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Citizens' Commitment in Risk Governance

From inaction to co-decision

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Índice

<i>José Manuel Mendes, Alexandre Tavares, Alexandra Aragão</i>	
Introduction – Citizens and risk governance	5
<i>Sofia Vaz</i>	
Environmental communication as a pre-condition for public participation	10
<i>Maria Carmen Llasat</i>	
Better resilience to hydrometeorological risks through better knowledge and sensibilization	14
<i>Liliane Hobeica, Adib Hobeica, Pedro Pinto Santos</i>	
Flood adaptation: Blending the spatial and sociocultural dimensions.....	22
<i>António Carvalho, Ana Raquel Matos, Vera Ferreira</i>	
Climate change, risk governance and grassroots movements: The case of the Transition Movement in Portugal.....	30
<i>João Alcione Sganderla Figueiredo, Danielle Paula Martins</i>	
Integrated Analysis for Diagnosing Environmental Impacts and Risks	36
<i>Rita Moura, Sílvia Luís, Ricardo Resende, Vasco Rato, João C. Ferreira</i>	
University community engagement in technologies for sustainability: A social architecture approach.....	43
<i>Isabel Estrela Rego, Sofia Morgado Pereira</i>	
Volcanic risk perception of farmers and non-farmers in the Azores	48
<i>Maja Grünzner, Sílvia Luís, Christian A. Klöckner, Bente J. Graae</i>	
Gaming as a novel intervention tool for conservation? The effects of the board game “Savanna Life” on communities in the Serengeti-Mara Ecosystem	57

Natália Vara, Cristina Queirós, Sónia Cunha, Sílvia Fonseca, Rui Campos

Relevance of coping strategies: comparative study of firefighters and pre-hospital emergency technicians..... 64

Rafael Sumozas

Commitment of the 2030 Agenda to sustainable cities/settlements and their resilience to risk 72

Rita Moura, Sílvia Luís, Maria Luísa Lima

Seniors' environmental risk perception regarding the presence of pharmaceuticals in water resources: Preliminary results 74

Sofia Morgado Pereira, Isabel Estrela Rego

The effect of demographic variables on the intentions to evacuate due to a volcanic eruption 79

Josep Espluga, Ana Prades

Public perceptions of nuclear energy through historical times and political spaces. A comparative study 86

Introduction – Citizens and risk governance

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The Sendai Framework for Disaster Risk Reduction (UNISDR, 2015) marked a turning point in the global governance of risk, from the articulation of scales (scalability) to the relevant role proposed to communities, vulnerable groups, and civil society stakeholders. In its guiding principles we can read that “special attention should be paid to the improvement of organized voluntary work of citizens” (UNISDR, 2015: 13). One of Sendai Framework’s main objectives is to promote resilience and responsible citizenship (ibidem: 16). Also, regarding the role of stakeholders, it is emphasized and expected that “Civil society, volunteers, organized voluntary work organizations and community-based organizations to participate, in collaboration with public institutions, to, inter alia, provide

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specific knowledge and pragmatic guidance...” (ibidem: 23).

The 2019 Global Assessment Report on Disaster Risk Reduction calls for the mainstreaming of data innovations as, for example, citizen-generated data (UNDRR, 2019: VI). And further mentions to citizens’ participation in the Global Assessment Report are sparse and non-consistent. A recent literature review reveals, for the field of floods, the broad approach to community-based disaster risk reduction, from crowdsourcing, to distributed intelligence, participatory science, and citizen science (from a soft to an extreme version of citizen science) (Wolff, 2021). A recent evaluation of co-delivery, co-decision and co-production in public policies concludes that,

However, we do not yet have a public service system which is designed, organised, incentivised or experienced in making use of the rich potential of citizen contributions. This is the challenge for future policy and research in public management—turning the huge potential of our citizens into the quality of life improvements for those citizens. (Loefflere, 2021: 403)

The International Risk Governance Council (IRGC, 2017) pointed out the relevance of decision-making processes involving all groups that have special interests or value commitments with respect to the risk or the benefits. Discourse-based strategies seek to create tolerance and mutual understanding of conflicting views and values and it’s a key to foster long-term trust and perceived legitimacy in risk management, in particular when risks are apprehended as complex, uncertain or ambiguous.

Enhancing knowledge creation, not only for data collection, but also for analysis or interpretation, can be an arena for a well-structured and analytic-deliberative discourse towards improving risk policies and risk management (Renn, 2015). As remarked by Paul et al. (2018), citizen science could complement more traditional knowledge generation practices, and also enhance innovation, adaptation, multidirectional information provision, risk management, and local resilience building.

As discussed by Frey and Ramírez (2019), in order to understand risk arrangement legitimacy, it is crucial to verify to what extent the local communities have an effective say, citizens are represented in their social diversity and exercise democratic control. It is, therefore, about building an ecology of knowledges where the broad involvement and participation of stakeholders, technical actors, scientific institutions, and the general public support the adequacy of operational responses, enable the scientific demonstration and cost-benefit analysis, or promote strategic or deliberative demonstration, namely through participatory forms, such as gaming, citizen-science and co-decision fora.

The EU security policy framework (EC, 2017) advocates the implementation of effective interaction policies between decision-makers, researchers, and operational stakeholders, centered on the needs of users and beneficiaries, and capable of strengthening the relationship between research, technology, and policies. In complement, the EU Research and Innovation Agenda (EC, 2018) argues that knowledge transfer must involve levels of horizontality, sharing and recognition of interactions between science and policy, and levels of verticality with articulation of scales of intervention, seeking that the development of science is based on the community of users or beneficiaries, aiming at new levels of society security and resilience.

Based on the participation of scholars, practitioners, and activists in the 2nd SRA-E-Iberian Chapter meeting in September 2019, in Coimbra, Portugal, a collective reflection moment was organised to propose a different approach to citizens’ co-decision in the area of risk governance. This effort resulted in the Coimbra goals, that are presented in the next section of this Introduction. Despite the fact that they were formulated before the Covid 19 crisis, the Coimbra goals on citizen engagement in risk governance gained even more relevance with the real-life experience of the pandemic crisis management and the subsequent crisis (social,

economic, mental health) intensified by the public measures to control the sanitary crisis.

In fact, the COVID-19 pandemic, that affects the whole world since the beginning of 2020, poses a major challenge to risk regulation and to citizens' participation. Although the COVID-19 pandemic was neither unpredictable nor unforeseen (Collins et al., 2020), it has been a real test to risk governance and to the strength and consolidation of democratic systems (Alemanno, 2020).

Although COVID-19 is undoubtedly qualitatively distinct from other outbreaks, from a risk regulation perspective there is little new in the actual health emergency crisis, as the responses relied on governments' routine decisions with the help of agencies, expert committees and dedicated emergency rapid response mechanisms (Alemanno, 2020). The element of surprise and the global scale of the COVID-19 pandemic shows how difficult it is to design public policies and maximize civil society responses based on learned lessons and past experiences (Jasanoff et al., 2021).

The COVID-19 pandemic is posing challenges beyond the public health arena, as the pandemic has rapidly morphed into an unprecedented socioeconomic and geopolitical crisis. One of the main structural factors in understanding the current global crisis is the different institutional configurations and the specificity of public health policies. Contrary to pre-pandemic global trends in public policy formulations, policies adopted in the COVID-19 pandemic were based on top-down approaches and expert knowledge that resulted in a decline in the democratic features of health crisis regulation and a diminished relevance of citizenship claims and rights (Zinn, 2020).

The questionable management options of the Covid 19 crisis demonstrated thoroughly the utmost importance of incorporating citizens views, fears and opinions in decision making, opting for more democratic decision-making procedures and more participated governance.

The Coimbra goals must be read in the light of the recent experience to understand their full potential for the improvement of future risk management practices.

Coimbra goals

Considering that Risk Analysis is a systematic process to comprehend the nature of risk and to express the risk with the available knowledge, and that Risk Communication is an exchange or sharing of risk-related data, information and knowledge between and among different target groups (such as regulators, stakeholders, consumers, media, general public), the following 12 goals were established:

- The way a risk is perceived and formulated affects the way it is managed or solved. Risk is historically, culturally, and politically framed and defined.
- The most common way of formulating and applying risk analysis and management is scientifically and technologically driven, resulting in different risk management outcomes.
- The definition of priorities is mainly unilateral, imposed by decision-makers in a top-down approach.
- An “ecology of knowledges” must be recognized and integrated in the context of risk analysis.
- The “technological fixes” are always value-driven, although they are presented as being neutral.
- Risk governance demands an interdisciplinary approach: it is framed by political, economic, social, psychological, legal, and ethical dimensions.
- Risks, namely environmental risks, are also ethical problems. Risk communication and governance must emphasize the ethical aspects.

- Risk governance can and should trigger a broader social discussion on the practical implementation of fundamental values such as democracy, freedom, solidarity and sustainability.
- Risk related participatory processes should be based on trust and procedural fairness.
- Trust and perceived legitimacy mean shared knowledge and even co-constructed knowledge.
- Risk science must be participatory aiming at the promotion of shared narratives and co-construction of discourses.
- Risk governance should be based on citizens' co-decision.

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Environmental communication as a pre-condition for public participation

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Abstract: This text, a written presentation², defends three interlinked theses: a. looking at environmental problems as ethical problems; b. understanding better the interface between science, society and policy; and, c. improving environmental communication enlarges the scope of possible answers and promotes public participation encouraging people to go from inaction to co-decision. When the realm of environmental problems includes uncertainty and risk, then this interlinkage is even more relevant. Communicating ignorance, risk, and uncertainty to allow public participation in difficult processes of decision demands humility, responsibility, respect and openness from all sides. Ethics helps.

Keywords: Environmental ethics, environmental communication, time, silence, frugality

Ethical questioning

The way one formulates a problem affects the way one solves that problem. Being aware of how we look into problems, most notably environmental problems, is a relevant field of inquiry. Given the demand for quick answers, the frames in which environmental problems tend to be formulated are mainly within science or technology. This type of formulation allows a fast response that solves immediate problems. Environment as science and technology has grown significantly in its half a century history. Some environmental problems within air pollution or water pollution for e.g., are already solved at technical level. Yet, regardless of the immense progress in science, the truth is that we are still in the midst of the environmental crisis.

When science and technology are not enough to solve a problem, then policy needs to enter the equation. This is a welcoming dimension for helping taking decisions especially in face of issues where there is a need for balancing environmental impacts with benefits at other levels. When policy enters the conversation, then most probably the environmental problems in dispute need decisions beyond science and including choices that have to be justified politically

¹ Sofia Guedes Vaz worked in several public and private organizations, both national and international in the environmental field. Her academic background, which began in environmental engineering and continued with environmental philosophy, gave her an interdisciplinary perspective and a comprehensive understanding of the importance of different types of knowledge. How to better communicate environmental issues is one of her passions together with citizen engagement initiatives. Sofia is a member of IFILNOVA and is currently the President of the Portuguese Society of Environmental Ethics.

² This text is based on the oral presentation done at the workshop. It is not a scientific paper and there are no references, even though some of its ideas have been discussed already in the literature.

and economically. Yet policy-decision tends to be biased towards economy and economic growth undermining very often environment. When uncertainty and risk are involved then both scientists and policymakers lose ground, and the system becomes even more complex.

The claim here is that environmental questions are also ethical questions demanding and benefiting of complementary ways of framing and looking into them. Normative assumptions about what is valuable, just, right, good need to be explicit and critically analysed and that is the benefit of philosophy entering the conversation. Framing environmental questions also as ethical questions enlarges the scope of the discussion and when civil society is involved in the conversation, it becomes even more relevant. When arguing and justifying the values that underlie decisions, the discussion becomes less confrontational than if based only on the final decisions themselves. This implies better probabilities for compromising and more inclusive answers.

Climate change, loss of biodiversity or unsustainable production and consumption, to mention only the three largest global environmental problems, would gain if seen also as ethical problems, as the conversation would include not only possible scientific or technological answers but also the values that are behind our understanding and acting in the world.

Values such as the intrinsic value of nature and inter and intra-generational justice – the founding principles of environmental ethics – have to be put forward and enter the debate. Looking at climate change as belonging to a justice realm (towards nature, towards the other far away at spatial and temporal scales) changes the discussion and broadens the understanding of what it is at stake.

Interface between science, society, and policy

The second thesis of my proposal is on the importance of understanding the interface between the three actors of the theatre of life: science, society, and policy. These actors are summoned to the stage to deal with issues such as complexity, uncertainty, risk, value commitments, plurality of legitimate perspectives, questions that abound within environmental questions.

Promoting the commitment of citizens, taking them from inaction to co-decision, as the title of this workshop challenges us to think about, arises epistemological, methodological, and institutional questions:

- a. At epistemological level it would be important to consider that the role of science and scientists cannot be confined to its traditional roles and that the new social contract for scientists must demand that they also address the needs of society and considering the boundaries of science accepting that science is a value-loaded social process.
- b. Methodological problems arise also, demanding clarification on questions such as how to make the identification of the issue; the choice of relevant scales and disciplines; or open and transparent processes of how methodologies are chosen.
- c. Institutionally it would be important to remember the five EU principles of governance: openness, accountability, effectiveness, coherence, and participation.

These questions open the processes and challenges the public, the scientists, and the policymakers and from informing policy type of models, we need to go to mutual learning type of models. These mutual learning concept mirrors the democratization of knowledge that needs to be promoted, accepted, and integrated in decision-making processes.

To seduce the public from inaction to co-decision it is important to come back to the importance of ethics and its basic questions: what I should do; how should I live; what type of person do I want to be; what are the values that should guide what I do, how I live, who I am. But ethics is not only a matter of helping us to manage well our relationship with ourselves,

with the world and with others, but it is also a matter of building the world, outlining its development in a certain way.

Ethical questions make us think and help us arguing, explaining, and justifying the criteria for our actions and so the role of environmental communication should be pointing to the ethical dimension of environmental problems and of their relationship with our lives.

Environmental communication

Notwithstanding its uttermost importance and relevance, environmental communication still encompasses some problems that are in need of further pondering, namely:

- a. Environmental communication can be quite moralistic, having a narrow discourse on imposing what one should or should not do: you should recycle, you should not eat so much meat, you should not use the car, you should, you shouldn't. Even though it is clear that environmental questions pose moral and ethical demands on us, the way one convenes it would benefit of a more thoughtful framing.
- b. Environmentalists tend to have the monopoly of having seen the light for a better world and therefore are always more right than anyone else, they are owners of the truth, closing possible enriching and constructive dialogues.
- c. Environmentalists tend to limit and base their discourse on facts and indicators showing endless numbers and graphs without framing them or pointing their overall significance, and so easily forgotten. Even though it is uttermost important to get the facts right and be aware of the magnitude and dimension of existing environmental problems, cold numbers tend to push away empathy towards problems.
- d. Some discourses tend to be quite catastrophic giving a sense of the meaningless of individual actions and sort of disclaiming responsibility.

A more philosophical type of communication involving questioning, taking us out of comfort zones convene us to awaken our ethical me, our ethical us, pushing to a more active citizenship. Storytelling becomes paramount in this scenario, as it is a much more organic and an easy way of seeding certain environmental ideas. Telling stories in a simple and intelligible way exemplifying values and rousing emotions inside one's environmental narrative is productive in bringing people into meaningful and interactive dialogues.

In my personal quest for having a story, a narrative that would inspire people to think more on the environment, I decided I would walk from Lisbon to Porto, paying homage to Greta Thunberg³ and to understand better and in a more direct way the real country. In the end, I summarized the 17 walking days and the 360 km in 3 concepts and questions:

- a. Time – I was not efficient, I was not in a hurry, I went slowly, and I soften my rhythm. It was refreshing and liberating not caring about time. A slow life with no need for the new and the fast. So, the first question is if we re-think time and accept it at a slower pace, what would that do to the environment?
- b. Silence – walking alone makes our mind burgeoning and thinking in all directions but at a certain stage, one gets tired of words, of rationalities and even of thinking and I became more attentive to other senses, smells, sounds, and feelings. I passed through beautiful landscapes, rich and diverse, with sounds bursting from everywhere, birds, leaves, water running; I also passed through forests of eucalyptus where there was a total silence, no birds, no crickets; I pass through roads hearing cars, trucks, and horns.

³ The Portuguese NGO – ZERO supported me and helped organizing media coverage which meant I talked daily to a Portuguese national radio station – TSF - on the environmental issues that would cross my mind and that were inspired by the daily landscapes. I also had the opportunity to write to a couple of national newspapers and I was interviewed by three TV stations.

Feeling the heat, the cold, the rain, the wind made me feel grateful. So, the second question is if we were more attentive to our feelings, our sensations what would that do to the environment?

- c. Frugality – I had nothing but my seven kilos´ rucksack with basic stuff, including two books (that I didn´t read). I bought nothing but food, slept in bunk beds, hostels, schools and charity places. I had little and I needed little. So, the third question is if we give up much of our material life, what would that do to the environment?

I hope my narrative encourages people to think about time, silence, and frugality. To integrate it into a meaningful narrative, feeding the void of imagining alternative realities. We are stuck to the monolithically paradigm of economic growth not really opening ourselves to alternative narratives.

Will my story inspire more people than if I presented indicators, facts, and moral demands? As the title of this text suggests will it promote more eagerness for citizens to participate in public debates?

Finale

This text aimed at suggesting that ethics is a fundamental discipline to enter the equation on public discussions on environmental questions and that it is important that we think about the values that matter most to us and to understand what the values that matter to others are. This type of discussions foster respect for each other and become more encompassing of the challenges that the reality of current environmental problems poses to us and to the world.

The final statement would be that promoting ethics and environmental communication grounded around understanding the values we share, would help public participation to be more efficient and productive. That is very relevant because public participation and co-decision are paramount in building a better and more inclusive world.

Better resilience to hydrometeorological risks through better knowledge and sensibilization

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Abstract: Hydrometeorological risks (it is to say all the natural risks related with meteorological conditions, following UNISDR nomenclature) are the most important natural hazard in the world. Their mitigation and adaptation to the impact that climate change has on them is a priority in most government agendas. However, recent reports and papers still show significant uncertainty associated with their future development. Uncertainty is still higher when we consider the interaction with society and the changes in vulnerability. Therefore, they need to be treated from a holistic perspective that integrates bottom-up (from impact and vulnerability) and top-down (from hazard) approaches in the same methodology. Besides this, the Hyogo and Sendai protocols developed by UNISDR insist in the development of adaptation measures through the improvement of the risk awareness and resilience. This communication shows a holistic approach to hydrometeorological risks, mainly in the Southern of Europe, as well as the different tools and procedures for a better empowerment of the population.

