ns}

	g	0.14**	0.29^{ns}	0.12^{ns}	0.01^{ns}	0.03^{ns}	0.06*	0.007^{ns}
Q13	**a**	0.06^{ns}	0.45^{ns}	0.34*	0.03^{ns}	0.04^{ns}	6E-05^{ns}	0.04^{ns}
	b	0.25****	0.37^{ns}	0.017^{ns}	0.001^{ns}	0.01^{ns}	5E-04^{ns}	0.01^{ns}
	c	0.08*	0.42^{ns}	0.24^{ns}	7E-04^{ns}	0.04^{ns}	0.02^{ns}	0.02^{ns}
	d	0.16***	0.24^{ns}	0.11^{ns}	3E-04^{ns}	0.01^{ns}	0.02^{ns}	0.04^{ns}
	e	0.12**	0.37^{ns}	0.23^{ns}	0.009^{ns}	0.01^{ns}	0.05*	0.05^{ns}
	f	0.02^{ns}	0.34^{ns}	0.2^{ns}	0.004^{ns}	0.01^{ns}	0.02^{ns}	0.02^{ns}
	g	0.05^{ns}	0.35^{ns}	0.24^{ns}	0.006^{ns}	0.06*	0.001^{ns}	0.02^{ns}
Q14	**a**	0.26****	0.36^{ns}	0.18^{ns}	4E-04^{ns}	0.08*	0.004^{ns}	0.008^{ns}
	b	0.13**	0.45^{ns}	0.24^{ns}	7E-05^{ns}	0.14***	0.07**	0.02^{ns}
	c	0.32****	0.36^{ns}	0.16^{ns}	0.02^{ns}	0.1**	0.05*	0.01^{ns}
	d	0.15**	0.36^{ns}	0.18^{ns}	0.01^{ns}	0.08*	0.04*	0.002^{ns}
	e	0.19***	0.32^{ns}	0.13^{ns}	0.003^{ns}	0.09**	0.09**	0.02^{ns}
	f	0.21****	0.32^{ns}	0.22^{ns}	0.03^{ns}	0.07*	0.01^{ns}	0.02^{ns}
Q16	**a**	0.02^{ns}	0.41^{ns}	0.21^{ns}	0.006^{ns}	0.01^{ns}	0.001^{ns}	0.01^{ns}
	b	0.15**	0.29^{ns}	0.14^{ns}	0.006^{ns}	0.09**	0.01^{ns}	0.01^{ns}
	c	0.08^{ns}	0.32^{ns}	0.18^{ns}	2E-06^{ns}	0.02^{ns}	0.002^{ns}	0.01^{ns}
	d	0.15**	0.42^{ns}	0.29^{ns}	0.003^{ns}	0.02^{ns}	0.04*	0.02^{ns}
	e	0.25****						
df*		4	40	23	1	2	1	3

*degrees of freedom; level of significance: ns >0.05, * <=0.05, ** <=0.01, *** <=0.001, **** <=0.0001

Table A8 The one-way ANOVA results for question items, stakeholder types (ST), administrative unit (AU), and f the post-hoc analysis for items (note that w-z letters are a coding that shows how the items sharing a letter are not significantly different; there is no correspondence between these letters and the ones from Table 3).

Items	**Eta squared**	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**
Q1	0.21****	w	yz	x	zw	y	y		
Q2	0.23****	x	y	x	y	y	z	x	
Q3	0.25****	x	y	x	y	y	z	x	
Q4	0.22****	x	yz	x	y	y	z	x	
Q9	0.03****	x	xy	x	xy	y	x	x	

Q10	0.06****	yz	xy	xy	xy	z	xy	x	
Q12	0.1****	xy	zw	yz	yz	x	zw	w	
Q13	0.25***	y	x	y	y	y	y	z	
Q14	0.11****	x	yz	z	y	z	z		
Q16	0.15****	y	y	x	y	y			
AU	Eta squared	-							
Q1	0.05^{ns}								
Q2	0.03^{ns}								
Q3	0.04*								
Q4	0.03^{ns}								
Q9	0.19****								
Q10	0.12***								
Q12	0.06**								
Q13	0.06**								
Q14	0.07***								
Q16	0.1***								
ST	Eta squared								
Q1	0.17***								
Q2	0.06***								
Q3	0.09***								
Q4	0.1***								
Q9	0.09***								
Q10	0.03***								
Q12	0.15****								
Q13	0.02**								
Q14	0.14****								
Q16	0.03**								

level of significance: ns >0.05, * <=0.05, ** <=0.01, *** <=0.001, **** <=0.0001

Table A9 The logistic regression results for question items, stakeholder types (ST), administrative unit (AU) and flood vs. hilly administrative units (FAU vs. NAU)

Items	**M R^2**	**FAU vs. NAU**	**M R^2**
Q5	0.005^{ns}	**Q1**	0.0014^{ns}
Q6	0.001^{ns}	**Q2**	0.00005^{ns}
Q7	0.001^{ns}	**Q3**	0.0002^{ns}
AU	M R^2	**Q4**	0.001^{ns}
Q5	0.006^{ns}	**Q5**	0.001^{ns}
Q6	0.006^{ns}	**Q6**	0.006*
Q7	0.004^{ns}	**Q7**	0.003^{ns}
Q8	0.02^{ns}	**Q8**	0.00004^{ns}
Q11	0.011^{ns}	**Q9**	0.0054*
Q15	0.15**	**Q10**	0.0008^{ns}
Q17	0.0013^{ns}	**Q11**	0.0005^{ns}
Q19	0.11^{ns}	**Q12**	0.0007^{ns}
ST	M R^2	**Q13**	0.000006^{ns}
Q5	0.064***	**Q14**	0.0002^{ns}
Q6	0.042***	**Q15**	0.007^{ns}
Q7	0.00005^{ns}	**Q16**	0.0014^{ns}
Q8	0.086**	**Q17**	0.0004^{ns}
Q11	0.003^{ns}	**Q19**	0.04*
Q15	0.16***	-	-
Q17	0.096**	-	-
Q19	0.098**	-	-

M R^2 is McFadden's pseudo-R squared; level of significance: ns >0.05, * <=0.05, ** <=0.01, *** <=0.001, **** <=0.0001