THE SOCIAL DIMENSION OF COASTAL EROSION: THE CASES OF ESPINHO/PARAMOS AND FONTE DA TELHA

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ABSTRACT

Purpose: This work examines society's perception of coastal erosion and its risks. As activities in coastal areas have increased and diversified, ecosystems have been damaged, and erosion along the coast has increased. Inland communities, however, tend not to perceive erosion risks and rely on government-financed engineering structures to protect themselves. Environmental, economic, and social variables play a role in this. This complexity can lead to conflicts, resource disputes, negative impacts, and scepticism towards coastal management strategies. Public participation is critical to managing coastline risks sustainably. This paper addresses the social-economic and environmental effects of coastal erosion in a Portuguese coastal urban area.

Design/methodology/approach: Two case studies with different socioeconomic and environmental characteristics are studied qualitatively and quantitatively. Non-social variables such as waterway safety zones and coastal characteristics, social variables relating to the population, economic variables, and environmental factors were considered. Two areas in central and northern Portugal were studied, one, between Cova do Vapor and Fonte da Telha (Costa da Caparica), and another one between Espinho and Paramos.

Findings: Two empirical models have been developed to increase scientific knowledge. The first model conceptualizes coastal erosion social perceptions. Coastal erosion perceptions and vulnerability classifications were used to develop the second, more complex model. A framework for assessing societal vulnerability to coastal erosion is provided.

Originality/value: The study discusses the lack of knowledge about the social dimensions of coastal erosion. Historically, social desires and political decisions drove erosion risk mitigation, but a holistic approach must also recognize cultural values, behaviour, and demographics. Coastal communities' traditional knowledge and online information enrich public understanding of coastal phenomena and justify public involvement in coastal management.

KEYWORDS

Coastal Erosion; Sustainable Coastal Management; Coastal Communities; Societal Participation

1. INTRODUCTION

Coastal erosion is becoming a significant issue in Europe, with severe erosion processes and high-pressure situations along the coastline. According to Eurostat (2023), in the European Union (EU) countries that have a coastline, approximately 214 million people, 47% of the population, live in shoreline areas, making them the most vulnerable to the risk of sea, coastal erosion and flooding. Despite the recent international attention on

these issues, there is limited literature on them in Portugal. Therefore, this study aims to contribute to coastal risk perception knowledge by analysing two coastal communities that face high vulnerability and urban pressures. These areas are among the most critical in Portugal.

1.1. Coastal erosion: environmental and social aspects

The coast is a valuable natural resource under pressure due to human activities. This includes urbanisation, sediment extraction for building construction, and heavy use for recreational and tourism purposes. Coastal areas are also vulnerable to physical processes like storms and waves, which cause coastal erosion. This natural process enables the coastline to adapt to waves and sea-level rise due to global warming.

Coastal communities have always had to adapt to coastal dynamics. However, this adaptation has not been accompanied by sufficient knowledge of the social aspects affected by erosion or the social perception of risk. This gap has become increasingly significant in the current era of limited budgets, economic difficulties, and difficult resource allocation decisions. Nowadays, decision-makers realise that a holistic understanding of the coastal environment is crucial for robust public policy addressing this problem. Such an understanding should encompass societal values, people's preferences, culture, and traditional knowledge.

In accordance with Liberman and Trope's (1998,) Theory of Reasoned Action, and Trope and Liberman's Construal-Level Theory of Psychological Distance (2010), when people perceive a phenomenon as psychologically close, they are more likely to face it concretely since they feel more concerned and more likely to act (Spence et al., 2012). However, in the present work, another construct is added to the prior concepts of Liberman and Trope: the geographical and temporal proximity of a perceived a phenomenon, namely, the coastal erosion (Figure 1). The reason is the following: the present moment is the only thing that can be perceived directly by people. In the absence of other places, other people, and alternatives to reality, other realities cannot be experienced. However, our actions and decisions are influenced by memories, plans, forecasts, hopes, and counterfactual alternatives constantly present in our minds, which influence our emotions and guide our choices.