Keywords: Floods, precipitation, climatic change, socioeconomic impacts, Mediterranean

Introduction

Hydrometeorological risks (it is to say all the natural risks related with meteorological conditions, following UNISDR, 2016, nomenclator) are the most important natural hazard in the world. Their mitigation and adaptation to the impact that climate change has on them is a priority in most government agendas. However, recent reports and papers still show significant uncertainty associated with their future development. Uncertainty is still higher when we consider the interaction with society and the changes in vulnerability. Therefore, they need to be treated from a holistic perspective that integrates bottom-up (from impact and vulnerability) and top-down (from hazard) approaches in the same methodology. In this sense, we understand by hazard a dangerous phenomenon, substance, human activity, or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage (UNISDR, 2016). Hazard depends on frequency, intensity, and magnitude of the phenomenon. Following the same nomenclator,

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vulnerability would be the conditions determined by physical, social, economic, and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards (UNISDR, 2016), and would be constituted by exposure, sensibility and resilience.

The Hyogo and Sendai protocols developed by UNISDR insist in the development of adaptation measures through the improvement of the risk awareness and resilience. This communication shows a holistic approach to hydrometeorological risks, mainly floods, as well as the different tools and procedures for a better empowerment of the population.

Evidence on flood impacts, trends, and scenarios

Among natural disasters, floods pose a significant threat to people, despite the noteworthy improvements in forecasting, emergency management, and realization of protective works. In 2015 they have affected more than 27 million of people and more than 3000 casualties. In 2018 alone, floods affected more than 35 million people and claimed the lives of 2859, with the Kerala (India) event being the most devastating, with more than 500 fatalities (International Disaster Database; <http://www.emdat.be/database>). A recent study from Petrucci et al. (2019) has published the EUFF (EUropean Flood Fatalities) database that contains all the casualties due to floods in some regions of Europe (Czech Republic, Israel, Italy, Turkey, Greece, Portugal, South France, Catalonia and Balearic Islands) for the period 1980–2018. This work identifies 812 fatal floods with 2466 fatalities, and, on average, each event killed 3 people, mainly males, aged between 30–49 years and the majority of them happened outdoor. Most often people were dragged by water/mud when travelling by motor vehicles. Some cases of hazardous behaviors, such as fording rivers, were also detected. The primary cause of death was drowning, followed by heart attack.

In spite that numerous papers focusing on vulnerability have been published in the field of natural hazards, research devoted to characterizing economic vulnerability due to floods from a holistic point of view has been scarce. One of the most typical evaluation is through the assessment of the economic costs resulting from reinsurance data. In this field, Barredo et al. (2012) shows as the increase of the economic impact of floods may be observed, in part, to an increase of assured property and the cost of life. Without neglecting this type of approach, which is also very useful and, in many cases, the only one available (Cortès et al. 2019), a holistic proposal allows us to better identify the fields of action to mitigate the damage. An example is the recent paper published by Aroca-Jiménez *et al.* (2018) that proposes the application of an integrated vulnerability index to estimate potential impacts in urban areas: the Integrated Economic Vulnerability Index, IEVI, that allows the classification of 31 economic indicators into five thematic groups grouped in: 1) Exposure component (potential damages caused in flood-prone areas and potential damages at individual level); 2) Sensitivity component (economic capacity of urban areas to deal with flood consequences and the wealth level of the urban areas); 3) Resilience component (citizens' capacity to cope with flash flood consequences).

Due to changes in societies, land use, and policies, flood impacts on individuals have changed over time, either increasing or decreasing depending on the region. The work of Kreibich *et al.* (2017) compares the difference of the primary drivers of flood risk change as well as of fatalities and economic damage between two events in the same place. It shows that flood impact can decrease because of modifications in habits and behaviors, due to both generalized improvement of the cultural level of population at large, and to the diffusion of facilities and technologies. On the other hand, it can increase due to the increase of the value of the exposed assets and vulnerability.

About future scenarios, changes in the probability of damaging flood events in the Eastern part of Spain, with a global warming of 1.5°, 2° and 3° C above preindustrial levels, show a general increase in the probability of a damaging event for most of the cases and in both regions of study, with larger increments when higher warming is considered and when both climate and population change are included. The model uses an ensemble of seven regional climate model simulations EURO-CORDEX project (Jacob et al., 2014), and considers 5 different socioeconomic scenarios (the Shared Socioeconomic Pathways that include projections for population, urbanization and Gross Domestic Product at global and national scales, O'Neill et al. 2014).

Then, following the literature previously cited and other bibliography in the same matter, it can be concluded that:

- Floods causing multiple fatalities are gradually disappearing, and in their place are a higher number of cases with fewer deaths per even due to imprudent behaviours. The mean death tolls are still high in developing countries.
- Flash floods events and associated economic and human lives losses are still increasing all over the world
- Changes as both urbanization of flood prone areas and individual dangerous behaviors could increase flood fatalities.
- Flood impact may increase because of increasing individual exposure. For example, the growing personal trust in high-performance of SUV (Sport Utility Vehicle) and pickups can encourage hazardous behaviors such as crossing rivers.
- The probability to die during a flood essentially depends on some physical parameters characterizing the flood-human's interaction, as water speed, height of water level and water turbidity during the flood.
- Due to the high spatial variability and a high degree of complexity in the relationships among different vulnerability factors the use of integrated indexes to estimate economic impacts is proposed. For regional approaches and lack of enough information, insurance data can be used as proxy.
- It is necessary to include variables that consider change in both climate and socioeconomic conditions in the analysis of flood damage.
- Economic losses caused by floods are expected to rise worldwide in the coming decades, which is largely due to the increasing exposure of elements at risk but also to the increase of extreme precipitation.

Disaster Risk reduction

The Third UN World Conference on Disaster Risk Reduction agreed on The Sendai Framework (18 March 2015). This framework introduces Seven Global Targets:

1. Substantially reduce global disaster mortality by 2030, aiming to lower average per 100,000 global mortality rates in the decade 2020-2030 compared to the period 2005-2015.
2. Substantially reduce the number of affected people globally by 2030, aiming to lower average global figure per 100,000 in the decade 2020 -2030 compared to the period 2005-2015.
3. Reduce direct disaster economic loss in relation to global gross domestic product (GDP) by 2030.

4. Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030.
5. Substantially increase the number of countries with national and local disaster risk reduction strategies by 2020.
6. Substantially enhance international cooperation to developing countries through adequate and sustainable support to complement their national actions for implementation of this Framework by 2030.
7. Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to the people by 2030.

These objectives should be achieved following the Four Priorities for Action:

- Priority 1. Understanding disaster risk
- Priority 2. Strengthening disaster risk governance to manage disaster risk
- Priority 3. Investing in disaster risk reduction for resilience
- Priority 4. Enhancing disaster preparedness for effective response and to “Build Back Better” in recovery, rehabilitation, and reconstruction

There are three dimensions of disaster management that can help to cope with these objectives and priorities: philosophy, strategy, and tactics. For instance, the 2007 EU Floods Directive offers a philosophy of flood risk management. Strategy indicates objects or themes to complete each function, and tactics are concrete methods to execute each strategy. For example, enhancement of individual perceptions of risk is a mitigation strategy, which includes various tactics such as distributing flood risk maps, media campaigns, signboards, exhibitions, and school education (Nakamura and Llasat, 2017). These dimensions can be contemplated in the different strategies developed to mitigate natural risks. As an example, the main types of flood strategy and their limitations are shown below.

Structural flood protection

Deflection and retention facilities, check dams, flood-control reservoirs, levees, etc.

Main constraints:

- Cost of construction and maintenance
- Impact on ecosystems, landscape
- Collateral impacts: population displacement, cascading effects, critical infrastructures failures
- “Levee effect”, “safe development paradox”, or “safety dilemma”: unintended effects which, paradoxically, seems to increase risk. The increasing flood protection can attract settlements and high-value assets in the areas “protected”, due to a sense of complacency, which can dangerously reduce preparedness (Di Baldassarre et al, 2018).

Land-use planning and other legal regulations

Building codes, mandatory insurances, risk mapping...

Main constraints:

- Difficult accessibility to hazard/risk maps in spite of being “publics”
- Difficult comprehension of hazard/risk maps
- Urban planning and personal/public interests
- Changes in the price of the soil
- Re-insurance systems that do not favor good practices

Warning systems

They depend on the hazard type. The success of warning systems depends on run-off times, communication chain, capacity (time, space, mobility) of people to move (or remain) to a safe place.

Main constraints:

- Computational and physical modelling limits
- Different criteria between different organisms in the same place/región
- Increasing the initial uncertainty by combining it with the uncertainty of the following processes
- Communication chain

Emergency plans

Emergency plans, coordination civil protection and other operatives, evacuation procedures and maps

Main constraints:

- Lack (or not application) of local planning
- Non existence of evacuation maps

Risk Perception

Campaigns, information, mass-media, empowerment of the population, self-protection. Those actions should improve the risk perception of inhabitants and foreigners.

Main constraints

- “Bad memory” of past events
- False sensation of security
- Non enough public information
- Different experiences by different individuals or groups within a society

Better resilience to hydrometeorological risks through better knowledge and sensibilization should improve risk perception and individual and social empowerment. Social perception and awareness determine the effectiveness of flood risk mitigation and emergency plans since they enable suitable risk communication and education plans to be devised to improve community resilience (exhibitions, demonstrations, and workshops). Historical data and knowledge of past events are one of the best tools to improve risk awareness. They are useful to risk mapping, identifying vulnerable groups and ranking circumstances in terms of dangerousness, making educational campaigns aiming to promote risk consciousness and defensive behaviors. Increase people’s resilience to floods can be done through: educational campaigns, teaching individuals how to behave in the case of flood, and avoiding risky situations, such as driving through floodwater or swimming in a flooded river. This goal involves several subjects: the scientific community, decision-makers, emergency management organization, and, finally, individuals.

Comprehensive flood risk management implies integrated vulnerability analysis plus risk communication plans to inform the population about how they should proceed (or how they should not) when facing a flood event. The participation of the population in the formulation of vulnerability reduction strategies reduces the possible economic damages, increases the efficiency of risk management plans, increases empowerment, and increase community resilience. Nowadays, mobile phones and social media are useful to save lives and to alert people about dangerous situations related to floods. Apps’s can be useful for developing citizen science (citizens can actively participate in some phase in the research process), as the case of

FLOODUP (Llasat-Botija et al. 2018), a mobile phone application that provides information about floods, what to do/not to do, and collect data to rebuild flood events.

Conclusion

In conclusion, the lessons to learn and the messages to take home are the following:

- Since it is not possible to guarantee complete safety, risk management is currently directed toward recognizing risk and making people aware of and prepared to live with risk.
- Risk management must be treated from an integrated and holistic point of view.
- Risk maps have become an essential tool for land-use planning. They should be linked to other countermeasures (land-use regulation, insurance, warnings).
- Risk strategies and tactics should be based not only on modeling but on analysis on historical data and past events. They are useful to risk mapping, identifying vulnerable groups and ranking circumstances in terms of dangerousness, making educational campaigns aiming to promote risk consciousness and defensive behaviors, instead of risky behaviors.
- Risk reduction should be a key aspect of local development, which could contribute to the revitalization of the local economy. Local government have an important role in disaster management and prevention. Major cooperation between municipalities and state organizations is needed.
- If integrated risk management is expected, in all cases it is needed to effectively communicate these improvements to the different stakeholders (decision makers, emergency managers, disaster responders and society)
- Integrated vulnerability indexes that cope with the complexity and interactions of the different factors allows the definition of specific tactics for risk mitigation strategies according to the weaker points and limitations.
- Integrated vulnerability assessments can help to civil protection agencies to prioritize their actions; insurance companies to identify the most vulnerable areas and delimitate the catastrophe zones; policy makers to design the most adequate strategies; society to appropriate allocation of economic resources to vulnerability reduction; and to improve people protection actions by reducing risk behaviors and sensitivity and increasing resilience.
- Local government have an important role in disaster management and prevention. Major cooperation between municipalities and state organizations is highlighted
- Besides the self-protection guides provided by civil protection, municipalities or autonomous communities should distribute more information on risk easy to understand, including evacuation maps and protocols (in different languages)
- Educational campaigns aiming to promote natural risk consciousness and defensive behaviors, should be targeted to different vulnerable groups and ranking circumstances in terms of dangerousness.
- New technologies as mobile phones and social networks are useful to improve risk protection and prevention. Exhibitions containing historical information, campaigns and citizen science methodologies are useful for the population empowerment in front of natural risks.
- It is important to include variables that consider change in both climate and socioeconomic conditions in the analysis of future flood damage.
- The future challenge is to develop efficient adaption strategies, also considering the expected exacerbation of rain regimes as an effect of climate change.

- It is needed to limit the global warming as much as possible.

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Flood adaptation: Blending the spatial and sociocultural dimensions

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Abstract: The adaptation of the built environment to floods has been proposed as a no-regret strategy to face the heightened risks associated with climate change. Yet, the proponents of such an approach may understate floods' sociocultural drivers. This paper aims to discuss the interactions between floods' spatial and sociocultural dimensions, based on the analysis of a flood-adapted neighbourhood presently under construction in Bordeaux, France. The studied case showed that mindset adaptation to floods, instead of being a by-product induced by territorial adaptation, may constitute a condition for this to properly happen. Also, as the intervention's organizational structure did not include future inhabitants, the needed sense of flood stewardship has not been built along the design process. Thus, the conditions for safely living with floods may not be successfully attained, despite the spatial measures geared towards the neighbourhood's adaptation.

Keywords: Flood risk, territorial adaptation, mindset adaptation, risk governance, DRR

Introduction

Climate change has been challenging the way longstanding and recurrent hazard processes, such as floods, are approached. Accordingly, besides traditional disaster risk reduction (DRR) measures (focused on flood prevention and mitigation), societies, their representatives and risk managers are also led to embrace flood adaptation. The latter is here understood as comprising

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strategies not only for accommodation (i.e. providing space for water) but also for anticipation (i.e. thinking and acting before hazards strike). In this paper, we discuss some premises for holistic flood adaptation, taking as a thread the case of Bastide Brazza Nord, a flood-prone neighbourhood presently under construction in Bordeaux, France. The city's urban-regeneration policy encompasses the redevelopment of derelict floodable sites inherited from its industrial past as a means to avoid extending its current built-up area. The French legislation in force allows for flood-adapted urbanizations when the concerned municipal authorities ensure that flood risk will not be locally increased nor transferred elsewhere. But how sure can one be regarding future flood drivers, namely the combination of individual human actions?

Considering that all human beings are “flood designers” (Hobeica & Santos, 2016), our research intended to highlight possible mismatches between the spatial and sociocultural dimensions of flood adaptation, based on the experience of the Bordeaux project. Following the case-study method (Yin, 2009), we gathered data through a desk review, field observations and interviews with main seven professionals from public institutions and private practices. Using flood adaptation as our analytical framework, we then carried out an in-depth description of the Brazza case, a summary of which is herewith presented. This paper is structured as follows: we briefly review the flood-adaptation literature in Section 1, before presenting the Brazza Nord project in Section 2. In Section 3 we discuss some premises for living in a flood-adapted neighbourhood, whereas in Section 4 we delineate possible paths to counteract the identified mismatches.

Some reflections about flood adaptation

Floods are one of the hazard processes that best illustrate how recurrent and quite predictable events are sometimes transcended by extreme and unexpected conditions. At the same time, being floods a complex phenomenon in which natural and human dynamics intertwine, the three components of flood risk – hazard, exposure and vulnerability – are concomitantly influenced by anthropic action and inaction. Besides human behaviour, risk perception and cultural values also play a key role in flood-risk creation, mitigation and adaptation (Aerts et al., 2018). Thus, more holistic understandings of floods, accounting for their interconnected physical and sociocultural dimensions, are needed to achieve more effective flood mitigation and adaptation endeavours (Massuel et al., 2018; Navarro et al., 2020).

Yet, this standpoint still contrasts with most current DRR practices. For example, as stated by Ciullo and colleagues (2017, p. 880), “society makes scientific, economic and technical efforts to mitigate [floods] by developing protection measures”. Indeed, such efforts attempt to control the hazardous sources and include spatial adjustments to prepare for what science predicts will happen someday again. They may also comprise, for instance, the provision of flood forecasts and early-warning systems as soft measures to enhance disaster preparedness. But what about the efforts to change (undesirable) sociocultural patterns leading to risk escalation? Overall, floods' sociocultural dimension is frequently underrated within engineering- and economic-based approaches. Jongman (2018, p. 1), for instance, considered that effective flood-adaptation strategies should simply “combine flood protection infrastructure, nature-based solutions, and risk financing schemes to manage floods and buffer their economic impacts”. This author yet acknowledged that the human behavioural component, i.e. “the way individuals perceive and respond to risk”, still constitutes a gap for the proper management of flood risk (Jongman, 2018, p. 2).

As a result of such limitation, humans have been usually framed in DRR endeavours as passive targets located in the wrong place (Hobeica & Santos, 2016). Yet, the interventions of each human being, no matter their scope and timeframe – from disposing waste to parking a

car to implementing a highway –, have an impact – from negligible to highly significant – on a water basin. Accordingly, if minor and major spatial interventions do influence water dynamics, humans are rather active subjects in term of risk creation. Holistic DRR should hence take floods’ sociocultural dimensions – which actually drive human behaviour – into account and fully engage people to act in line with a flood mitigation and adaptation stance. As advocated by Kelman (2019, p. 2), “preventing disasters should positively and tangibly impact day-to-day living” and be pursued as a collective goal. Yet, this task is far from a simple one, especially given well-known biases and coping strategies regarding flood risk (Harries, 2008).

To circumvent these limitations, the framework of “integral adaptation” proposed by O’Brien and Hochachka (2011), although focused on climate change, seems opportune to properly deal with floods. These authors claimed that integral adaptation is a complex process that involves adjustments in four interrelated domains (personal, behavioural, cultural and systemic). Recognizing these different levels of adaptation and understanding their relationships can lead to transformations in the way that people actually perceive and manage change. If we consider floods as undesired events that change normality, O’Brien and Hochachka’s conclusion seems to fit the flood-adaptation challenge. Following their rationale, floods could be better tackled if reframed “from something that society manages through behavioral and systems changes to something that humans consciously create in alignment with their beliefs, values, and worldviews” (O’Brien & Hochachka, 2011, p. 100). In this regard, adapting floods’ sociocultural dimensions has a crucial role to support effective spatial adaptation to floods. Yet, although spatial flood adaptation is relatively fast and can be easily fostered through design, sociocultural flood adaptation is typically a more complex and long-term ambition (Hobeica & Hobeica, 2019).