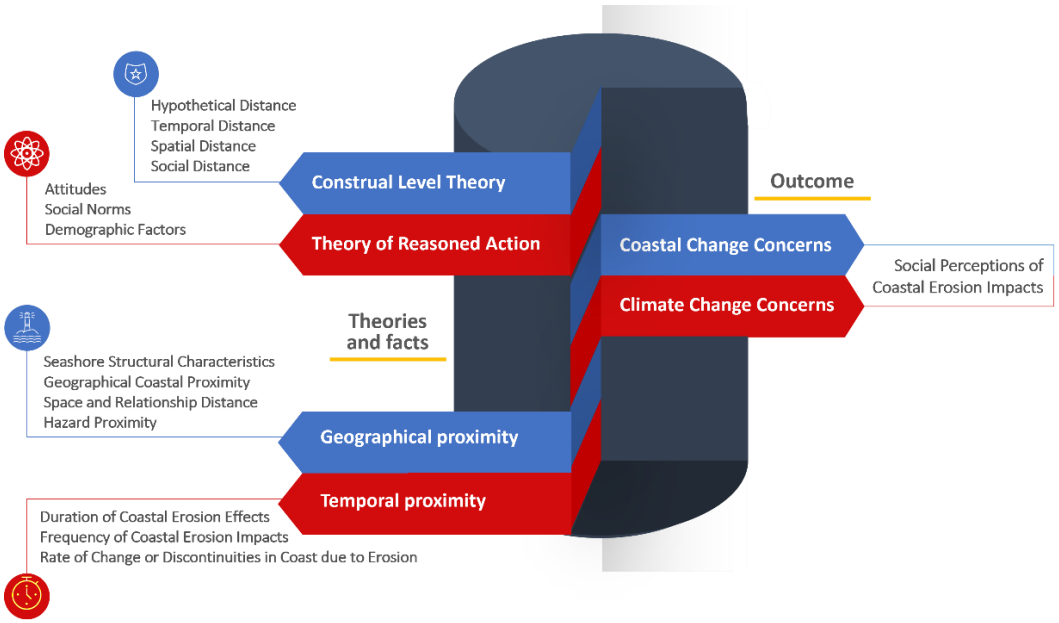

Figure 1. Conceptual model for social perception of coastal erosion impacts

Thus, geographical, and temporal proximity, as added in the present research, makes an innovation in the study of social perceptions of extreme phenomena impacts in coastal zones. Affected communities are more likely to face it concretely since they feel more concerned and more likely to act (Almeida, 2015; Spence et al., 2012).

Coastal erosion could be perceived as distant in space and time, contributing to a sense of detachment, particularly when communities do not live near coastal areas. In many cases, this distance correlates with a lack of concern for climate change. According to the literature, psychological distance from environmental issues if reduced, raise public awareness, and promote proactive action (Almeida, 2015).

1.2. Human influences *versus* coastal erosion in Portugal

Coastal erosion stems from several natural factors but also from human activity. Over recent centuries, anthropic activities have become as significant as natural factors in modelling the seashore and have contributed to the transgressive behaviour of the coastline. Human activities such as coastal construction, infrastructure development, and dredging have disrupted natural processes such as sediment transport and wave refraction, leading to an increase in coastal erosion rates. The consequences of this evolution of coastal areas are reflected in the flooding of riverine plains, the sanding- up of lagoons and estuaries, and in coastal erosion, as exemplified in Figure 2.

Figure 2. Portuguese coast erosion
(A and B) Beach zone and frontal dune area at Costada Caparica;
(C) Espinho, a month after artificial replenishment of sand (Automn/22)

Demographic imbalance and urban density have increased risk factors along the Portuguese coast. In Portugal, 1,300,000 people are exposed to sea level rise and tidal flooding. This vulnerability is due to their location on the edge of the coastline, and in some cases, urban areas are below average sea level (Antunes do Carmo, 2019).

In general, coastal vulnerability tackles a combination of physical, social, economic, and political factors that can affect a system when it is threatened by a particular event (Almeida, 2015). Vulnerability evaluation is vital for the integrated management of coastal areas. It is necessary to balance negative factors and interests so that the development model for these areas does not jeopardize the use of resources by future generations.

1.3. Understanding social perception and coastal erosion causes/effects

The perception of the coast as a social phenomenon has been individually and collectively constructed over time, causing conflicts. Understanding the causes and effects of environmental impacts in coastal areas is crucial, requiring enough data on potential interventions when assessing vulnerability. This perception may stem from coastal vulnerability to system changes and natural cycles, the significance of environmental impacts and risks, and the importance of evaluating such impacts as a basis for policy decisions (Almeida & Silva, 2021). To measure environmental impacts, responses, and human reactions within this dynamic interplay, indicators must be

carefully selected based on specific social and environmental criteria.

In the context of coastal systems, vulnerability and risk involve the relationship between people and the environment. Vulnerability is a fundamentally ecological and political concept, encompassing economic and political power, the environment, and biophysically and socially generated risk. Understanding the causes and effects ofcoastal erosion is therefore intricately linked to specific economic and political conditions unique to a particular place. The study of coastal vulnerability should be approached from a common, site-specific perspective, as illustrated in Figure 3, where numerous elements contribute to and shape the vulnerability of coastal regions and their inhabitants through interactions.

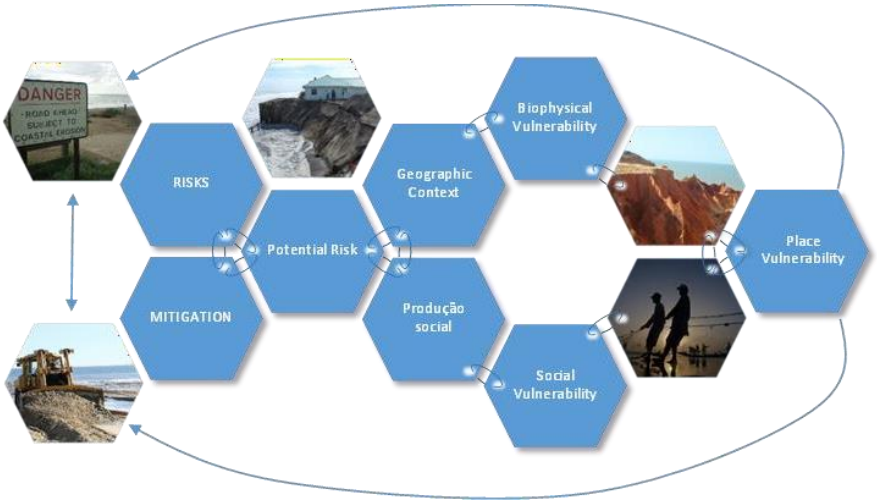

Figure 3. Conceptual framework for evaluating coastal vulnerability

There is a relation between risk mitigation measures and local vulnerability, whether-biophysical-or social-factors-are-involved. So, raising-mitigation measures may decrease risk and local vulnerability. On the other hand, changes in the geographical context or in social production, triggered by an increase in potential hazard, can lead to increased biophysical and social vulnerability and thus influence the region's vulnerability.

Since vulnerability is socially produced, risk is not evenly distributed across the social spectrum. This raises the question of whether all people inhabiting coastal areas are equally vulnerable to erosion effects and whether they know this. Vulnerability is explicitly linked to sustainability issues, the environment, hazards and risks, and

society's structure and organisation. This link connects the principles, values, and legitimate interests of citizens with their need to be protected by the state in a social reality that changes over time through collective life. To emphasise the importance of this, it must be said that public participation, expressed in co-management, requires shared responsibility between state institutions and citizens. Stressing such a process (bottom-up) requires the active intervention of all stakeholders in the decision-making process (Maher & Buhmann, 2019) and is only meaningful if it is properly explained.

2. SETTING THE GAP AND THE RESEARCH QUESTIONS

In Portugal, more than 50% of sandy shores have experienced retreat rates of more than 1 metre per year, with local maximum rates of 5-10 metres per year according to the 2023 report by the Environment Portuguese Agency (APA, 2023). Erosion of the Portuguese coast has become a major challenge due to factors such as (i) the lack of continuous and systematic monitoring of the coastline, (ii) an uncoordinated management strategy by local, regional, and national authorities and (iii) underestimation of erosion complexity (Almeida, 2015).

In this study, the cultural, social, economic, and behavioural values of individuals are explored, along with communication and education, and coastal managementdecision-making processes. This problem has been addressed with a variety of strategies, including reducing vulnerability to coastal hazards, and supporting resilient communities (IPCC, 2023).

There is a social movement forming in response to extreme environmental events. The participants are willing to collaborate on coastal zone management programmes. Communities living in coastal vulnerable areas for decades and all the information now available online have contributed to traditional knowledge of coastal environmental phenomena and their impacts on the coast over the years. As Almeida (2015) points out, these factors justify the inclusion of public opinions in professional debates.

Public participation is a key principle and best practice in integrated coastal zone management. Through this participation, adaptation measures to protect coastal zones and their inhabitants are better implemented (McKinley et al., 2022). Nevertheless,

community activities and citizen actions have usually been seen as the main factors negatively impacting coastal systems (Christie et al., 2019).