Designing and building a flood-adapted neighbourhood

Bastide, Bordeaux’s district on the right bank of the Garonne River, was predominantly occupied by industrial premises in the 19th and 20th centuries. With the relocation of most activities, the municipality initiated the reconversion of the district in the 1990s, with the ambition of recovering its previous green ambience to balance the densely built left bank. Following the regeneration initiatives of Cœur de Bastide and Bastide Niel, Bastide Brazza Nord has been envisioned as a multifunctional neighbourhood comprising both housing and productive activities. Brazza’s site, as described by an interviewee,

(...) is like a patchy enclave: stuck behind housing areas and factories that will remain, behind the hills, behind the railways (...). There are no inhabitants (that’s very strange), and only few jobs actually, it’s under-occupied, very empty, rather dead; in fact, it’s abandoned, it’s like a huge wasteland.

Besides, the site is heavily contaminated (ground pollution), and prone to floods, just like most of Bastide. Bordeaux’s PPRI (flood-risk prevention plan), approved in 2005, classifies the majority of Brazza as flood prone and liable to development under strict building regulations. The concerned authorities have thus been integrating risk concerns since the early planning stages in 2010, to eventually reach a flood-compatible urban regeneration. Moreover, the sheer impacts of the storm Xynthia on the French Atlantic coast also in 2010 – including the death of more than 50 people in their houses, legally built behind a dyke and thus taken as safe from floods – also played a role in this regard. Indeed, this event raised flood awareness among French politicians and the general public alike, and shed light on climate change as a driver of heightened future floods.

Consequently, the commissioner of the Brazza project, the Municipality of Bordeaux, stated clearly the flood-risk challenge in the project brief. The envisioned design should anticipate stricter flood regulations ensuing from the expected new PPRI – the one in force was already considered outdated, for it did not take into account the hazard conditions of the last disaster (in December 1999, linked to the storm Martin). Moreover, the design should also embrace the idea of ‘living with floods’. Choosing this standpoint was only possible because the level of flood risk locally is considered low. Such assessment was based on the involved water dynamics, as indicated during one of the interviews:

In Brazza, during the river-overflow episodes, the water slowly climbs the quay before spreading into the site at a reduced pace; so the velocities are not very high, even if the water levels attained are significant.

Accordingly, the three proposals for Brazza, developed in different planning phases, took flood adaptation as a driving design concept. The final plan, proposed by Youssef Tohmé Architects and Associates, Michel Desvigne Paysagiste and the engineering company Ingérop, adopted both structural and non-structural flood-adaptation measures, adhering to the following principles:

- The Garonne’s water should be visible in the neighbourhood during flood events (for the enhancement of risk perception);
- The flood solutions should be autonomous (i.e., not requiring any human intervention, taking thus into account the waning of flood memory and preparedness);
- The alteration of the local topography should be kept to a minimum, to avoid both soil contamination and reducing the current water-retention capacity of the site;
- The urban fabric and buildings should be hydraulically transparent, meaning that “*the water should be able to get in and out of the neighbourhood very easily*”, as summarized by one of the interviewees;
- The neighbourhood should be composed by two main flood-adapted building typologies, which make room for occasionally accepting the Garonne’s waters: elevated on stilts and with floodable crawlspaces and/or parking places (spatial flood adaptation).

Moreover, the concerned public authorities have also produced sensitization materials not to hold back potential investors and future inhabitants from the new neighbourhood. During the elaboration of the Brazza project, close cooperation was established between the design team and governmental authorities in various levels and sectors, including civil-protection officers. Using state-of-the-art flood modelling (Artélia, 2013), these actors were able to negotiate and agree on a given flood-adapted urban structure. Yet, the design team anticipated that the building stage will bring some operational challenges, as recognized by some interviewees. More generally, “*it’s not easy to deal with the water plot by plot, it’s not really the scale of water management...*”; on the other hand,

it’s necessary to know, now, how we make the project real and in which order, because if we start to insert all the new buildings without removing the ones that are already there, we will have a problem. Nowadays we already have buildings (the existing ones that will be demolished), and if we start constructing the new buildings before demolishing the old ones, the buildings’ footprint will be greater, it’s just like putting more pebbles into a water bowl.

Living in a flood-adapted neighbourhood

Designing and building a flood-adapted neighbourhood may be a complex endeavour for the involved parties. Yet, if sociocultural dimensions are not properly accounted for during this process, its intended outcome of providing for safely living in a flood-adapted neighbourhood

may be deemed to fail. In Figure 1 we schematized the process stages and main stakeholders of the Brazza project. The focus of our research was on the project stage, in which the inhabitants, still to be defined, were not involved. In sum, Brazza is being spatially conceived to welcome floods (Hobeica & Santos, 2016). Yet, just like the operational challenges of the construction stage, when the project is finally operational the day-to-day practices of inhabitants may undermine the neighbourhood's adaptability to floods. For instance, the use of the buildings differently from the design's expectations (e.g., the conversion of floodable basements into living spaces, a long-lasting practice in Bastide), may put people's lives in danger during future flood events.

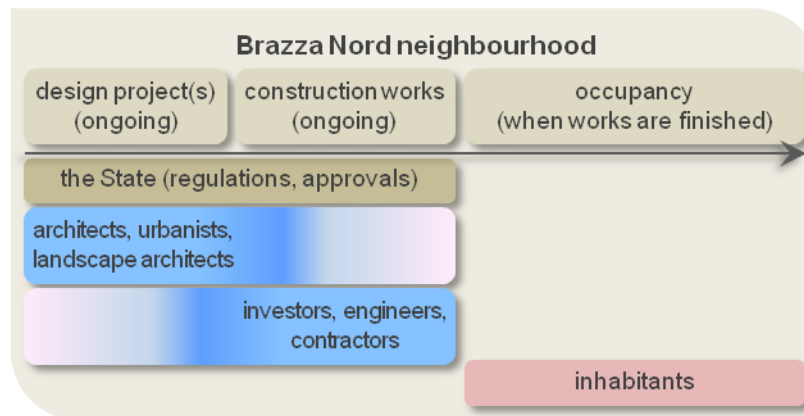


Fig. 1 – Involvement of Brazza's main stakeholders in the project stages

Future inhabitants of Brazza need not only to be aware that they would live in a flood-prone area, but also to be sensitized to accept to sporadically share their new neighbourhood with the Garonne's waters. Thus, what is at stake is not only a communication issue but also their inner adaptation, at the personal and behavioural levels, as conscious flood designers, who are aware of medium- to long-term scales.

Indeed, when analysing newspaper articles describing flood-related disasters, it is possible to infer that many of the reported losses – in particular fatalities and missing persons, but also temporary or permanent displacement – could have been avoided (Pereira *et al.*, 2015; Santos & Reis, 2018). Whether in rural or urban areas, flood-related disasters are often caused by misinterpretations of the related hazards, which lead to biased behavioural decisions, or by misconceptions in the spatial design of flood-prone areas. This suggests that flood losses also reflect a lack of sociocultural adaptation to these events.

At the same time, when considering exclusively recurrent and minor material losses due to floods, one can infer that simply avoiding them also means missing other opportunities. That is, it is possible to intervene in flood-prone areas to maintain day-to-day activities, mitigate direct and indirect impacts and even welcome and benefit from otherwise non-disastrous events (more frequent and less disturbing ones). In principle, spatial design, rooted in a deep understanding of physical, sociocultural and economic dimensions, can offer an effective and no-regret contribution to mitigate flood losses. Local interventions should, however, not disregard the fact that flood-generating processes occur at the scale of the entire water basin, which means that each action taken upstream may affect the site in which a flood-adapted project is being carried out.

Hence, spatial adaptation and sociocultural adaptation should go hand in hand in the design of a flood-adapted neighbourhood (Figure 2), based on the recognition that floods are inevitable socio-ecological processes strongly framed by the human dimension. Besides a

thorough understanding of the historical and hydrodynamic facets of flooding manifestations and its impacts, flood adaptation requires anticipating and challenging both excessive inaction and neglectful action, which can possibly be circumvented by the promotion of a sense of flood stewardship. This would be a mean to ensure a better cultural fit of the proposed food-adaptation solutions.



Fig. 2 – The blend of flood-adaptation dimensions embedded in the project stages

In the Brazza case, the flood hazard is in principle well known. At the same time, French authorities can quite easily update flood-exposure (and even flood-risk) maps taking into account the issuing of building permits for new urban-development initiatives, as informed by an interviewee. Yet, the consequences for flood risk of the sum of small-scale interventions at the scale of the entire basin and behavioural practices can often go unnoticed until a new disaster happens. But the fact that the organizational structure of Brazza's intervention did not include future inhabitants may imply that flood stewardship has not been built along the design process. Thus the conditions for safely living in this flood-prone neighbourhood may not be successfully attained, despite its spatial adaptation. This case indeed brings some key overarching questions, outside floods' spatial dimension, that are still to be addressed:

- Despite the state-of-the-art flood modelling performed, what are the social dimensions (not taken into account) that challenge the results of the simulations?
- How to effectively engage the inhabitants during the design stage and beyond, to encourage their commitment towards codesigning floods in a conscious (safe) mode?
- How can the moral hazard related to the advertised flood adaptability of the site be mitigated to foster local preparedness?

Final remarks

Flood-prone areas are complex territories in which physical and human processes overlap and constantly feed into one another. Flood adaptation encompasses understanding and accepting these processes, while minimizing, but not eliminating, disturbances – even in urban settings, in which people and assets are concentrated. Disasters should nonetheless be avoided, calling for a holistic understanding of flood risk, which should inevitably include the involved human drivers. The Brazza case pinpointed that mindset adaptation, instead of being a by-product induced by territorial adaptation, may actually constitute a condition for this to properly happen. Bold flood-risk adaptation thus requires taking people as its central dimension, while going beyond risk communication towards risk engagement.

At the same time, leisure, business and most human activities in flood-prone areas should not be jeopardized when flooding processes are sufficiently known. Conversely, floods can even be accommodated or welcomed when their spatial and sociocultural dimensions are consciously integrated through design. Finally, due to its central position regarding floods, human beings are invited to develop a sort of ‘flood stewardship’ and then ‘flood ownership’ to be effectively adapted to these processes. Nonetheless, the focus on mindset adaptation to floods – that is, on the personal-adaptation level – should not be confused with State disengagement in protecting citizens from hazardous events. The individual and institutional scales need to complement each other to achieve an effective blend of flood’s spatial and sociocultural dimensions.

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Climate change, risk governance and grassroots movements: The case of the Transition Movement in Portugal

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Abstract: This article stems from a poster presented at the conference “Citizens' Commitment in Risk Governance: From Inaction to Co-Decision”. It focuses on the Transition Movement in Portugal, a grassroots movement that aims at dealing with the challenges of climate change and peak oil.

Through semi-structured interviews with present and former members of the Transition Movement and the analysis of relevant documents, we explore the ways in which these groups develop various forms of bottom-up risk management.

The Transition Movement puts in place several initiatives whose goal is to pave the way for the emergence of low carbon societies, allowing us to understand risk management as an attempt to produce cultural, economic, environmental, and sociotechnical changes to face the challenges of climate change.

Keywords: Transition movement, grassroots movements, permaculture, risk management, low carbon transitions

Introduction

The aim of this paper is to reflect on the ways in which the Transition Movement (TM) in Portugal enacts risk governance at the local level. It stems from the research project TROPO: Anthropocenic Ontologies in Portugal – Social Movements, Public Policies and Emerging Technologies, currently being developed at the Centre for Social Studies of the University of

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Coimbra.⁴ TROPO is partially focused on bottom-up initiatives to tackle the challenges of climate change, and in this paper, we rely on data related to one of the case studies to discuss the role of citizens in risk governance.

Scholarly work has displayed longstanding concerns with how communities and grassroots movements play an important role in climate change adaptation and mitigation. While risk, in the early definition of Beck (1992), is understood as being entwined with a reflexive modernity, it should be framed within a broader framework of governmentality (Foucault, 2007) where communities – and individuals – “internalize” social and environmental threats and can be mobilized by governments – at the local, regional, national and supranational levels – to enforce biopolitical strategies.

Recent discussions on environmentality (Agrawal, 2005) have shed light on the role of materiality, technologies, and the human/environment interface in risk governance. In that sense, risk management – especially in the Anthropocene – is turned into the active shaping of sociotechnical milieus:

With the production of knowledge, emphasising that humanity has not only affected but significantly shaped (and partly destroyed) nature, protection and preservation are no longer sufficient. When nature has already been shaped by humanity over centuries, humanity’s relationship with nature can no longer be characterised in terms of preservation and protection. It is instead a relationship of active shaping (Zinn, 2016: 392).

Social movements and grassroots initiatives focused on climate change adaptation and mitigation often display material politics (Barry, 2013) that clash with “official” narratives, i.e., struggling to assemble sociotechnical arrangements that attend to the challenges of the socioenvironmental crisis. In other cases, through a set of actions – demonstrations, roadblocks, strikes, public performances and art – these groups attempt to force governments to put in place specific measures, such as the reduction of greenhouse gases (GHG) emissions or the declaration of climate emergency, as illustrated by the recent *School Strikes for Climate* or *Extinction Rebellion*.

The Transition Movement is an emblematic case study to reflect on the role of citizens in risk governance at the local level, as it is focused on rearranging the sociotechnical assemblages of local communities, while striving to achieve a bottom-up – and viral – effect to face the challenges of climate change and peak oil. As we will see throughout the paper, members of the Transition Movement display a variety of motivations, sociotechnical imaginaries (Jasanoff and Kim, 2009) and transition pathways, although they are generally committed to implement various forms of material participation (Marres, 2016) to enforce low carbon transitions and mitigation measures.

The Transition Movement

The Transition Movement is a grassroots movement focused on developing low carbon societies to face the challenges of climate change and, originally, peak oil. It was founded in 2004, by Rob Hopkins, in Kinsale, Ireland, where he worked as a permaculture teacher. Permaculture is the philosophical basis of the TM, and it aims at enacting agricultural systems aligned with natural ecosystems, including their stability and resilience, thus harmoniously integrating landscape and people (Mollison, 1990: ix).

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Permaculture, alongside localization and resilience, are the three main principles of the TM. Localization refers to the attempt to locally produce as many products as possible, including mushrooms, medicine, bread, glass, paper, fish, wood, fruits, etc. (Hopkins, 2008: 93).

Regarding resilience, it entails three main aspects: the need of communities to shape decisions affecting them; their ability to adapt through relevant techniques and tools; the need for long-term planning (Hopkins, 2011: 44). One of the early – and most emblematic – initiatives of the TM was the development of a plan to reduce fossil fuels dependency in Kinsale, in 2005, entitled *The Kinsale Energy Descent Action Plan*.

In 2006 there was the official inauguration of *Transition Town Totnes*, attended by over 400 citizens at Totnes City Hall, in Devon, United Kingdom. The first Transition course was also organized in Totnes, in 2007, and since then initiatives have spread all over the world, namely in Portugal.

The activities promoted by the TM can be understood as forms of material participation (Marres, 2016), resorting to the properties of several non-humans (organic and non-organic) to enact more resilient and sustainable socioenvironmental formations. Some examples include: urban and community gardens; sharing seeds and food; creating local food networks; wilderness walks; installing solar panels; building solar ovens, etc. There is also a concern with the advancement of a cultural, economic and subjective transition, specifically through talks and movie sessions, the development of local currencies, as well as by resorting to techniques of inner transition, drawing on the work of authors connected to deep ecology, such as Joanna Macy and John Seed (Carvalho, 2017).

Transition Town Totnes put together a series of these approaches throughout the years, namely by developing an oil vulnerability audit; the realization of a capacitation course for energy descent; developing a local currency (the Totnes Pound) and creating domestic groups to support environmental activists (Hopkins, 2011).

There is also an utopian dimension to the TM, with the clear ambition of achieving a true paradigmatic transition until 2030, including the transformation of fields such as food and agriculture; medicine and health; education; economy; transports; energy and housing (Hopkins, 2008). This “vision” for 2030 is particularly interesting to analyse the imaginaries of the TM, how it mobilizes technology and knowledge and how it enacts various forms of risk management.

Methodology

20 semi-structured interviews with current and former participants of the TM were conducted. Initially, we mapped several active transition initiatives in Portugal, in order to identify local transition groups as well as key actors of the TM in this country. As our aim was to understand individual experiences of Portuguese members of the TM, these interviews were conducted individually.

First, participants were questioned about their motivations to join the TM. We were also interested in the various activities put in place by local transition groups and their potential to overcome the challenges posed by climate change. We were especially interested in understanding whether local TM groups interact and cooperate with the wider community and local institutions (namely city councils and environmental and social organizations), and whether there is an articulation with other groups and TM initiatives in Portugal and abroad.

Participants were also asked to assess the impact of their local TM group, mentioning some of the main difficulties faced, including the fading out of the TM in Portugal. Another aspect that we explored has to do with inner transition and the role of psychological and subjective

aspects. We were interested in the impacts of the TM on their daily lives, namely concerning the adoption of certain habits, and how these contribute to processes of transition. Regarding climate change and environmental damage, we focused on whether the experiences within the TM influenced interviewees' perceptions on these phenomena. We also looked at the role played by the TM and related practices – such as permaculture – and other local initiatives in leading to a sustainable future, particularly in fields such as the economy, energy, transports and food.

Finally, interviewees were encouraged to imagine a post-transition world, sharing their visions, dreams and aspirations. Although our script did not focus specifically on the issue of risk management, participants framed individual attitudes, choices and behaviours as important to tackle the socioenvironmental crisis, arguing that the sum of these multiple actions at the local level may trigger a significant global change.

Results

In this section we present some of the activities put in place by the TM in Portugal. We argue that these may be read as bottom-up forms of risk management, focusing specially on climate change. Risk management is understood as a broader societal transition towards low carbon societies; risk, according to the TM assemblage, is deeply entwined with the consumption of fossil fuels and a wide range of actions that could be coined as “extractivist”. In order to foster the transition to low carbon societies, a set of sociotechnical and cultural changes are enacted; this is achieved through forms of material participation, i.e., through specific actions that carry the ethos and praxis of transition.

The range of practices and activities put in place by the TM in Portugal include: techniques such as sociocracy, social permaculture, non-violent communication, backcasting; Permaculture and Transition courses; awareness campaigns, petitions, information sessions, debates; documentary sessions; repair cafes; workshops (horticulture, apiculture, composting, cooking, natural cosmetic, medicinal plants...); community meals; city farms and gardens; local farmers markets; seed banks; direct exchange of goods and services; local and complementary currencies; *permablitz*; cultural and ecological festivals; art exhibitions; reforestation actions.