Coastal erosion on the Portuguese coast is a real problem with serious social and environmental effects that often requires various interventions. These interventions range from the construction or repair of coastal defences and the artificial reinforcement of beaches to more conflictual measures, such as relocating communities livingin areas considered at risk. It becomes especially problematic when these actions occurin areas where coastal erosion's social impacts are unknown or in communities that perceive the risk differently because of its integration into their daily lives.

The literature review identified a gap in coastal erosion social perception in Portuguese coastal communities. Coastal erosion and the associated risk for these communities remain largely unknown, providing an opportunity for research that aims to contribute to changing perception and beliefs about coastal erosion and coastal sustainability.

The initial questions are as follows:

- RQ1: How do coastal communities perceive, assess and act about coastal erosion risk?
- RQ2: What is the impact of the social perception of coastal erosion risk on publicparticipation and participation in environmental decision-making?

To summarise, the phenomenon under study is the lack of awareness of social perceptions about the risk of coastal erosion. The study also aims to explore the influence of these perceptions on public participation in decision-making processes related to social and environmental issues.

3. METHODOLOGY APPROACH

Two distinct coastal communities in Portugal were investigated for risk perception and social vulnerability: Paramos/Espinho in the northern region, and Costa da Caparica in the central/southern region, as shown in Figure 4. These areas were once fishing villages but have become tourist destinations and are highly vulnerable to coastal erosion due to substantial shoreline retreats.

Figure 4. Portuguese geographic localization of Paramos/Espinho and Costa da Caparica

Tourism and urban development have led to robust coastal defences in both locations. The construction of groyne fields and walls in the 1960s and 1970s led to increased human settlement and pressure on the area. Shoreline degradation downstream, however, has also been intensified by these defensive measures.

This work is based on two approaches. Firstly, a qualitative methodology based on 18 semi-structured interviews was conducted between September 2020 and July 2021 in the two areas analysed. For each case study, a group of regional institutions responsible for managing these areas (regional hydrographic administrations, protected area administrations, harbour administrations, civil protection) was selected, as well as local institutions (city councils, municipal councils), environmental NGOs and people with a direct interest in the coast (associations of residents and local entrepreneurs, tour operators, owners of seaside restaurants) and people who dependon the coast for their livelihood or whose identity is strongly linked to it (fishermen, surfers). On the other hand, to obtain opinions representative of the population of all areas, we adopted a quantitative approach involving a survey carried out in July 2021 on a representative sample of both locations (N=100).

The collected qualitative and quantitative data suits sustainability research (Scerry & James, 2010). These two approaches aimed to discover how the public perceives coastal risks and the vulnerability of the “natural” coast, what they know about coastal protection measures, how they evaluate them, and the measures taken by the institutions responsible for them. It was also to find out how they engage in decision-

making processes and how they view the coast's future, particularly concerning funding solutions and alternatives to coastal areas management.

4. RESULTS

4.1. Soil occupation variation and marine transgression perceptions

The study of land use change in Espinho and Costa da Caparica area over two decades using Geographic Information Systems (GIS) has shown that the city has grown considerably towards the sea during this period. This growth has increased the anthropogenic pressure on the coast and increased the risk in areas where the population either wants to settle or wishes to stay. In Costa da Caparica, houses, hotels, restaurants, and campsites have been increasingly constructed closer to the coastline, transforming the coastal landscape from a small fishing community into a densely populated area. In Paramos/Espinho (P/E), there are still remnants of the old fishing community in the dunes near the coast.

Effective coastal management requires population involvement. Thus, it is essential to understand how the public perceives coastal risks, especially erosion risks and itscauses. Local communities are the largest stakeholders in coastal management, and their views and attitudes can shape governments and organizations' decisions and policies. Also, the public can provide valuable feedback on potential solutions, and can help ensure that any decisions made are based on scientific evidence.

The survey results show that most respondents notice an increasing advance of the sea, which they attribute to coastal erosion. This is often not expressed quantitatively, but by reference points, such as landmarks inundated by the sea over time.

- *'The houses retreated; there were people who lived closer to the front, then they retreated further and further.'* (inhabitants of P/E)
- *'There was still a chapel (...) that was swallowed up by the sea.'* (P/E resident)

According to the data, the beach retreat, highlighted in Figure 5, is more significant for respondents from Costa da Caparica (500 metres) than for those from P/E (30 metres).