Official Transition initiatives in Portugal have peaked and are now slowly fading out. However, they have inspired other sustainability initiatives led by former TM members, as well as various forms of social action, namely against fossil fuel exploration. Moreover, interviewees displayed different imaginaries of socioecological transition and resilience to climate change, instead of reproducing the “official” narrative of the Transition Network.

Depending on the local TM group, we also identified multiple strategies to tackle climate change and enhance mitigation, including self-sufficiency, social mobilization at the local level, articulation with various political and social stakeholders (municipalities, governments, non-profit organizations, companies), social and green entrepreneurship.

Based on our findings, we contend that risk governance is a contested and ambivalent concept, as it may foster a wide range of initiatives at the local level to govern a world affected by climate change. These aforementioned initiatives, promoted by the TM, could be coined as forms of risk governance, and at the same time they are attempts to build a world – a low carbon society – addressing the risks of climate change and peak oil. In that sense, what is at stake in the typology of risk governance advanced by the TM is the enactment of environmentalities that follow the principles of permaculture, resilience and localization, sustained by a wide range of activities that embody the ethos of Transition.

Despite the shared vision and ambition of a low carbon society, we also registered different motivations, visions and imaginaries of risk governance, i.e., people who joined local TM groups were informed by manifold approaches that included deep ecology, social entrepreneurship, degrowth, green capitalism, neo-Luddism, environmental activism and new age spiritualities.

Nevertheless, there was a shared concern with climate change among members of the Transition Movement. Participants espoused a wide range of strategies to face the climate crisis, which are anchored in the tools and techniques of the TM (including the previously mentioned expressions of material participation). The interviews indicate that the TM entails forms of governmentality that encompass multiple dimensions of social life, and different styles of public and political engagement under the guise of the master narrative of low carbon transitions.

Conclusion

The analysis of the empirical material is still ongoing, but it is safe to assume that present and past members of the TM in Portugal understand their actions as ways of dealing with the challenges of climate change and environmental degradation in general. Their actions can be understood as forms of bottom-up risk governance and long-term resilience building: although they are usually not centred on dealing with emergencies, such as floods or wildfires, TM initiatives are focused on climate change mitigation, putting in place various mechanisms to tackle the cultural, sociotechnical, economic, and epistemological dimensions of low carbon transitions.

The active shaping of the human/environmental milieu that characterizes TM groups indicates that these actions of bottom-up risk governance are an emblematic example of the emerging environmentalities of the Anthropocene, as citizens are marshalled to implement multiple individual and life-style changes to face the threats of climate change and environmental degradation. This sheds light on how these emerging environmentalities foster novel biopolitics where individual behaviour is a key dimension to processes of low carbon transitions, turning citizens into active agents of risk management.

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Integrated Analysis for Diagnosing Environmental Impacts and Risks

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Abstract: This paper presents the problematization of issues related to environmental risk in urban areas, based on the case study of the municipality of Novo Hamburgo, in southern Brazil. Having as a guiding axis of the analysis the process of formation of the municipality, based on industrial development, these areas also present high probability of occurrence of landslides and floods. We sought to identify, map and investigate how the social, environmental and health risks are perceived by the different actors (social, economic and political) involved. Through fieldwork, questionnaires, environmental analysis, discussion forums with agents from various sectors of society, it was possible to begin an integrated understanding of the cause-and-effect relationships that are inherent in risk issues. It is expected, at the end of the work, contribute to the understanding of the relationship of land use and occupation, and develop integrated methodologies for risk management that can be replicated in other municipalities.

Keywords: Municipality, industrialization, contamination, disasters

Brief environmental history: the complex relationship between the appropriation of natural resources and environmental impacts generated

Urban space, represented by cities and large human settlements, has concentrated a significant part of natural disasters and damage, even though the territorial portion of cities is small when compared to the surface of the planet (Nunes, 2015). Recent studies by Peci et al. (2017) have shown that, in several regions of the world, climate change is rapidly changing the earth's ecosystems. As a result, the largest number of epidemics is predicted due to the displacement of mosquitoes; a new design of agricultural geography, due to the damage generated to pollinators; and migrations from whole traditional communities in search of food. Not being

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enough, consequences for the human communities can be felt, because in cities that grow and shelter more and more people, especially in countries such as Brazil, damage to the quality of life and impairment of health and social well-being are added. In this regard, it is essential to highlight the insufficiency of basic sanitation due to waterborne diseases, outbreaks of diarrhea, malnutrition and other diseases resulting from contamination by chemical components identified in water bodies (Freeman, 2013).

Climate change is presented to society by the IPCC mainly in the last three decades, as pointed out by Areia and Tavares (2019), which makes this a relatively new issue in the environmental field. On the other hand, environmental risks and damage caused by human activities, based on the industrialization model that did not favor the control of environmental impacts, have long been known to society. Hogan (2007) presents some tragedies that have marked history and reinforce the long history of impacts when associated with industrialization, such as in 1930, Belgium, when about 60 people died after heavy fog in a region with a strong presence of industrial activity. A few years later, in 1952, 4,000 deaths were reported in London, as a result of a thermal inversion with high concentrations of air pollutants, compromising the health of the London population, which only became aware of the damage after a long time. The release of mercury in the Minamata Basin in Japan in 1956, with serious consequences for the population and the environment, adds to the many other moments that have been experienced by mankind, which demonstrate the emergence of relating industrial progress with the paradigm about environmental issue, manifested in the relations of society and environment as the main paradigm of modernity.

In Brazil, the context of environmental impacts is known internationally with the emergence of Cubatão, city of São Paulo state, which emerges as an economic protagonist and came to be reported as the most polluted cities on the planet in the mid 1980s. Cubatão went from a context of industrial growth and promise economic development, to a toxic and pollution space, with several cases of diseases and chronic problems in newborns, frequent episodes of acid rain, with high social and public health costs, and consequent high commitment of natural resources (Klanovicz, 2018).

More recently, disasters from mining activities raise the question of measures to control industrial impacts in Brazil. The disaster that hit the city of Mariana in 2016, with a total of 35 municipalities directly impacted and 19 people killed, and the one that occurred in Brumadinho, in 2019, with more than 270 deaths, indicate the misappropriated appropriation relationship of natural resources and context of the risk society that has been outlined to date.

A valley that challenges sustainability

The Rio dos Sinos, the main water body of the Vale dos Sinos, in the Brazilian state of Rio Grande do Sul, the region where this paper operates, was the scene of important socioeconomic transformations locally, as it allowed the arrival of many immigrants, mainly Germans, which resulted, in the mid-1970s, in the title of National Footwear Capital, granted to Novo Hamburgo (Prodanov, 2009). But, according to Nunes et al. (2019), the model of industrial expansion adopted at the time is very similar to the traditional model of predatory nature extraction, characteristic of the conquest of the New World. Figueiredo (2014) contributes to the detail that most of the cities in this region were built around the tanning activities, the main local industry, such as Novo Hamburgo. In 2006, the Sinos River Valley appears in the media with a lamentable environmental disaster, where thousands of fish are found dead, compromising water quality for consumption and damage to biological systems



Figure 1. Fish Mortality in the Bell River in 2006.
Source: courtesy of Jackson Miller.

To date, it is possible to identify liabilities resulting from a period of intense industrial activity in the municipalities of Vale dos Sinos. However, in addition to the environmental risks related to local industrialization, Novo Hamburgo, one of the municipalities that most attracted people, between the 1950s and 1980s, lives with the disasters associated with occupation in areas with landslides and flood risks. According to the mapping produced by the Geological Survey of Brazil (CPRM, 2011), there are eleven high-risk sectors sensitive to environmental degradation; This is due to human intervention, where at least 4,153 houses and 16,612 residents were identified, occupying such areas and subject to the environmental risk situation. The CPRM identifies these areas of environmental risk by their geological weaknesses, natural in nature, but also by human intervention. Criteria involving the definition of these risk areas are mainly due to landslides, erosions, siltation and flooding.

For Tominaga (2009), flooding is a process triggered mostly by rains, which vary in intensity and duration. Soil sealing, rectification and silting of water bodies has intensified the occurrence of floods and floods, as they impede the runoff of rainwater, which does not drain as naturally. In addition to these concepts, the floods and floods, especially when analyzing the ecosystem in urban areas.

As a basic assumption, the research presented here is the result of a process of investigation and interaction with these risky spaces of the Environment and Society groups and the Environmental Education Program in Natural Disasters of Feevale University, Novo Hamburgo. The project activities started in 2016 and focus on the exchange of knowledge from professionals and the community, and methodologies from different areas of knowledge.

In Brazil, the major disasters are related to floods and landslides, and these processes are strongly associated with the degradation of fragile areas (Brasil, 2007). For Kobyama (2006), mass movements happen when solid materials (soils, rocks and vegetation) move downhill by the action of gravity and in Brazil, this phenomenon is related to the infiltration and saturation of water in the slopes' soil. It is of fundamental importance the observation of evidence and evidence of soil movement observed in the place, such as: cracks in the ground, felling steps, sloping trees, landslide scars, flood marks, among others (CPRM, 2011).

Environmental impacts and risks

The main results obtained so far are: knowledge and mapping of the main natural, anthropic, social and structural threats (Figures 2, 3, 4 and 6). Irregular occupation in environmental protection areas extends over sloping areas and flood plains of the river. According to Martins et al. (2019), approximately 70% of the areas with risk exist the predominance of urbanized area, and 26% of area with native vegetation. When analyzing the areas of irregular occupation, at least 150 nuclei with irregularity characteristics were accounted, some of them under areas with contamination by industrial waste (Figures 3 and 6).

Basic sanitation is understood, according to Law 11,445 of 2007, as being the treatment and distribution of water for the supply, collection and treatment of sewage, waste collection and urban drainage. As a diagnosis of basic sanitation, one can state the absence of sewage treatment, the use of nozzles for human supply, drainage problems that result in flooding, and insufficient selective collection (Figure 5).



Figure 2. Irregular occupation area. Source: Authors.



Figure 3. Solid waste collected in water body. Source: Authors.



Figure 4. Restricted area due to mass movements. Source: Authors.



Figure 5. Nozzles for human supply. Source: Authors.



Figure 6. Water bodies with high presence of domestic sewage and effluents, without treatment. Source: Authors.



Figure 7. Discussion forum for proposal building and dissemination of partial results. Source: Authors.

Community opinions and perceptions were of fundamental importance to understand the dimension of community risks, which from 285 questionnaires applied together to residents, showed the adaptation of residents to the context presented.

By analyzing the potability of water consumed by communities living in risk areas, up to now, 6 drinking water spouts were evaluated. The evaluations were performed based on the potability parameters of the Ministry of Health that recommend the evaluation verified by the Water Quality Surveillance for Human Consumption (VIGIAGUA). The results showed that one water spout has the presence of total coliforms, and the others are in drinking conditions. It is worth mentioning that the legal instruments for risk management, the analysis of local communication and education strategies and the Interlocution with municipal public managers are under evaluation. At all stages of the project, the dissemination of knowledge was privileged, involving undergraduate and graduate students from different areas, in teaching, research and extension activities.

Considerations

The projects presented here aim to point out structuring ways to think and rethink what planning is being made in relation to sanitation, housing, drinking water quality and leisure facilities, which culminate in a healthy environment. Above all, considering that the result presented here, by the perception of the risk of the city residents and the public power and its relation to the real risks, lead to potentialize a real channel of dialogue with new public policy propositions.

The activities carried out within the scope of diagnostics to understand the impacts and risks are under development, through the articulation of a multidisciplinary team, in order to provide conditions for understanding the complexity that is placed in the local context. Finally, it is worth recalling Agenda 21, an important environmental planning instrument built on the 1992 United Nations Conference on Environment and Development, which emphasizes the importance of acting locally, which is the best way to meet global challenges. Without further comment, the perspective of this report is, locally, to understand the population and territorial dynamics, with a view to understanding, in an integrated manner, the relationship of this case study with environmental impacts and risks.

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University community engagement in technologies for sustainability: A social architecture approach

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Abstract: Climate change is a pressing global problem, threatening the sustainability of communities. There is a growing need to advocate for a change in environmental behavior to develop more sustainable contexts. Recently, an emerging concern has been the high and unnecessary consumption of energy in the public sector. The project “University community engagement in technologies for sustainability: A social architecture approach” aims to reduce

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energy consumption in a public university institution (Iscte - Instituto Universitário de Lisboa) with the help of its large community participation. Here we present an overview of the implementation phases of the project and its' innovative social and architectural approach to sustainability.

Keywords: Environmental sustainability, energy consumption, buildings, behavior change, social and architecture approach

Introduction

Climate change poses a major threat to all ecosystems' livelihood. In fact, the more human activities disrupt the climate, the more severe, pervasive, and irreversible are the impacts on our planet (IPCC, 2014). Such changes can be observed on a global scale: the atmosphere and oceans are warming up, snow and ice are melting, sea levels are rising, and weather is changing drastically (Chalmers, 2014). Nowadays, efforts to mitigate and adapt to climate change, adopt pro-environmental behaviors, and work towards more sustainable communities are critical. Examples of eco-friendly actions that everyone can take include, but are not limited to, using cleaner energy sources, improving energy efficiency, and reducing energy consumption (IPCC, 2014).

One important area of change that has been gaining a lot of attention recently is the energy consumption behavior in public and shared buildings. Buildings are the largest energy consumers, accounting for 32% worldwide (Chalmers, 2014) and 40% in Europe of the total energy usage (European Commission, 2019), and these numbers are expected to double or even triple in a few decades. Moreover, recent reports show that in developed countries, public and shared buildings have higher levels of unnecessary and inefficient energy consumption (Chalmers, 2014), possibly because individuals have no feedback on their behavior and the disperse responsibility enables them to engage in more wasteful behaviors. As a result, the public sector holds a great potential for energy savings of 50% to 90% in existing and new buildings (Chalmers, 2014).

Project's Overview

The project “University community engagement in technologies for sustainability: A social architecture approach” emerges as a response to this problem, aiming to change the behavior of Iscte users to reduce energy consumption, thus promoting energy efficiency and conservation. This strategy seeks to reinforce the dual connection between humans and environment, in the sense that people promote sustainability with their environmentally friendly behaviors and in exchange, the improved and healthier contexts promote their well-being and quality of life.

Designing effective interventions for sustainable environments requires the combination of technology, practices, and skills from multiple disciplines, as well as the participation of the wide range of users involved in these contexts (Curry et al., 2018). As such, two important aspects were considered in this project, namely: (a) the assemble of a skilled multi-disciplinary team, combining the knowledge of main areas, such as Psychology, Engineering, Architecture, and Informatics, and (b) the participation of the Iscte community, including all types of users (i.e., students, academic staff and non-academic staff). Since public participation in decision-

making is seen as a key element for successful sustainable behavior change (Poppe et al., 2018), this project was thought-out to listen closely to users' opinions as a way to ensure their concerns and needs are considered, as well as to encourage them to cooperate and have an active role in enacting the environmental change at Iscte.

The intervention contemplates four strategic phases. The first phase focuses on identifying Iscte's current environmental situation. As a starting point, we want to assess users' perceptions regarding environmental sustainability. After we understand who the targets are, how they feel about sustainability and when, and how they behave within the buildings, and in what circumstances do they engage in pro-environmental actions, we can determine how motivated they are to change their energy consumption patterns at Iscte. Simultaneously, we also want to install sensors to collect data on energy usage, luminosity, humidity, temperature, and noise inside of the buildings and calculate Iscte's global and localized (e.g., departments) ecological footprint. To do so, we plan to use the Internet of Things (IoT) platform, which allows us to gather, monitor, and analyze a larger amount of real-time sensor data directly from the environment. This data can then be used to predict and simulate future scenarios and enhance the performance and optimization of energy resources (Curry et al., 2018).

The second phase comprises the elaboration of an environmental plan, with established goals to reduce energy consumption according to users' behaviors and characteristics, physical and architectural features of the buildings, and organizational environmental policies and practices. With the combined data, we aim to develop a mobile app so users can have easy access to contextual information to act in an environmentally friendly way at Iscte and thus improve the quality of the shared space based on immediate personalized feedback. When interventions are designed, it is important to consider each user and their motivational stage, hence why customized apps designed to support behavior change help users stay motivated and committed with the new behavior (Curry et al., 2018). To determine users' stage of change regarding their energy usage behavior at Iscte, we will apply the principles of the Trans-Theoretical Model (TTM). The TTM comprises five major stages of change that unfold through time: precontemplation (i.e., not ready to change), contemplation (i.e., thinking of changing), preparation (i.e., getting ready to change), action (i.e., change to the new behavior) and maintenance (i.e., maintain the new behavior and prepare for possible relapses). Once the stage is determined, the TTM helps identifying the adequate strategies to guide users through their environmental behavior change (Prochaska & DiClemente, 1982).

The third phase involves the whole community in order to achieve the desired goal, using behavior change tools (e.g., give information about the pros and cons of the target behavior) and gamification strategies (e.g., positive reinforcement with a points system whenever people engage in sustainable behaviors) that are appropriate for the users' stage of change. Consequently, we plan to implement tailored interventions, based on the contextual features, actual consumption behavior, and type of user. Technology-tailored messages have become a common strategy to boost behavior change by providing personally relevant feedback that assist users to initiate and maintain the change over time (Krebs, Prochaska, & Rossi, 2010). Our goal is that when users need information on how to intervene in energy friendly way at Iscte, they can access the mobile app and get quick information about the actions they can perform in order to improve the current environmental conditions. As an additional outcome, we want to encourage off-campus sustainable behavior with a positive spillover effect. The premise is that once people start engaging in one sustainable behavior, such as consume less energy, they might be more prone to adopt the same pro-environmental behavior in other contexts (e.g., private homes), and also possibly adopt other similar and equally important sustainable behaviors (Thøgersen & Crompton, 2009), both at Iscte and other contexts.

The fourth phase comprises the dissemination of the methodology and results in open-access sources and scientific journals to augment international diffusion. Besides, we also plan to develop a set of recommendations and good practices in a policy-brief format for sustainability in public buildings. We anticipate the potential implementation of this project in two contexts, universities and other public buildings, as the steps are planned to be easily adaptable to these settings. In addition, we also want to promote training sessions and workshops for stakeholders interested in replicating this project as a way to maximize the positive outcomes of promoting sustainability in public and shared spaces.