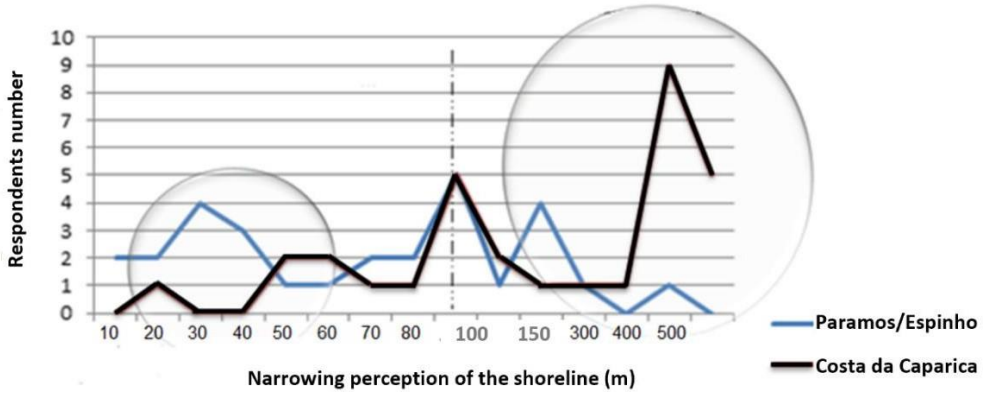

Figure 5. Community recognition of shoreline reduction over the last 30 to 40 years

For 44% of respondents, erosion is due to natural causes such as winds, tides, sea level rise and climate change. 17.5% believe that erosion is the result of anthropogenic activities, including coastal urbanisation, ports, dams, and sand extraction.

4.2. Perceptions of risk and of coastal erosion sources

The analysis of perceptions aimed to identify the main threats perceived for Paramos/Espinho and Costa da Caparica coast. The survey results show that most respondents consider the risk of coastal erosion to be serious or very serious. This is particularlytrue for Costa da Caparica, where over 75% of respondents consider this risk to be a significant problem that will worsen in the future (Figure 6).

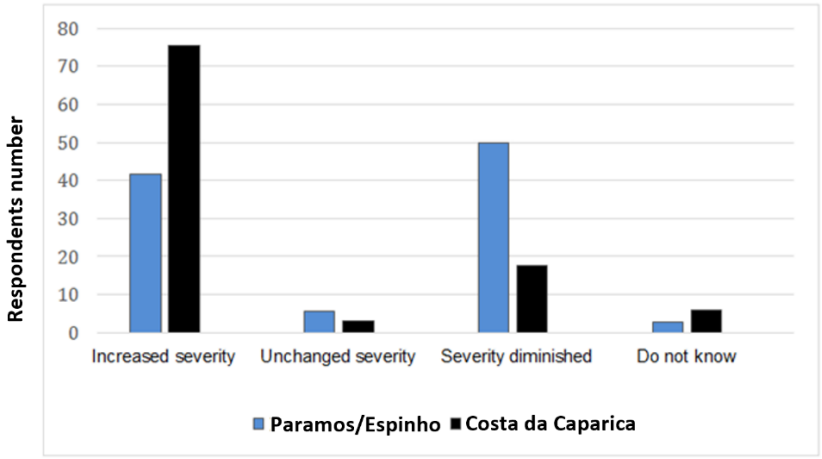

Figure 6. Perceptions regarding coastal erosion severity and sea advance

The two biggest coastal areas threats cited by respondents were storm surges and urban encroachment. Beaches were perceived as the most vulnerable element due to their

susceptibility to storm surges, erosion, and flash flooding. This vulnerability also extends to businesses, such as beach licence holders and service providers, who suffer economic losses through lost revenue if a beach is damaged or rendered unusable. Similar concerns were expressed about the challenges facing coastal fishing communities. Some of the interviewees (Costa da Caparica and P/E) provided insights:

- *'Storms have always occurred. I remember one night when I was still a student, during a storm, the sea took away 17 old establishments. I recall the sea damaging the railway line, and the sea reaching the traffic lights at the entrance to Costa, more than once. Tides and storms have always been there.'*
- *'There were no groins. Forty-six years ago, I got married in the chapel, and to reach the sea, I had to walk a lot. That's true, now the sea is already here, and there is almost no sand, just rocks.'*

Regarding the causes of coastal erosion, Figure 7 illustrates the general impressions of stakeholders from Paramos/Espinho and Costa da Caparica.

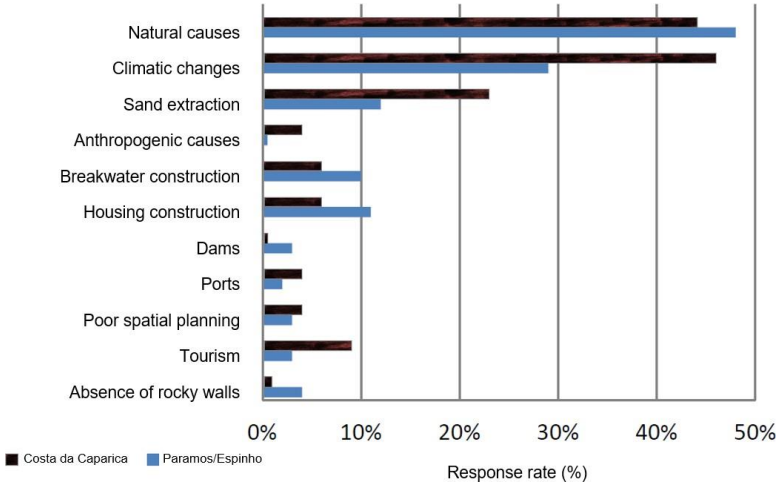

Figure 7. Perceived causes of coastal erosion

Most consider natural and distant phenomena, such as climate change, as the main causes. The only anthropogenic cause deemed more relevant is sand extraction, primarily highlighted by respondents from Costa da Caparica.

4.3. Perceptions on coastal erosion risk and on the efficacy of coastal defence measures

Based on the survey results, respondents from both regions emphasize the importance of preserving the coastline in its current state, with respondents from Paramos/Espinho expressing the strongest preference (Figure 8).

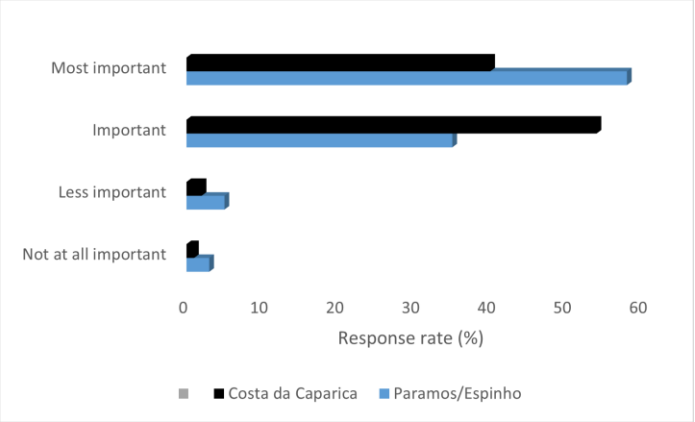

Figure 8. The importance to maintain the coast unchanged (%)

More than 90% of respondents agree that the coast should be protected "at all costs". Based on perceptions of the effectiveness of coastal defence structures (Figure 9), hard defences such as groynes and concrete walls are considered the most effective. This preference may partly be because artificial reinforcement of beaches, which often results in regular sand replenishment, is viewed not only as a recurring cost but also as a temporary and less permanent solution.

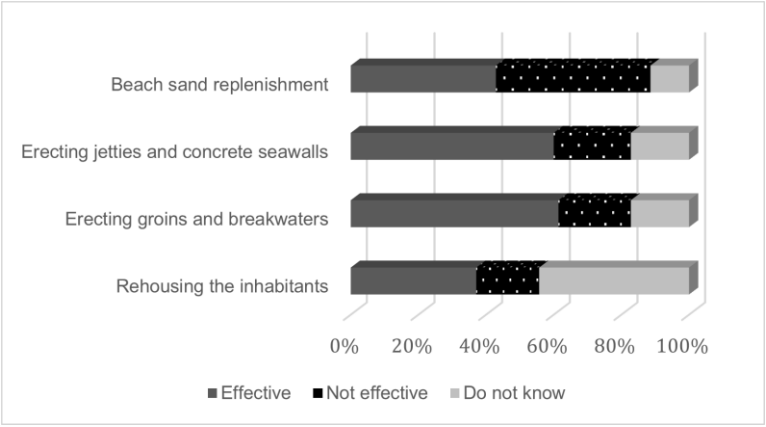

Figure 9. Stakeholders' perceptions regarding the effectiveness of coastal defence interventions

Neither municipality (Paramos/Espinho nor Costa da Caparica) favours the alternative of relocating buildings and resettling the population at risk. Despite acknowledging the

necessity of hard interventions, stakeholders in both municipalities acknowledge their adverse effects on the coast, especially in the south. Hard-engineered coastal interventions have often been linked to sediment loss and decreased beach sand in southern areas. Coastal defence infrastructures are negatively viewed in Costa da Caparica, even though they occasionally provide protection.