Conclusion

The project holds an interesting approach by incorporating the knowledge and strategies from multiple research fields. More importantly, the combination of the real-time environmental data with users' profiles represents one of the most innovative contributing factors of this project. Even though tailored behavior changes interventions tend to be highly effective, they are difficult to implement using conventional ways (Krebs et al., 2010). By using the IoT platform and the mobile app, we are able to gather and transmit information through quick and easily accessible channels and reach the entire community. This gives us the opportunity to intervene at the right time, with the right strategy, and encourage users to participate and get more actively involved in the management of energy resources at Iscte in efficient and effective sustainable way. With this intervention, we expect the Iscte community to feel empowered and more ready to make this environmental change.

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Volcanic risk perception of farmers and non-farmers in the Azores

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Abstract: Disasters are multidimensional events that affect populated areas. The study of risk perception aids the understanding of human behavior in disasters and provides vital clues for volcanic disaster management. Risk perception was associated with the quality of risk communication, preparedness, and evacuation behaviors. About the last, farmers seem reluctant to evacuate. We hypothesize that volcanic risk perception differences may be present. This study aims to describe the volcanic risk perception of farmers and non-farmers and verify differences between the two groups in a location exposed to volcanic risk (Azores, Portugal) where the farming sector is predominant. A survey methodology was employed with self-completed questionnaires and application aided by an interviewer to 127 farmers and 442 non-farmers. We found moderately high volcanic risk perceptions. Five Fisher's exact tests with Bonferroni correction were applied to verify differences in the volcanic risk perception dimensions. No statistically significant differences were found. These results can inform disaster management and enhance the knowledge about the volcanic risk perception of farmers, suggesting that occupation may not influence volcanic risk perception.

Keywords: volcanic risk perception; volcanic eruption; disaster management.

Introduction

Natural disasters occur when an extreme event causes massive destruction and social disruption in a populated area (Alcántara-Ayala, 2002). One can assume two fundamental disaster dimensions: a geophysical dimension referring to the physical area, and a social dimension referring to the affected population (Chakraborty et al., 2005). The study of risk perception aids the understanding of human behavior included in the social dimension. Risk perception was associated with the quality of risk communication, preparedness, and evacuation behaviors (e.g, Ropeik & Slovic, 2003; Tobin & Whiteford, 2002). Here, we will address differences in volcanic risk perception of farmers and non-farmers of a volcanic area (Azores, Portugal),

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because studies reported that farmers seem to be more reluctant to evacuate and evacuation behaviors were associated with risk perception (Lebon, 2009; Wilson et al., 2012, Tobin & Whiteford, 2002).

Despite multiple definitions, risk perception refers to a subjective, dynamic, and complex cognitive process (e.g., Lindell & Whitney, 2000; Slovic, 1999). It is influenced by variables such as qualitative attributes of risk (e.g., dread, familiarity), affect, worldviews, socio-demographic factors, hazard knowledge, and experience (Johnston et al., 1999; Renn, 2008; Slovic, 1999).

Residents in volcanic areas tend to devalue the risk of an eruption (e.g., Bird & Gísladóttir, 2012). Notwithstanding the mentioned variables, volcanic risk perception is influenced by volcano proximity, volcanic hazard knowledge, and the low frequency of volcanic eruptions compared to other hazards (Carlino et al., 2008; Perry et al., 1982).

Previous studies found an association between risk perception and preparedness (Chaney et al., 2013), the quality of risk communication, and evacuation behaviors (e.g., Lindell et al., 2019; Riad & Norris, 1998; Ropeik & Slovic, 2003; Tobin & Whiteford, 2002). These factors are central to the success of disaster management, contributing to saving lives if a volcanic eruption occurs. We failed to find studies reporting differences in preparedness and interpretation of risk messages (risk communication) between farmers and non-farmers. Nonetheless, studies reporting differences in evacuation behavior were found. When facing a volcanic eruption, evacuation is often adopted to safeguard life (Wilson et al., 2012), but residents may refuse or be reluctant to evacuate (e.g., Dow & Cutter, 1998). The explanations for the evacuation behavior of farmers are unclear. This can occur because of the type of livelihood, lack of economic resources or planning to evacuate livestock (Wilson *et al.*, 2012) or to change professional activity, attachment to place and animals (Lebon, 2009; Tobin & Whiteford, 2002), or as we hypothesize here, due to different risk perceptions.

We assume that differences in volcanic risk perception can add to the knowledge about factors in disaster management such as evacuation behaviors, preparedness, and interpretation of risk messages because risk perception was associated with these factors. We failed to find works exploring the volcanic risk perception of farmers, thus adding to the literature.

Considering these arguments, we will describe, verify and explain non-significant differences in volcanic risk perception of farmers and non-farmers of Vila Franca do Campo (São Miguel, Azores), an area exposed to volcanic risk. This study is part of a project addressing volcanic risk perception and social vulnerability of residents and economic sectors in Vila Franca do Campo. Therefore, this analysis includes only part of the collected data.

Material and Methods

Local context

The Azores are a nine-island volcanic archipelago located on a triple junction of tectonic plates in the Atlantic Ocean. The islands have persistent low-magnitude seismicity (Carmo, 2013) and are vulnerable to indirect volcano hazards, such as gas emissions, landslides, earthquakes, floods, and tsunamis (Wallenstein et al., 2007).

Vila Franca do Campo municipality is located near Fogo volcano, thus exposed to volcanic risk, and has frequent seismic swarms (Wallenstein et al., 2007). Similar to other volcanic regions where the soil is fertile, agriculture and livestock activities are predominant (Almeida & Silva, 2013; Teixeira et al. 2014).

Participants

A convenience sample of 442 non-farmers of Vila Franca do Campo was used. Most non-farmer participants were female ($n = 227$), with ages between 34 and 49 years old ($n = 137$) and with secondary education ($n = 102$).

Regarding the farmers, a convenience sample of 127 farmers was used. Most were male ($n = 121$), with ages between 50 and 64 years old ($n = 48$) and with basic education ($n = 49$).

All participants had at least 18 years old. All the non-farmers participants lived in Vila Franca do Campo, whereas the farmers lived or worked in the municipality.

Materials

A paper-pencil questionnaire was designed considering literature and pretested. It had 65 items, assessing: (1) Volcanic risk perception; (2) Volcanic hazard salience; (3) Volcanic hazard knowledge; (4) Self-efficacy beliefs in the context of a volcanic eruption; (5) Volcanic preparedness; (6) General trust in authorities in the context of a volcanic eruption; (7) Evacuation attitudes; (8) Place attachment; (9) Sense of community; and (10) Sample characterization and social vulnerability in a volcanic eruption.

To accommodate the singularities of economic sectors of agriculture, sea and tourism included in the project, other versions of the questionnaire were designed and pretested. These included additional items concerning, for example, volcanic risk perception related to business.

The questionnaires can be obtained with the first author.

The analysis of the items of volcanic risk perception of farmers and residents (non-farmers) is presented here.

Procedure

The data was collected between February and August 2018 following a survey methodology. The questionnaires were handed to stakeholders for self-completion and applied by researchers, door-to-door and in the streets of the municipality. These were accompanied by an envelope, contributing to assuring confidentiality, and by an informed consent approved by the Ethics Committee of the University of Azores, indicating the research objectives, assuring confidentiality, and attesting for the voluntariness of participation. The document also indicated that it was expected single individual participation.

Quantitative methods were applied to analyze the results.

Results

Volcanic risk perception

Volcanic risk perception was assessed considering four dimensions:

- 1) Perceived likelihood: asking participants if they considered likely a volcanic eruption on the island of residence that threatens their security with the answer options: ‘Yes’, ‘No’, ‘I don’t know’;
- 2) Perceived imminence: asking participants when they think a volcanic eruption would occur on the island of residence with the answer options: ‘This year’, ‘In the next five years’, ‘In the next ten years’, ‘In my lifetime’, ‘Not in my lifetime’;

- 3) Perceived severity of consequences: asking for ratings of the degree to which a volcanic eruption can affect the island of residence, them and their family and on a five-point Likert Scale ranging from 1 ‘Nothing’ to 5 ‘Totally’;
- 4) Affect: was assessed through evaluations of dread. Participants were asked to indicate the feelings that accompany their thoughts about a potential volcanic eruption on their residence island from the options: ‘Panic’, ‘Fear’, ‘Anxiety’, ‘Inability to react’, ‘Indifference’, and ‘Other’.

Volcanic risk perception of farmers.

The results on perceived likelihood of farmers can be consulted in Figure 1. Most mentioned they considered ‘Likely’ a volcanic eruption on the island of residence that threatens their security (72%).

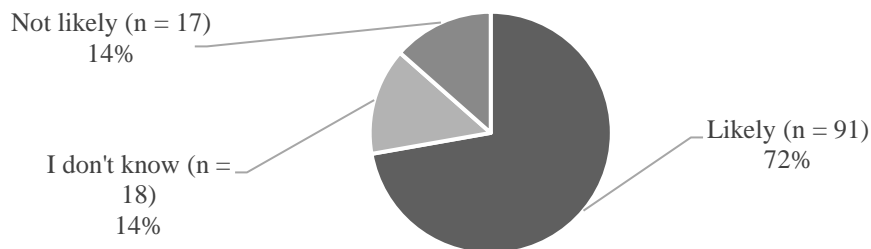


Figure 1. Perceived likelihood of farmers.

Regarding perceived imminence, most farmers considered that a volcanic eruption would occur on the island of residence ‘Not in my lifetime’ ($n = 12$, 57.1%), followed by the farmers that mentioned ‘In the next five years’ ($n = 4$, 19.0%), ‘In my lifetime’ ($n = 3$, 14.3%), and ‘In the next 10 years’ ($n = 2$, 9.5%).

Concerning perceived severity of consequences, most farmers stated that a volcanic eruption could affect their island of residence ‘Much’ ($n = 34$, 43.6%), ‘Somewhat’ ($n = 21$, 26.9%), ‘Totally’ ($n = 17$, 21.8%), ‘Little’ ($n = 5$, 6.4%), and ‘Nothing’ ($n = 1$, 1.3%). About the perceived consequences of a volcanic eruption for them and their family, most farmers referred ‘Much’ ($n = 41$, 49.4%), followed by those who considered that a volcanic eruption could affect them and their family ‘Somewhat’ ($n = 23$, 27.7%), ‘Totally’ ($n = 15$, 18.1%), and ‘Little’ ($n = 4$, 4.8%).

The results on the affect towards a volcanic eruption can be found in Table 1.

Table 1

Affect towards a volcanic eruption of farmers	
Emotional reaction	n (%)
Fear	39 (31%)
Anxiety	26 (20.6%)
Inability to react	21 (16.7%)
Panic	21 (16.7%)
Indifference	17 (13.5%)
Other	2 (1.6%)

From the two farmers that mentioned the option ‘other’, one said ‘I do not know’ and one mentioned ‘It depends on the occasion and my mood’.

Considering these results, it is possible to assert that the volcanic risk perception of farmers was moderately high.

Volcanic risk perception of non-farmers

The results on the perceived likelihood of non-farmers can be consulted in Figure 2. Most considered ‘Likely’ a volcanic eruption on the island of residence that threatens their security (76%).

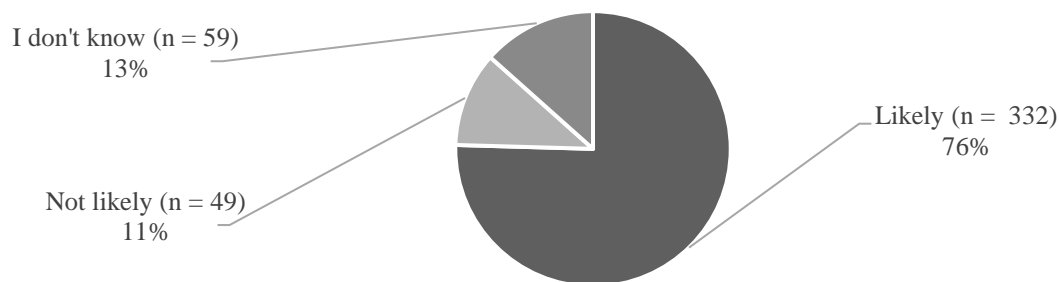


Figure 2. Perceived likelihood of non-farmers.

Regarding perceived imminence, most non-farmers considered that a volcanic eruption would occur on the island of residence ‘Not in my lifetime’ (n = 55, 50.5%), followed by the non-farmers that mentioned ‘In my lifetime’ (n = 34, 31.2%), ‘In the next five years’ (n = 9, 8.3%), ‘In the next 10 years’ (n = 9, 8.3%), and ‘This year’ (n = 2, 1.8%).

Concerning perceived severity of consequences, most non-farmers stated that a volcanic eruption could affect their island of residence ‘Much’ (n = 185, 57.3%), followed by the non-farmers that considered that a volcanic eruption could affect their island of residence ‘Totally’ (n = 81, 25.1%), ‘Somewhat’ (n = 47, 14.6%), ‘Little’ (n = 9, 2.8%), and ‘Nothing’ (n = 1,

0.3%). About the perceived severity of consequences of a volcanic eruption for them and their family, most non-farmers mentioned ‘Much’ (n = 156, 48.4%), followed by the non-farmers that considered that a volcanic eruption could affect them and their family ‘Totally’ (n = 92, 28.6%), ‘Somewhat’ (n = 62, 19.3%), ‘Little’ (n = 9, 2.8%), and ‘Nothing’ (n = 3, 0.9%).

The results on the affect towards a volcanic eruption are presented in Table 2.

Table 2

Affect towards a volcanic eruption of non-farmers	
Emotional reaction	n (%)
Fear	n = 199 (46.1%)
Anxiety	n = 74 (17.1%)
Inability to react	n = 71 (16.4%)
Panic	n = 51 (11.8%)
Indifference	n = 33 (7.6%)
Other	n = 4 (0.9%)

From the four non-farmers that mentioned the option ‘other’, three said they did not know and one mentioned mixed feelings.

Considering these results, it is possible to assert that the volcanic risk perception of non-farmers was moderately high.

Differences in volcanic risk perception

To verify differences in volcanic risk perception between farmers and non-farmers five Fisher’s exact tests were used. Bonferroni correction for multiple tests was applied and the results are significant at the .01 significance level (Table 3).

Table 3

Differences in volcanic risk perception between farmers and non-farmers	
Volcanic risk perception dimensions	p-value*
Perceived likelihood	p = .701
Perceived imminence	p = .328
Perceived severity of consequences for the residence island	p = .014
Perceived severity of consequences themselves and their family	p = .146
Affect	p = .026

*Significant at $p < .01$ level.

No statistically significant differences were found between farmers and non-farmers regarding volcanic risk perception dimensions.

Discussion

The purpose of this study was to describe and verify the differences between the volcanic risk perception of farmers and non-farmers of a location exposed to volcanic risk, Vila Franca do Campo (S. Miguel, Azores), because of the implications of risk perception to volcanic disaster management.

Risk perception is a central concept in the study of human behavior in disasters. It was associated with preparedness, risk communication, and evacuation behaviors (Perry, 1990; Ropeik & Slovic, 2003; Tobin & Whiteford, 2002). Studies found that farmers seem to be reluctant to evacuate (Lebon, 2009; Wilson et al., 2012, Tobin & Whiteford, 2002). Risk perception was associated with evacuation behaviors (Tobin & Whiteford, 2002). Therefore, we assume that risk perception may be different between farmers and non-farmers.

Volcanic risk perception was moderately high. Lower levels of volcanic risk perception were expected because of the risk devaluation found elsewhere (e.g., Bird & Gísladóttir, 2012). Volcanic hazard knowledge may explain these results (Carlino et al., 2008). No statistically significant differences in volcanic risk perception dimensions were found between the two groups. These results may be explained by the presence of common factors with major influence in volcanic risk perception such as experience and proximity with the volcano (Carlino et al., 2008; Perry, Lindell, & Green, 1982). Volcanic hazard knowledge could be evaluated because it seems to influence volcanic risk perception.

We used convenience samples, thus the results are not generalizable, although they indicate tendencies that may extend to the entire groups and be present in other locations.

Despite the non-verification of the hypothesis, these results can still inform volcanic disaster management and enhance the knowledge about the volcanic risk perception of farmers, suggesting that professional occupation may not influence volcanic risk perception. Volcanic hazard knowledge and its relation to volcanic risk perception should be further analyzed.

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Gaming as a novel intervention tool for conservation? The effects of the board game “Savanna Life” on communities in the Serengeti-Mara Ecosystem

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Abstract: The AfricanBioServices project developed the board game “Savanna Life” (<http://www.savannalife.no/>) as a contribution to promote sustainable development. The game represents the everyday-life and problems of a community living in and around the greater Serengeti-Mara Ecosystem. The overall goal of the game is to achieve the highest individual well-being score, as well as a positive well-being group outcome. In this study, the psychological determinants and outcomes of the game are explored. A pre-post-test study design was implemented, with 18 player groups from Kenya and Tanzania (four players per group, N = 72). After playing the board game villagers perceived it was less difficult to do something to protect the nature around them and to contribute something towards the well-being of their community, but they felt less connected to nature. As such, “Savanna Life” partly influenced a few psychosocial variables and had an unintended effect. It is suggested that it can be useful in creating a common ground to engage villagers in discussing difficult topics around environmental issues.

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Keywords: Environmental games, educational games, perceived behavioral control, Africa, theory of planned behavior

Conservation and behavior change of environmentally harmful behaviors in protected areas

The destruction of nature is largely related to human activities, which must change for a more sustainable path (Schultz, 2011).

A major problem arises when searching for validated methods to change behavior in various countries. Most studies in social sciences have been conducted in industrialized countries, using samples of individuals that are western, educated, industrialized, rich and democratic (Arnett, 2008; Henrich, Heine, & Norenzayan, 2010). This WEIRD-bias demands more research in developing countries. Our study contributes to diminish this bias by conducting research on environmental behavior in protected areas in Tanzania and Kenya.

Gaming as environmental communication tool to change behavior

Environmental communication is as an instrument to make people aware of environmental issues and leading them to more pro-environmental behavior (Cox, 2013).

The need for environmental learning experience, such as an educational game is being advocated by researchers (Ballantyne & Packer, 2005; Fjællingsdal & Klöckner, 2020; Fjællingsdal & Klöckner, 2017; Hariohay et al., 2019; Klöckner, 2015). Educational games (sometimes referred as serious games) are environmental communication tools which provide environmental learning experience to bring new knowledge and transform behavior (Connolly, Boyle, MacArthur, Hailey, & Boyle, 2012).

Methods

Participants

This study took place in the Serengeti-Mara ecosystem. During September 2018 we visited four villages in Narok County and the city Narok (managers and policymakers) in Kenya (55.6 %) and in March 2019 we visited four villages (Serengeti, Bariadi, Ngorongoro and Meatu district) in Tanzania (44.4 %). A detailed description of the villages has been deliberately abandoned so the anonymity of the participants is secured. A total of $N = 72$ (44.4% female and 55.6% male) participants in the age range from 15 to 58 ($M = 27.8$, $SD = 11.02$) completed the questionnaire. The board game was played in four different villages. There was one male and one female group in each village. In average the participants attended school for 9.41 years ($SD = 4.34$). The villagers reported that their wealth in comparison to their community was “average/normal” ($N = 63$, $M = 2.87$, $SD = 0.55$).

Instruments

Savanna Life

The AfricanBioServices project developed the board game “Savanna Life” by collaborating with a professional game designer and integrating their knowledge about how ongoing climate change, human population growth and the way how change of land use affect biodiversity and human well-being. The game represents the everyday-life and problems of a community living in and around the greater Serengeti-Mara Ecosystem and it is directed towards people and their livelihood strategies in Africa. It was created “as a learning tool to enable local households and ultimately communities to evaluate the consequences of livelihood strategy choices and investment and to safely explore alternative strategies.” (Saíd et al., 2019, p. 76).

Questionnaire

An anonymous questionnaire was handed out to villagers and other stakeholders (managers and policy makers) living close to protected areas in the greater Serengeti-Mara-Ecosystem.

The questionnaire included the following single-item measures:

- Knowledge of contributing something towards the well-being of the community (Rating scale from 1 - no knowledge to 5 - great knowledge)
- Perceived behavioral control of (Rating scale from 1 - very easy to 5 very difficult)
 - contributing something towards the well-being of the community
 - protecting nature
- Attitude towards nature use (Likert scale from 1 - strongly disagree to 5 - strongly agree)
- Connectedness to nature (Inclusion of Nature in Self Scale, shortened to 5 response options)
- Risk perception environmentally harmful behavior in protected areas (Rating scale from 1 - not at all risky to 5 - extremely risky)
- Expected benefits of environmentally harmful behavior in protected areas (Rating scale from 1 - no benefits at all to 5 - great benefits)
- Likelihood of the environmentally harmful behavior in protected areas (Rating scale from 1 - very unlikely to 5 - very likely)

Manipulation check: A 5-point rating scale ranging from very unlikely to very likely illustrated how likely participants related their game behavior towards their real-life behavior ($M = 3.55$, $SD = 1.44$).

Results

Game outcomes

A positive game score was held by 38.9% of the groups. Hence, we had less positive-score-groups than negative-score-groups. On a scale from -5 to 10 the average final fortunate score was 0.16 ($SD = 2.58$). In a range from 0 to 20 the groups went in average 7.94 ($SD = 5.27$) times into the Serengeti for grazing livestock or to poach (Field 13 & 14) during the board game. From five game rounds (related to years) the players in the groups cooperated in 2.94 ($SD = 0.94$) rounds.

Game effect on psychosocial variables

In general, villagers had high knowledge about contributing something towards the well-being of their community and perceived it as neither easy nor difficult before and after the game play. Protecting nature was seen as neither easy nor difficult, as well. They perceived nature primarily for human use to a high amount. The participants felt a strong connection to nature.

Moreover, paired sample t-Tests comparing the before and after questionnaire scores showed that study participants changed their perceived behavior control of contributing something towards the well-being of their community and protecting nature after playing the board game “Savanna Life” (see Table 1). The study participants perceived less difficulty to contribute something towards the well-being of their community, next to perceiving that it was less difficult for them to do something to protect the nature around them to a small amount.

Furthermore, study participants marginally significantly changed their perception of connectedness to nature after playing the board game “Savanna Life” (see Table 1). After the board game, the participants perceived that they were less connected to nature.

Table 1
Paired sample t-Test of the mean differences of the pre- and post- board game scores for the psychosocial variables (T1 = Before playing Savanna Life, T2 = After playing Savanna Life).

Variable	T1 <i>M (SD)</i>	T2 <i>M (SD)</i>	t-Statistics	p-Value	Cohen's d
Knowledge of contributing something to the well-being of the community	3.90 (1.14)	3.94 (1.06)	-0.14	0.89	0.017
Perceived behavioural control of contributing something to the well-being of the community	3.21 (1.19)	3.07 (0.95)	1.98	0.052	0.24
Perceived behavioural control of protecting nature	2.89 (1.21)	2.71 (1.20)	1.98	0.052	0.24
Attitude towards nature use	4.25 (1.11)	4.24 (1.29)	0.11	0.92	0.012
Connectedness to nature	4.24 (1.18)	4.07 (1.25)	1.72	0.090	0.20
Risk perception of livestock grazing in protected areas	4.15 (1.13)	4.04 (1.08)	0.68	0.50	0.083
Risk perception of poaching in protected areas	4.54 (1.04)	4.39 (1.26)	0.97	0.34	0.12
Expected benefit of livestock grazing in protected areas	2.97 (1.30)	2.79 (1.29)	0.60	0.55	0.074
Expected benefit of poaching in protected areas	1.03 (1.42)	2.01 (1.43)	-1.25	0.22	0.15
Likelihood of livestock grazing in protected areas	3.28 (1.32)	2.94 (1.40)	1.49	0.14	0.18
Likelihood of poaching in protected areas	2,46 (1.46)	2.60 (1.44)	-0.96	0.34	0.011

Discussion

Most studies on environmental behavior aim to provide information, which helps to reduce environmental impact of human activities (Klöckner, 2015). In line with past research this study focused on proposing a board game as environmental communication tool to change beliefs and possibly behavior. We investigated environmentally harmful behaviors and beliefs towards nature in Africa. Even though there has been some research in conservation, extensive research with social science theories, like the theory of planned behavior, has not yet been well established (Browne-Núñez & Jonker, 2008; St John et al., 2011). These studies can help exploring drivers and contribute to decreasing the “WEIRD”-bias in social science. Moreover, through the exploration of monocultural measurement techniques, challenges of culture related research can be addressed and a transfer to cross-cultural research is made possible (Johnson, 2006). This study contributes to diminish this gap by applying variables based on the theory of

planned behavior, although the theory itself was not tested due to contextual and practical constraints.

The board game aimed to foster discussion around different livelihood strategies and their consequences to reduce environmentally harmful behavior. In addition, the present study's central purpose was to evaluate the effect of the game session on villagers and higher-level stakeholders' beliefs and their connection towards nature.

After playing the board game, villagers and higher-level stakeholders living close to protected areas in Africa felt less connected to nature, next to perceiving that it was less difficult to do something to protect the nature around them and to contribute something towards the well-being of their community.

In conclusion, "Savanna Life" partly influenced a few psychosocial variables and had an unintended effect. It is suggested that it can be useful in creating a common ground to engage villagers in discussing difficult topics around environmental issues rather than as a tool that has immediate behavioral outcomes.

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Relevance of coping strategies: comparative study of firefighters and pre-hospital emergency technicians

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Abstract: Emergency rescuers are the first to respond and are often exposed to potentially traumatic stimuli and situations. Implementing coping strategies helps them to minimize the effects of exposure and ensures their mental health. This study aims to identify and compare, in a sample of 394 firefighters and 404 pre-hospital emergency technicians, the coping strategies most used after exposure to stressful situations, and to analyze if they vary according

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to sociodemographic variables. Results revealed that active coping strategies, planning, positive reinterpretation, and acceptance are the most prominent in both groups. Significant differences were found between the two groups in all coping dimensions, with firefighters having the highest averages in almost all strategies. Negative correlations between age, weekly hours and some coping dimensions were found. This highlights the need to promote psychological well-being of first responders and more resilient emergency organizations.

Keywords: Coping strategies, firefighters, prehospital emergency technicians, comparative study

Background

First responders are often exposed to potentially traumatic stimuli and situations, but it is not always assured that they take care of their own mental health. Thus, some events where they must intervene may trigger trauma on emergency and rescue workers, who are the first to arrive at the scene. When these situations involve an event with traumatic potential, they are referred as a critical incident. This is considered a negative event and as being incongruent with the cognitive structures of the individual, affecting their normal confrontation and adaptation mechanisms, causing loss of psychological balance and alteration of habitual functioning (Everly, & Mitchell, 1997). Exposure to a critical incident is not an absolute condition for the installation of mental pathology, since the reactions of people exposed to the same situation are different. Thus, there are risk factors that predict the presence of distress and the appearance of physical and psychological health problems after exposure to a critical incident (Leon, 2004).

Literature points out that there are protective factors related to lower levels of stress, anxiety and depression disorders in survivors, such as coping strategies, which allow them to resume normal day-to-day activities and take an active stance in the face of the consequences of the incident (Van Ommeren, Saxena, & Saraceno, 2005). Coping can be a stabilizing factor that facilitates the adjustment of the individual or his/her adaptation to stressful situations or moments (Pais-Ribeiro & Rodrigues, 2004), allowing to integrate what happened and restore normal functioning. Coping strategies act as a prerequisite for successful adaptation, both of which are mediators of stress effects (Lima, Lemos, & Guerra, 2002). Although there are several definitions of coping, the concept of coping is relatively consensual as a set of cognitive behavioral efforts made by the individual to cope with threatening or stressful situations, chronic or acute, regardless of their outcome, which seeks to manage the demands, internal or external, considered to exceed personal resources (Lazarus & Folkman, 1984). Thus, coping encompasses the whole set of strategies used by the person to adapt to adverse circumstances (Antoniazzi, Dell'Aglio, & Bandeira, 1998). For professionals who daily face critical incidents, this process of consciously responding to a negative or stressful external event may be essential to minimize the effects of exposure and ensure their mental health. Moreover, it is crucial that emergency professionals are resilient and that the coping strategies favored allow to mitigate exposure to potentially traumatic stimuli.

Considering the relevance of these professionals for society, there is a growing interest in the study of their working conditions, and also in the risk and protective factors that can create healthy work environments and promote psychological well-being. Studies with firefighters revealed that these professionals frequently use avoidance strategies when exposed to high stress (Witt, Stelcer, & Czarnecka-Iwańczuk, 2018), that problem-focused coping is often used

while in the incident and in the early stages of operational tasks, while the emotion-focused responses are more common during post-incident periods of fatigue and exhaustion (Young et al., 2014). Critical incidents are also a constant for paramedics, and research shows a positive correlation between coping strategy of engagement and quality of life among emergency service employees (Matonkar, 2019) and that dysfunctional coping style, anxiety, and depression were more likely to increase severity of post-traumatic stress symptoms, being young professionals more vulnerable to stress (Kerai, et al., 2017). Studies also suggest that occupational stress is higher for ambulance crewmembers (Mildenhall, 2012). Moreover, according to Ângelo (2016), emergency organizations face specific organizational demands related to relief tasks, as well as chronic demands related to professional practice and acute demands resulting from unforeseen situations, and many psychosocial risks are difficult to eliminate.

The volatile and unexpected nature of incidents, as the ones that recently occurred in Portugal (e.g., June and October 2017 forest fires, INEM helicopter crash in 2018, Madeira tourist bus crash in 2019), imply the development of competences that enable, on the one hand, the management of the most frequent occurrences and for which there is a high level of knowledge/preparation, and on the other hand, the management of less frequent incidents and/or for which there is little knowledge/preparation (Nilakant et al., 2016). Recently, the International Critical Incident Stress Foundation (Shallcross, 2013) has warned that relief workers are “first to respond, but last to seek help”. Thus, it is important that they take care of themselves because, despite their high resilience and their ability to adapt to critical incidents, the accumulation of incidents has a detrimental effect on individual well-being and relief services provided. Moreover, it is essential to analyse these factors, both the protective and risk factors, in order to alert to the importance of rescue workers’ mental health, namely those involved in tragedies, which may affect them in the long run. This study aims to identify and to compare, in a sample of volunteer firefighters and of pre-hospital emergency technicians, the coping strategies most used after exposure to stressful situations, and to analyze if they vary according to sociodemographic variables.

Method

This study used a probabilistic sample, composed of 394 volunteer firefighters (86% male and 14% female) and 404 pre-hospital emergency technicians (70% male and 30% female). Table 1 shows that both professionals have a similar average age. Regarding Firefighters, the average professional experience is higher, compared to Pre-hospital Emergency Technicians professionals, but this group is the one who works more hours per week.

Table 1. Sample characterization

Variable	Firefighters’ Mean (SD)	Pre-hosp. Emergency Technicians’ Mean (SD)
Age	33.1 (8.4)	34.6 (4.8)
Job experience	14.1 (16.4)	7.8 (2.9)
Hours per week	35.7 (21.4)	41.7 (5.8)

An anonymous and confidential self-completed printed questionnaire was used, composed by two groups of questions. Group I was constituted by questions of socio-demographic and

professional characterization, such as age, gender, years of service and average weekly working hours.

Group II corresponds to the Brief Cope (Carver et al., 1989; translated by Pais-Ribeiro & Rodrigues, 2004) aiming to evaluate coping strategies and including 28 items organised into 14 dimensions of two items each: active coping (“I do what has to be done, one step at a time.”), planning (“I think about how I might best handle the problem.”), seeking social support for instrumental reasons (“I ask people who have had similar experiences what they did.”), seeking social support for emotional reasons (“I try to get emotional support from friends or relatives.”), turning to religion (“I prayed or meditated.”), positive reinterpretation and growth (“I look for something good in what is happening.”), self-blame (“I criticized myself.”), acceptance (“I learn to live with it.”), focus on and venting of emotions (“I get upset and let my emotions out.”), denial (“I refuse to believe that it has happened.”), mental disengagement (“I turn to work or other substitute activities to take my mind off things.”), behavioral disengagement (“I just give up trying to reach my goal.”), use of substances (“I took refuge in alcohol or other drugs: pills, etc. to make myself feel better.”) and humor (“I faced the situation with a sense of humor”). Items are presented as actions and scored on a 4-point likert scale (between 0 = I never did this, and 3 = I almost always did this). The final result is presented as a profile of coping strategies, since the subscales are not summed nor is possible to calculate a global score.

For statistical analysis, the IBM-SPSS 25 program was used for descriptive, comparative and correlational analysis.

Results

The results revealed that active coping strategies, planning, positive reinterpretation and acceptance are the most prominent in firefighters and pre-hospital emergency technicians, except for active coping who presents high values in firefighters (Figure 1).

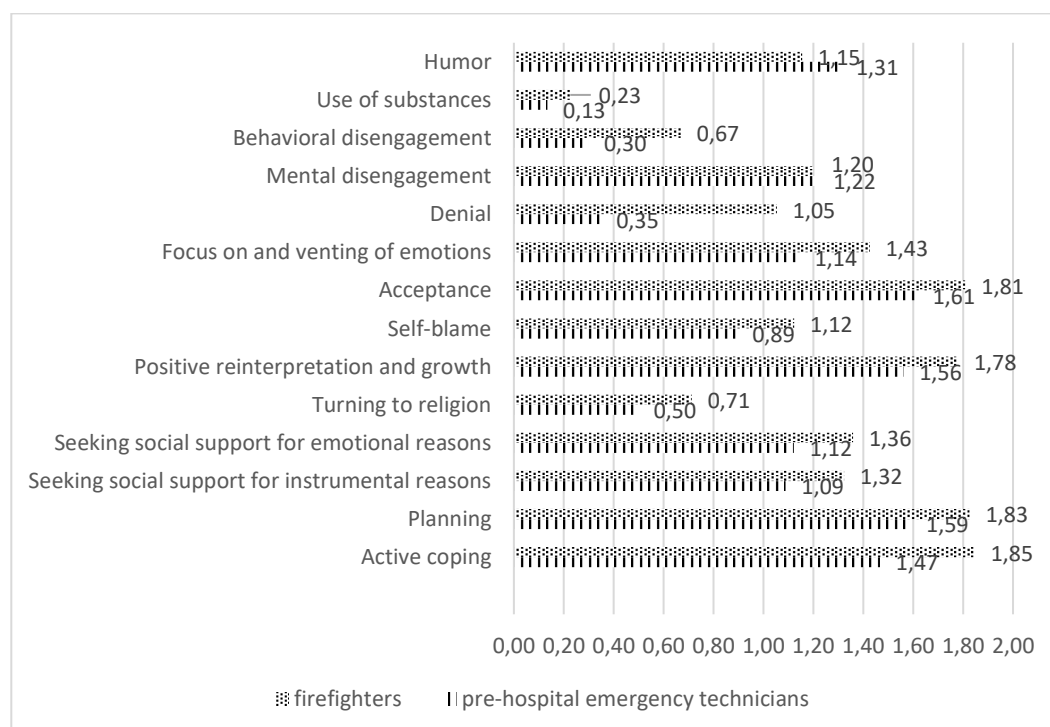


Figure 1. Mean and Comparison between the two professional groups.

Statistically significant differences were found between the two professional groups in all coping dimensions ($p \leq 0,01$), with firefighters having the highest means in almost all strategies except humor and mental disengagement (Figure 1, values in bold), higher in the prehospital emergency technicians.

Regarding correlational analysis, Table 2 presents the cases where statistically significant correlations were found. Thus, among firefighters it was found negative correlations between age and acceptance strategy, and between the average number of weekly hours and the strategies: positive reinterpretation, self-blame and mental disengagement. Among pre-hospital emergency technicians, age correlates negatively with the use of humor and positively with the focus on and venting of emotions.

Table 2. Correlational analysis separated by professional group

Firefighters	Age	Hours per week
Acceptance	-.133**	
Positive Reinterpretation		-1.112*
Self-Blame		-1.118*
Mental Disengagement		-1.127*
Pre-hospital Emergency Technicians	Age	Hours per week
Humour	-.103*	
Focus on and venting of emotions	-.106*	

Conclusions

Scientific research is providing visibility to first responders, showing that less positive coping strategies predict burnout (Vara, Queirós, & Kaiseler, 2013), lack of control contributes to experiencing negative emotions (Avraham, Goldblatt, & Yafe, 2014) and firefighters who use passive coping such as emotional-centered coping have negative effects on mental health such as post-traumatic stress disorder (Lee, Jeong, & Choi, 2019). Additionally, firefighters prefer to manage stressful feelings within their own culture, using informal coping strategies, namely cognitive mechanisms and peer support (Mildenhall, 2012). Folwell and Kauer (2018) recommended for volunteer emergency medical technicians: financial assistance with Employee Assistance Programs, social events that encourage communication and interaction, and taking time off and having a clear recruitment/retention plan. This highlights the need to promote psychological well-being, as well as to develop and train coping and stress management skills, during and after critical incidents, to minimize the development of traumatic symptoms.