4.4. Public participation

As evidenced by the survey, coastal issues are not well discussed in the public sphere. Less than 5% of respondents have attended any meeting before coastal management decisions. Institutional actors have expressed concern about the lack of a culture of community participation in the decision-making process on territorial management. Conversely, the authorities do not appear to go beyond what is legally required to involve citizens in these processes.

The respondents have pessimistic expectations regarding the importance of public participation in the decision-making processes related to coastal management (Figure 10). There is an opinion that public intervention is ineffective in Caparica, which is shared by 75% of residents, while this opinion is held by less than 45% of residents in Paramos/Espinho. In contrast, a small percentage (11% on average) held a more optimistic view and believed that community meetings to inform and sensitize residents about coastal interventions would benefit the area.

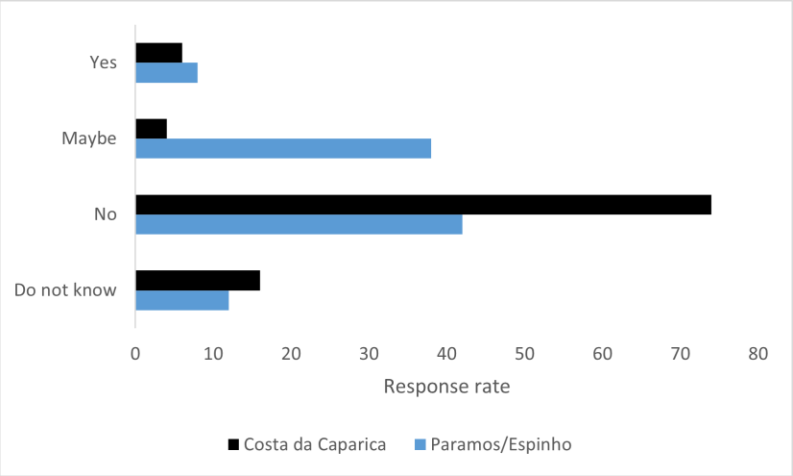

Figure 10. Perception of public engagement in decision-making process for coastal management

Interviews analysis of municipality representants and other public stakeholders revealed the importance that the municipality places on citizen participation in local government. Despite this, the effectiveness of a selected representative's participation in municipal executive meetings, where plans for managing vulnerable areas and interventions are presented and discussed, is often viewed as low or ineffective. Participants often described the marginalisation of fishermen's opinions as a form of social exclusion.

4.5. Social vulnerability framework in the context of coastal erosion

This research contributes to a context-based understanding of erosion susceptibility, as illustrated in Figure 11. A dynamic and fluid state of vulnerability is explained by a complex web of factors. A central aspect of this framework is vulnerability, which is influenced by biophysical and socioeconomic processes at the global, national, regional, and local levels (Almeida, 2015).