These skills and competencies can be developed through interventions aimed at the organizational structure and professionals, with mutual benefits for both (Salanova, Llorens, & Martínez, 2016), as well as for their service-dependent community (Shakespeare-Finch & Daley, 2017). Bennett and colleagues (2005) emphasized the importance of these interventions

being developed in the organizational structures within the emergency field, adapting to the idiosyncratic features of this institutional type. However, given the impossibility of intervening with the contingencies and potentially traumatic stimuli to which these professionals are daily exposed, the importance of intervening with the professionals is emphasized, seeking to privilege well-being and to develop a learning environment, alleviating suffering at work (Areosa, 2018; Salanova et al., 2016). As advocated by the Job Demands-Resources Model (Bakker, Demerouti, & Schaufeli, 2003), to address occupational demands and their potential consequences for workers' health, it is important to develop and promote professional resources, namely strategies for managing the technical and psychological demands and challenges (Lanza, Roysircar, & Rodgers, 2018; Malinen, Hatton, Naswall, & Kuntz, 2019). However, for this to be feasible, it is essential to understand these demands and associated traumatic potential, as well as the adaptive coping strategies used and that can be promoted by the organizational structure, namely through continuous training and psychoeducation.

In general, it is recognized the importance of promoting healthier and more resilient emergency organizations and professionals, and therefore of preparing each rescuer technically and psychologically (Ishak & Williams, 2018). This preparation may focus on coping strategies given the impossibility of minimizing exposure to potentially traumatic stimuli with clear impact on psychological and occupational health (Petrie et al., 2018). Thus, due the risk involved in fulfilling their duties and functions, it is of utmost importance, at the organizational and individual levels, to proactively develop coping skills that enable professionals to adapt to these challenges, their transformation and learning (Sawalha, 2015). It is also important to prevent traumatic symptoms and the use of maladaptive coping strategies (Cunha et al., 2017), while promoting the occupational health of the professionals involved. Thus, both professionals and organizations will better face disasters/tragedies and become more resilient.

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Commitment of the 2030 Agenda to sustainable cities/settlements and their resilience to risk

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Abstract: This innovative experience presents an analysis from the artistic education on the development of the International Agenda 2030 [1], through the production of visual educational resources in the university classroom, with the aim of provoking a discussion in the students, oriented to promote actions linked to this Agenda, under the motto Transform Our World and integrated by 17 Sustainable Development Goals (SDG).

Keywords: Risk and resilience; Inaction and co-decision; Sustainable cities/settlements; The 2030 Agenda; Sustainable Development Goals.

Sustainable Development of cities

The sustainable development of cities implies a form of respectful growth with the planet. The environment is very important in all aspects. Within the SDGs is SDG # 11: sustainable cities and communities, which is a process of continuous growth over time, harmonizing the development of renewable energy and new forms of consumption compatible with the environment. Climate change and its effects must be stopped. Buildings and infrastructures must be strengthened for citizens. The risks affect all people, even more the poor who sometimes must live in spaces threatened by natural disasters: landslides, flood areas, with high seismicity. Therefore, these people are more vulnerable. In short, we must pursue social transformation. Critical citizenship that demands responsibilities from its politicians, in matters of urban planning and sustainable development risks. The purpose is to curb climate change and reduce risks.

Project development - Expected results

Within the objectives, ODS # 4 seeks to guarantee an inclusive, equitable and quality education. SDG 4 promotes lifelong learning opportunities for all. Education for Sustainable Development (EDS) plays an important role in raising awareness among students. EDS offers innovative tools that make it possible to understand the international context, the responsibility of

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education as a transmitter of values. Among these tools, sustainable art is the motor for the development of education and sensitize students have a greater awareness of their city and sustainable development (Sumozas; Galindo, 2018). Sustainable art works on social, economic, and environmental issues. The innovative proposals of sustainable art seek solutions to any ecological problem such as recycling and the recovery of urban environments (Sumozas, 2018).

Objectives

In short, it is about developing innovative initiatives through the realization of photographs as a teaching resource that seeks to contribute to social transformation through the promotion of a trained, active, and critical student body.

Discussion and Conclusions

As teachers, we have an important role in the generation of a critical consciousness from the (SDE), the social dimension of artistic expressions. In this case, by taking photographs applied to the education, in addition to its didactic interest, allows the discussion of values from sustainable art and modes of consumption. Create a greater awareness and respect for the environment, allows to translate a new ethical position towards it. When debating on the difficulties, successes and learning that can guide future interventions of this type in the UCLM. Therefore, it is intended to promote the visual dialogue established by the proposals based on the ApS (learning and service), between sustainable art and the environmental problem.

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Seniors' environmental risk perception regarding the presence of pharmaceuticals in water resources: Preliminary results

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Abstract: The presence of pharmaceutical residues in the environment poses a great threat to water sources, affecting human and aquatic life. Among other sources of pollution, senior residences have become a major source of urban water pollution due to pharmaceutical leftovers and residues given its high level of medication consumption. In this study, we assess seniors' ($N = 46$) environmental risk perception of two non-prescribed and two prescribed pharmaceuticals that are used to treat mild and severe diseases, with different environmental risk profiles. The results show that prescribed pharmaceuticals were considered to have a higher environmental impact, and that the assessments of the elderly were based primarily on the severity of the disease for which these pharmaceuticals are recommended as treatment. These misconceptions might influence seniors' motivation to take an active role in mitigating this problem and engage in pro-environmental behaviors to reduce urban water contamination due to pharmaceutical residues.

Keywords: Pharmaceuticals, environmental risk perception, disease severity, seniors, water pollution

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Introduction

The dissemination of pharmaceuticals in the environment is a worldwide increasing problem and most individuals do not seem to be aware of its' existence. Nowadays, pharmaceuticals are consumed in large quantities and the number has been steadily increasing over the past decades due to a higher demand of treatments for chronic diseases, and it is also expected to continue to raise with the increase of the population and life expectancy (Lacorte et al., 2018; Quesada et al., 2019). As a result of individuals' and animals' metabolic excretions and improper disposal of pharmaceutical leftovers, particularly through the sewage grid, pharmaceutical residues are often present in water resources, such as waste and superficial waters (Adeel et al., 2017; Gómez-Canela et al., 2019). These substances represent an environmental hazard because each has its' own action mechanism which makes their detection and subsequent removal particularly difficult. Moreover, pharmaceuticals can be persistent and accumulate in the environment for years and be resistant to conventional wastewater treatments (Quesada et al., 2019). Risk assessment studies are not conclusive regarding the negative effects of the presence of pharmaceuticals in the environment (World Health Organization, 2012), but there is small evidence that some of these substances can have a disruptive impact on human health and aquatic life (Quesada et al., 2019). Given the uncertainty and the potential risk, there is an emergent need to create and implement preventive measures to help mitigate this problem (Kümmerer, 2010).

The phenomenon of aging has been significantly increasing during the last decades. In Europe, elderly people represent about 15% of the total population, part of which lives in senior residences, mostly settled in urban areas. Due to their declined health and higher need of medication, elders consume an average of 5 to 10 pills per day, a much higher quantity compared to the healthy population. As such, senior residences represent a major source of water pollution due to pharmaceutical residues in major cities (Gómez-Canela et al., 2019; Lacorte et al., 2018). Recent water analysis conducted in senior residences located in three Southwestern European countries (Portugal, Spain, and France) detected high concentrations of pharmaceutical residues in the wastewaters. Moreover, the analysis also shows that regardless of the type, any pharmaceutical can represent a high risk given its' potential to be persistent, bioaccumulative, or toxic for the environment/water sources (Innovac'Eau, 2018).

Current Study

Understanding risk perception is fundamental to ensure a safe and effective way to use and dispose of pharmaceutical leftovers (Slovic et al., 2007). This study focuses on exploring one of the causes that might influence seniors' environmental risk perception. In particular, we assess seniors' environmental risk perception of two non-prescribed pharmaceutical: acetylsalicylic acid, used for a more severe health condition such as inflammatory pain, and amylmetacresol, used for a milder health condition, like a sore throat; and two prescribed pharmaceuticals: ifosfamide, used to treat a severe disease, namely cancer, and lercanidipine, used for a milder disease, such as hypertension. We expect that in the absence of knowledge, senior lay people assess the environmental risk based on the known characteristics of the pharmaceuticals which do not determine its' real environmental impact. Thus, we hypothesize that prescribed pharmaceuticals are perceived to have a higher environmental impact than non-prescribed pharmaceuticals, and that pharmaceuticals that treat severe diseases are perceived to have a higher environmental impact than mild diseases.

The four pharmaceuticals we study allow to test these hypotheses as risk evaluations indicate that amylmetacresol has a higher environmental impact than acetylsalicylic acid, and lercanidipine has a higher environmental impact than ifosfamide (Innovec'Eau, 2018).

Method

Participants

Forty-six participants were recruited in multiple senior residences located in urban areas, in Portugal. The majority were female (67%), with an average of 75 years old ($SD = 13.43$). Eligibility criteria included living or daily attend senior residences. All participants provided their informed consent to participate in the study and were guaranteed the anonymity and confidentiality of their answers.

Procedure and materials

Data was collected through a paper-based survey. For this study, we used a set of four items (e.g., “do you consider that the presence of [acetylsalicylic acid] in the environment, due to its consumption and excretion (urine and faeces), has a high or low environmental risk”) to measure environmental risk perception for each pharmaceutical, using a seven-point Likert-type response scale, ranging from 1 (low risk) to 7 (high risk). Statistical analyses revealed a good level of internal consistency ($\alpha = .89$) for the environmental risk perception variable.

Results

To examine the environmental risk perception, each pharmaceutical was compared using one-way repeated ANOVA with a within-subject factor design 2 (non-prescribed vs. prescribed pharmaceutical) x 2 (pharmaceuticals to treat mild vs. severe diseases). The hypothesis that pharmaceuticals are perceived to have a higher environmental impact than non-prescribed pharmaceuticals was partially corroborated. Results show that the pharmaceuticals' prescription had a main effect that was only marginally significant ($F = 3.627$; $p = 0.065$; $\eta p^2 = .09$). Results also show that the severity of the disease had a significant main effect ($F = 4.620$; $p = 0.039$; $\eta p^2 = .12$), meaning that the assessment of environmental risk of both prescribed and non-prescribed pharmaceuticals was based on the severity of the disease these pharmaceuticals are used as a treatment.

Discussion

The presence of pharmaceuticals in the environment, particularly in water sources, is an emerging unknown risk and is expected to worsen in the future. Little is known about how seniors perceive the environmental risk associated with pharmaceutical they consume on a daily basis. This study's aim was to contribute to this area by exploring how senior assess the environmental impact of four types of pharmaceuticals, two prescribed and two non-prescribed pharmaceuticals recommend as treatment for mild and severe diseases. According to the results, senior lay people appear to be assessing the environmental risk of pharmaceuticals based on characteristics that do not influence it but are easily known by them. In fact, when people do not have enough time, knowledge, or motivation to deliberately evaluate risk, they tend to rely on automatic information that might not be relevant for that evaluation (Visschers & Siegrist, 2008). It is possible that seniors might perceive prescribed pharmaceuticals and

pharmaceuticals used to treat severe diseases as more favorable for their health, thereby using that information to disregard the environmental risk of these substances. These results are congruent with other studies that show that prescribed pharmaceuticals tend to be perceived as high in benefit and low in risk (e.g., Slovic et al., 2007).

These findings are very important given that if seniors believe that non-prescribed pharmaceuticals and pharmaceuticals that treat mild diseases do not pose a threat for the environment, they may be less inclined to engage in risk mitigating behaviors, like the proper disposal of unused or expired pharmaceuticals. Such misrepresentations should be clarified by risk communicators, given that increasing awareness and knowledge represents a first important step to empower people to make their own decisions based on reliable facts and, consequently, encourage them to engage in more pro-environmental behaviors.

These results should be interpreted with caution. First, given the cross-sectional nature of the study, we cannot establish casual relationships between variables. Secondly, the sample size is relatively small since we only selected seniors with good cognitive functioning, capable of understanding the surveys' contents. Despite the fact these are preliminary results, this study has highlighted the importance of evaluating risk perception among lay people as a way to understand how to manage this environmental problem in the future, and reduce the levels of pharmaceutical residues in the environment, and more precisely, water resources. For future studies, we suggest the inclusion of senior residences' staff and healthcare professionals that have a more active role in prescribing and handling seniors' medication.

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The effect of demographic variables on the intentions to evacuate due to a volcanic eruption

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Abstract: In the case of a volcanic eruption, evacuation is often adopted as a measure to safeguard life. An effective evacuation requires adequate timing and the compliance of the population. Therefore, understanding the intentions towards an evacuation and the variables influencing these intentions are important topics to explore, because of their possible implications for the success of an evacuation. The literature about the effect of demographic variables gender, age, and education on evacuation behaviours and intentions has mixed results. The study of these relationships in the context of a volcanic eruption is under-researched. Thus, the goal of this study is to verify the influence of gender, age, and education on the evacuation intentions of a convenience sample of 443 residents of Vila Franca do Campo (São Miguel, Azores) for the case of a volcanic eruption, following a survey methodology. A Binominal Logistic Regression was conducted to verify the effect of gender, age, and education on evacuation intentions. The results indicated that the predictive power of the model was not affected by these variables, thus finding no effect (Overall statistics score = 17.401, $df = 10$, $p = .066$). Other variables associated with situational or personal factors may explain the differences between evacuation intentions. These results point to important tendencies concerning evacuation intentions and the need to explore the effect of other variables on the evacuation intentions in the case of volcanic eruptions.

Keywords: Evacuation intentions, volcanic risk, evacuation, demographic variables

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Introduction

Evacuation is a commonly adopted measure to safeguard life if a volcanic eruption occurs (Wilson et al., 2012). An effective evacuation needs to be timely and gather the compliance of the population (Carlino et al., 2008; Tobin & Whiteford, 2002). Therefore, understanding the attitudes towards an evacuation (intentions to evacuate or not evacuate) and the variables influencing these attitudes are important topics to explore because attitudes express behavioural tendencies with implications for behaviour (Ajzen, 1991) and the success of an evacuation (e.g., Bird & Gísladóttir, 2012; Paton, 2003). Here we will verify the influence of gender, age, and education on the evacuation intentions of residents of Vila Franca do Campo (São Miguel, Azores) assuming a volcanic eruption scenario.

The evacuation decisions have been associated with several variables that can be aggregated in two major groups: 1) Related to the situational context: cooperation between authorities, evacuation accommodation, intensity of the hazard and affected area, characteristics of the warning system, and source and content of the warning message (Bateman & Edwards, 2002; Carlino et al., 2008; Leonard et al., 2008; Matyas et al., 2011), and 2) Related to the individual: risk perception, time of preparations, family reunification, additional information gathering, household size and composition (e.g., having elderly or children), presence/absence of planning for the family, pets or livestock, presence/absence of evacuation resources (e.g., transportation), having pets, health status, wealth, housing type, risk education levels, experience with the hazard and with evacuation warnings, homeownership, feelings of safety at home, property protection, work factors, neighbours peer pressure, attachment to place and livelihood sources, efforts and costs involved with evacuation arrangements, and knowledge of the warning system (Baker, 1991; Bateman & Edwards 2002; Carlino et al., 2008; Gladwin & Peacock, 1997; Gregg, et al., 2004; Lindell & Perry, 2012; Lindell et al., 2015; Matyas et al., 2011; Riad & Norris, 1998; Solís et al., 2010; Tobin & Whiteford, 2002; Wilson et al., 2012).

Concerning the issues related to the individual, the role of demographic factors on evacuation decisions is still controversial. McCaffrey et al. (2018) studying bushfires state that these factors do not predict evacuation decisions. Baker (1991) found that age, gender, and race were not associated with evacuation intentions and Bateman and Edwards (2002) failed to find an effect of age, education, race, income, or work status with evacuation. However, other authors have considered that demographics influence evacuation decisions, namely gender, income, race, and residence location (Matyas et al., 2011; Riad & Norris, 1998). The results from previous studies indicate that women are more likely to evacuate than men (Bateman & Edwards, 2002; Liu, 2011; Riad & Norris, 1998). This can be due to the higher responsiveness of women to warnings, higher risk perception, social roles (differences in caregiving and family obligations), and higher exposure to risks (Bateman & Edwards 2002), thus, gender differences seem to be mostly caused by social roles. Results concerning the effect of age on the evacuation intentions are mixed. Gladwin and Peacock (1997) found that households with elders are less likely to evacuate, and households with children are more likely to evacuate. Baker (1991) mentioned that despite the mixed results, and the issues related to mobility limitations, it seems that retired elders are more likely to evacuate than other age groups. Respecting education levels, Solís et al. (2010) found no effects on evacuation likelihood, but Smith (1999) found a small yet positive effect. Regarding income, no significant associations were found (Smith, 1999).

Most of the mentioned works studied hurricane or bushfire evacuations and intentions. The influence of demographic factors on evacuation behaviour or intentions in the context of a volcanic eruption seems to be under-researched. Therefore, we will verify the influence of

gender, age, and education on the evacuation intentions of residents of Vila Franca do Campo municipality (São Miguel, Azores) for the case of a volcanic eruption and explain non-significant results. This study is part of a more extensive research about volcanic risk perception and the social vulnerability of the residents and the economic sectors of the sea, agriculture, and tourism in Vila Franca do Campo. Consequently, this analysis fails to include the entire data.

Material and Methods

Location

The complex geological framework of the Azores, located on the triple junction of lithospheric plates (North American, Eurasia, and Nubia), causes frequent seismic and volcanic activity on the islands (Gaspar et al., 2015).

The last volcanic eruption on the islands to affect the population occurred in the Capelinhos volcano (Faial Island, 1957–1958), causing substantial destruction and the emigration of around 40% of the island's active population (Coutinho et al., 2010).

The municipality of Vila Franca do Campo (S. Miguel Island) is located near the Fogo volcano, thus subjected to volcanic risk. Seismic swarms regularly affect this municipality (Wallenstein et al., 2007).

Future volcanic scenarios for S. Miguel Island point to the occurrence of explosive eruptions with the production of pyroclastic flow/surges, ashfall, debris flow, blocks, bombs, lava flows, lapilli, earthquakes, floods, landslides, tsunamis, CO₂ seepage, (Ferreira et al., 2015; Gaspar et al., 2015; Wallenstein et al., 2015).

Participants

A convenience sample of 443 residents of Vila Franca do Campo was used. All participants had at least 18 years of age. Most were women ($n = 228$, 51.5%), with ages between 34-49 years old ($n = 137$, $n = 30.9\%$) and secondary education ($n = 103$, 23.4%). The majority of participants were working ($n = 255$, 57.7%), in the tertiary sector ($n = 181$, 77.4%) with an income between 584.85-1000 euros ($n = 198$, 50%), were homeowners ($n = 387$, 87.8%), with access to personal or family transportation ($n = 329$, 74.9%). Most participants lived with other people ($M = 2.80$, $SD = 1.384$), the majority in households of three persons ($n = 114$, 28.1%). From these, 98 had one child in the household (61.3%), 68 had one elder (+65years old) in the household (73.9%), and 30 had one disabled person (100%).

Materials

The instrument used was a paper-pencil questionnaire based on literature and was pre-tested. It included 65 items, evaluating: (1) Volcanic risk perception; (2) Volcanic hazard salience; (3) Volcanic hazard knowledge; (4) Self-efficacy beliefs in the context of a volcanic eruption; (5) Volcanic preparedness; (6) General trust in authorities in the context of a volcanic eruption; (7) Evacuation attitudes; (8) Place attachment; (9) Sense of community; and (10) Sample characterization and social vulnerability in the context of a volcanic eruption.

Other versions of the questionnaire were constructed and pretested to address the singularities of the economic sectors of the sea, agriculture, and tourism. These include additional items concerning, for example, volcanic risk perception related to business, business volcanic preparedness, and self-efficacy beliefs related to business in the context of a volcanic

eruption.

The instruments are available with first author.

The analysis regarding the items of evacuation attitudes and sample characterization is presented here.

Procedure

A survey methodology was applied. Data were collected between February and August 2018. The questionnaires were distributed to stakeholders for self-completion, and the researchers administered the questionnaire door-to-door and in the municipality streets. To assure confidentiality an envelope was also handed with the instrument, along with an informed consent approved by the Ethics Committee of the University of Azores, informing about the research objectives, assuring confidentiality, and attesting for the participation's voluntariness. Furthermore, the document indicated it was expected single participation by residents.

Quantitative methods were applied to analyze the results from evacuation intentions and demographics.

Results

Evacuation intentions were assessed asking participants: 'If there was an evacuation alert, would you comply with this alert?'. The answers included the options: 'Yes, immediately', 'Yes, but not immediately', 'I would evacuate only if I thought it necessary' and 'I would not evacuate' (e.g., McCaffrey et al., 2018).

For this analysis, the answers were aggregated in two major categories: (1) Evacuate immediately including the answers with the first option, and (2) Reluctant or refusing to evacuate, including the answers with the remaining options.

Concerning evacuation intentions, 381 participants mentioned that in the case of a volcanic eruption, they would evacuate immediately, and 55 mentioned being reluctant or refusing to evacuate.

A Binominal Logistic Regression was conducted to verify the effect of the variables gender, age, and education on the intentions to evacuate. The results indicate that the predictive power of the model is not affected by the predictive variables (Overall statistics score = 17.401, $df = 10$, $p = .066$), therefore there is no effect of gender, age, and education on the evacuation intentions of participants as stated by Field (2005): '(...) none of the variables excluded from the model could make a significant contribution to the predictive power of the model. As such, the analysis would have terminated at this stage' (p. 235).

Discussion

The purpose of this study was to verify the influence of demographic variables, namely, gender, age, and education on the evacuation intentions of 443 residents of Vila Franca do Campo (São Miguel, Azores) considering a scenario of a volcanic eruption.

The results from the Binominal Logistic Regression conducted to verify the effect of the demographic variables mentioned indicated that the predictive power of the model was not affected by these variables, thus finding no effect. These results are in agreement with previous studies reporting that gender, age and education do not predict evacuation behaviour or intentions (McCaffrey et al., 2018; Baker, 1991; Bateman & Edwards, 2002; Solís et al., 2010). Other factors may explain differences in evacuation behavior, for example, cooperation between authorities, evacuation accommodation, intensity of the hazard and affected area,

characteristics of the warning system, and source and content of the warning message (Bateman & Edwards, 2002; Carlino et al., 2008; Leonard et al., 2008; Matyas et al., 2011). These differences may also be explained by risk perception, time of preparations, family reunification, additional information gathering, household size and composition (e.g., having elderly or children), presence/absence of planning for the family, pets or livestock, presence/absence of evacuation resources (e.g., transportation), having pets, health status, wealth, housing type, risk education levels, experience with the hazard and with evacuation warnings, homeownership, feelings of safety at home, property protection, work factors, neighbors peer pressure, attachment to place and livelihood sources, efforts and costs involved with evacuation arrangements, and knowledge of the warning system (Baker, 1991; Bateman & Edwards 2002; Carlino et al., 2008; Gladwin & Peacock, 1997; Gregg, et al., 2004; Lindell & Perry, 2012; Lindell et al., 2015; Matyas et al., 2011; Riad & Norris, 1998; Solís et al., 2010; Tobin & Whiteford, 2002; Wilson et al., 2012).

The influence of demographic factors in evacuation behaviour or intentions in the context of a volcanic eruption seems to be under-researched, thus the present study extends the knowledge about evacuation intentions and behaviours concerning this hazard.

The use of a convenience sample makes generalization of results impossible. Yet the results reveal important tendencies, for example, the majority of residents stated that they would evacuate immediately, thus contributing to a timely evacuation which is one of the characteristics of a successful evacuation (Carlino et al., 2008; Tobin & Whiteford, 2002). Other variables related to the subject or the environment should be further explored.

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Public perceptions of nuclear energy through historical times and political spaces. A comparative study

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Abstract: Based on a comparative analysis of eight countries with nuclear developments, we analyze the factors shaping risk perceptions with the aim of finding country patterns. Our results show although the perceived risks and benefits of nuclear energy are very similar in the eight countries, their social and institutional responses are very different. We suggest that this evidence illustrates the determining role of socio-cultural and political-institutional dimensions of risk, concluding that, in order to understand the public perceptions of nuclear energy, we need to understand how people perceive their relationships with institutions (trust), and the specific socio-cultural factors of the context in which the nuclear technology is perceived. Importantly, these factors are unevenly distributed among the different countries, and three main groups of countries depending on the role that nuclear energy is playing in the national political and ideological arenas have been identified.

Keywords: risk perception, trust, ideology, social identities, nuclear energy

Objective

Our objective is to understand the underlying reasons for favouring or rejecting the use of nuclear energy in different countries over time.

Theoretical background

Our hypothesis is that disparities between different actors' visions are grounded on the existence of different perceptions regarding the 'consequences' at stake. Several types of risk

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consequences can be identified, here called ‘risk dimensions’ (see also Espluga et al. 2017, 2018a, 2018b):

- Health & Environment dimension: This dimension includes the perception of positive and/or negative effects related to human health (acute or chronic effects) and to environmental issues (water, soil and atmosphere pollution, loss of biodiversity, climate change effects, etc.). Safety concerns and other control-management related factors are also considered here.

- Economic dimension: This dimension refers to the perception of factors related to economic issues, either in positive and/or negative ways. It encompasses topics such as potential (or actual) job creation, new business related to the construction or management of nuclear infrastructures, potential economic losses due to nuclear incidents, security of supply, industrial progress, resource requirements, concerns about energy prices, etc.

- Socio-cultural dimension: The basis for this dimension is the evidence that, despite what might be expected, there is not always a linear relationship between the perception of benefits generated by an activity or technology and the perception of the risks it involves. Contributions from the psychometric paradigm (Slovic) and the cultural theory (Douglas) would support this dimension. Categories such as perceived threats for local social networks, territorial identities, locally unwanted land uses, lifestyles, cultural traditions, values, beliefs, world-views, etc., are included in this dimension.

- Political-institutional dimension: In order to understand people's responses to a risk, we need to analyse the context of the social relations in which these responses take place. This includes, institutional dimensions like credibility, trust, perception of injustice or inequality, governance issues (etc.) (Wynne, 1996; Renn, 2008). From this perspective, when people evaluate a potential hazard, they implicitly make an evaluation of the institutions that promote and manage it, and generate judgements on their credibility or. Categories such as ‘trust’, credibility, perception of injustice, equity, confidence in institutions, governance issues, etc. are part of this general dimension.

These conceptual assumptions shine a light on the structure of the perceptions of the nuclear energy actors. We do not only distinguish between nuclear proponents or opponents, but also identify the specific dimensions that underlie actors’ support or rejection of nuclear technologies. Thus, we address the frequent ambivalences related to nuclear developments, such as when (for example) an actor agrees that nuclear energy constitutes an economic benefit but at the same time considers it is unacceptable because it imposes threats to certain local identities, or it is linked to undesired uses of the territory, or because of lack of trust in the managing institutions.

Our proposal has clear implications for risk management, communication and engagement. If the public dispute relies on concerns about safety, health, environment, or economic issues, objective data could work for achieving agreements, denying arguments, etc. However, if the dispute focuses on people’s values or ideologies, or on lack of institutional trust or confidence, things become more complex. Objective data could not provide strong basis for achieving an agreement. In these cases, objective data is not at the core of the debate, it is the capacity of institutions or companies to be trustworthy what is at stake. Trustworthiness is not only composed by technical values (expertise), but also by a subjective dominant dimension (fairness) which is very difficult to manage (especially when it has been lost) (Gamero et al. 2011). Finally, if the arguments in controversies revolve around questions of social identities, values and beliefs, etc., communicating objective data will also probably be unfruitful (although it has to be done anyway) as actors are looking for recognition from the others (claiming status, dignity, etc.).

Methods

The empirical basis for our analysis consists of the so-called Short Country Reports (SCRs) produced within the recent 3.5-year “History of Nuclear Energy and Society” (HoNESt) project, which analysed the interaction between the nuclear sector and society in 1950-2015. The selected countries are: Bulgaria, Germany (only the former Federal Republic), Finland, Spain, Sweden, United Kingdom, Ukraine, and United States of America.

The SCRs provided historical narratives covering a time span of 60 years, containing specific evidence that allowed the social scientists to identify key events, actors, arguments, behaviours, and types of public engagement. The conditions under which nuclear energy has been developed in different countries vary greatly over time, since each historical phase is characterized by a specific political, social, and economic context. In our analysis we distinguish between three main historical phases:

- Phase 1: 1950 – 1970: Shaped by post-war developments and the incipient Cold War, the Atoms for Peace programme, and the first phase of nuclear energy development.

- Phase 2: 1970 – 1990: Characterised by concerns about economic growth and about energy shortages in the wake of the oil crises, by the spread of public mobilisation against nuclear installations, which was reinforced in particular by the Three Mile Island (TMI) and Chernobyl accidents.

- Phase 3: 1990 – 2015: From the fall of the Iron Curtain and the debate about globalization, the rise of the climate change issue, the debate about peak-oil and the role of renewables in national energy plans, and by the Fukushima accident.

Since historical country narratives have provided the empirical source of our analysis, the nature of these specific ‘primary data’ needs some consideration. All of the SCRs produced by the HoNESt historians therefore follow the same structure. A thematic analysis of all this written material was carried out to identify, analyse and report patterns within data. All the SCRs can be found at the HONEST website (<http://www.honest2020.eu/d36-short-country-reports>).

Key findings

a) Perceived risks follow a very similar pattern over time in all analysed countries:

According to the SCRs, references to perceived risks are relatively scarce in the first period (1950-1970), they increase during the second period (1970-1990) and then they decrease again somewhat in the third period (1990-2015). Generally, the types of risk arguments are very similar over the time intervals (basically health and safety concerns, environmental and economic risks). The trend is very similar in all of the countries that we examined. Concerns about economic risks increased during the second period (1970-1990). At that time, nuclear projects cost and economic uncertainties were used key arguments in debates about nuclear power. This type of reasoning continues to be important in the third period (1990-2015).

b) Perceived benefits changed over time and countries following similar patterns:

In terms of benefits, health and safety references were almost absent during the first period (1950-1970). After the 1970s, in an effort to counterbalance public concerns, guarantees of safety notably increased. Health benefits appeared linked to the medical applications of nuclear developments. The perception that nuclear power was economically beneficial has been quite constant, however, it starts to decrease in the most recent period. Safety guarantees, namely promises to preclude health and environmental harms appear in the 1970s. Environmental issues become more prominent over time, especially linked to the expected role of nuclear power in the fight against climate change in the national and international policy agendas. In

fact, the most important change of arguments appears in the field of environmental benefits. In the first and second periods these were conceptualized in terms of offering a cleaner alternative to heavily polluting conventional coal-fired power plants, avoiding dam-building for hydroelectric plants, or even beneficial for new agricultural or touristic activities. However, during the third period (1990-2015) the argument changed radically towards benefits for fighting climate change.

c) The main political-institutional factors identified in the SCRs shaping social trust in institutions are the following:

Institutional trustworthiness: this draws attention to the fact that in many cases, certain social societal actors did not perceive the behaviour of the public institutions in charge of managing or regulating nuclear energy as trustworthy. Distrust is related to the perception of incorrect or unethical behaviours, for example by favouring private interests over public ones, by ignoring conflicts of interests, notably in case of state-owned utilities regulated by politicians, by acting against the law or by secrecies. In the SCRs there are many examples of (the critique of) such behaviour. Thus, we can conclude that this a very common factor in most analysed countries. In some countries (such as the UK, Finland, etc.) the level of trust in institutions has been found to be higher (regarding nuclear development, but not so much regarding waste management).

Political ‘games’: Trust was apparently undermined by the politicians’ instrumental use of nuclear power issue, e.g. when facing elections (as mentioned in the F.R. Germany report, for instance), or when changing views once in the government (as described in the Spanish report). Nuclear power was also a controversial issue between pro- and anti-European parties in some countries (mainly in Eastern Europe), etc. In these cases, decisions on nuclear energy seemed less motivated by an assessment of the cost and benefits of nuclear power, than an instrumental party-political purpose.

Dependency on other countries: It becomes a factor influencing decision making, leading national governments to adopt certain policies in order to ensure energy independence. Concerns about the ‘dependency on other countries’ seems more relevant in the East European countries (Bulgaria, Ukraine, etc., even in Finland), but it was also important in France (no national coal, gas or oil resources).

d) The analysis also found several socio-cultural factors shaping public perceptions on nuclear energy, such as the following:

Socio-cultural factors related to structural interactions:

- Territorial identity conflicts: These were related with grievances over unequal treatment of different regions; conflicts over economic activities and land uses, etc.

- Pride in national scientific achievements (and, sometimes, linked to pride in national military).

Socio-cultural factors related to individual lifestyles:

- Subjective attributes of risk: perception regarding difficulty of calculating risks, perception of low controllability of risk, unwillingness of being exposed, familiarity with the technology (and coping with similar risks in the past).

- Conflicts of values: social conflicts related to preferences for different lifestyles, diverse visions regarding economic and social development, dissimilar attitudes towards pacifism / military uses of nuclear technology, intergenerational justice: concerns about how future generations will judge current ones because of their management of nuclear energy, etc. These are elements that respond to different ideologies or ways of understanding how society and its evolution should ideally be.

e) Country-typologies:

All these factors are also unevenly distributed among the different countries, and could

help to understand the different social responses to nuclear energy. The articulation of this complex set of factors in our analysis leads to the emergence of three main groups of countries:

- Countries where nuclear energy plays a key role in national independence. This independence has conditioned both public opinion and management spheres and has led to a situation where the perceived benefits (in terms of national independence, pride, etc.) are higher than the perceived risks. Bulgaria, Ukraine, and to some extent Finland, would be part of this typology. These countries are characterized by a high to medium public acceptance of nuclear energy over time, and by sharing a particular position between historical Eastern and Western worldviews and geo-strategic tensions. In these countries the decision of using nuclear energy was a result of historical and geo-strategic decisions, leading to a situation where the perceived benefits (in terms of national independence, pride, etc.) are higher than the perceived risks. Nuclear energy was de facto imposed in the past, but this choice was done for reasons of security of supply and technological development, in an international context where achievements in modern nuclear technologies were part of the (Cold War) race with US.

- Countries where the nuclear issue was instrumentally used for political and electoral purposes, and where the behaviour of some institutions (promoters and/or public authorities) was perceived as low trustworthiness. F.R. Germany, Sweden, and to some extent Spain, would be included in this typology. In all three countries public perception of the nuclear issue has been used for political and electoral purposes. For instance, in the FR Germany and in Sweden, the proximity of political elections affected the decision making in some of their nuclear developments. While in Spain, the political parties changed their opinion about nuclear developments due to political strategies of the electoral arena. Although these three countries share some political-institutional factors, they have a base of socio-cultural factors which are quite different. For instance, in the F.R. Germany conflict values revolved around preferred development models and how these could be judged by future generations (for supporting nuclear developments instead of more sustainable energy models), along with ideological debates (concerning the role of nuclear energy in military affairs and potential risk of war). In Spain the main socio-cultural conflicts focused on land uses and economic activities in some territories, coupled with feelings of territorial grievances (by unequal distribution of risks and benefits among territories). In Sweden, national scientific pride seemed to be one of the main factors influencing nuclear public perceptions (positively, in this case), although at the local level some conflicts were detected in terms of land uses and local development models.

- Countries with higher public trust towards institutions (regulators/public authorities), conflicts between economic activities and land uses, and disagreeing values related to the use of nuclear weapons and the risk of war. These countries share a strong national scientific (and military) pride, which has inevitably influenced the public perception of risks and benefits, as well as the trust in institutions. The UK and the USA would share this typology. These countries had very early nuclear development, and in both cases, they suffered incidents/accidents which created an impact on public opinion (Windscale in the UK, Fermi or TMI in the USA). In the case of the UK it seems that the institutional approaches to nuclear management favoured an increased confidence of part of the population. Regarding the socio-cultural factors, both countries shared the public perception of conflicts between economic activities and land uses, and conflicts about values related to the use of nuclear weapons and the risk of war. Interestingly, both countries share a strong national scientific (and military) pride, which inevitably influenced the public perception of risks and benefits, as well as the trust in institutions.

Conclusions

In our analysis, we note that the evolution of perceived risks and benefits across time displays very similar patterns across countries. Nevertheless, public acceptance of nuclear energy is quite different in each country. This evidence clearly suggests that additional variables need to be considered in order to understand public acceptance of nuclear issues. Thus, the study of public responses and engagement with nuclear projects needs to focus on how people have perceived their relationship with institutions and corporations, as well as the type of socio-cultural factors shaping the societal context in which the risks and benefits are perceived.

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