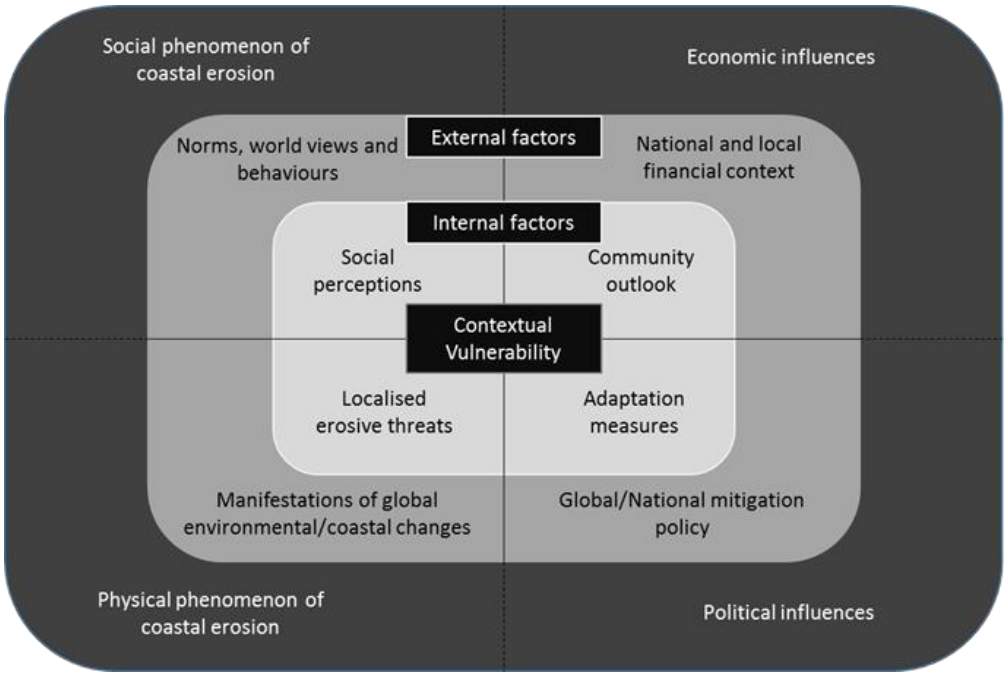

Figure 11. Social vulnerability framework in the context of coastal erosion

By incorporating physical (ecological), social, political, and economic factors identified in Paramos/Espinho and Costa da Caparica, the contextual framework of vulnerability seeks to enrich our understanding of vulnerability to coastal erosion.

According to Figure 11, social factors significantly influence coastal erosion susceptibility. This social phenomenon is constructed both individually and collectively. The changes that the erosion phenomenon brings to the coast, its impacts and how communities perceive vulnerability all contribute to their actions and behaviours. This includes stakeholders' relative vulnerability and perceptions of coastal erosion on the demand side.

5. DISCUSSION

The two case studies show extreme vulnerability in relation to current or past coastal events and the rate of coastline retreat with the development of urbanisation and the densification of human activities. Some erosion events were recalled by elderly people living in Paramos or Costa da Caparica. Despite the perceived risk and coastal changes caused by erosion and problems with hard coastal defences such as breakwaters, people continue to live in areas threatened by erosion.

In both case studies, the socio-economic characterisation of the population living in these areas illustrates a correspondence between the areas most affected by ecological and social stratification, potentially exacerbating the vulnerability of populations exposed to environmental risks such as coastal erosion. In both Paramos/Espinho and Costa da Caparica, community functions were perceived to be under threat (despite tough coastal defences and management measures) and resettlement was not a viable option, so a social limit to further adaptation was reached.

The perception of a shared risk to coastal areas, the impact of extreme weather events and coastal retreat, can help develop a stronger sense of community and thus better prepare coastal populations to respond and adapt (Schmidt et al., 2013). However, to achieve an adaptive governance approach, there is a need to build end-to-end trust between the different institutions dealing with coastal issues and between them and the range of interested stakeholders (Josephs & Humphries, 2018).

Coastal erosion management strategies have social and political implications and decisions on coastal management activities should be based on the best available science but also consider stakeholder perspectives (Leonidou et al., 2018). Stakeholders may have conflicting views on coastal erosion management strategies.

Optimal policy decisions require the resolution of conflicts between coastal protection and development, environmental protection and conservation, and social traditions. To this end, coordinated multi-stakeholder participation on coastal management issues is required as part of effective management practise. Moreover, such participatory processes are crucial for truly sustainable outcomes.

Traditions of public participation in coastal management vary widely across Europe, ranging from well-institutionalised participatory mechanisms involving stakeholders in coastal planning, to clear and communicative public policies on interventions for mitigation and protection (Lloid et al., 2013). It is crucial that local communities are genuinely involved and actively engage with issues such as sense of place or cultural identity (Casey & Becker, 2019). The process may be slow, but over time a broader understanding and more unified vision of the future of the coast can be achieved. Present results point to disbelief, discouragement, and mistrust among all social actors when it comes to participating, being heard, and being recognised as partners by political forces in their various circles of government.

In both cases, fishermen are a crucial group. Interviews with stakeholders indicate that socially rooted and respected fishing communities, well represented by local fishing associations, can be important partners in building community relations.

Participants emphasised the authorities' lack of sensitivity towards traditional knowledge and their unwillingness to welcome and integrate the contribution of participants' experiences. Thus, to overcome these problems, relevant data must be made available and accessible for interpretation, as stipulated in the AarhusConvention (1984). To make informed decisions, participants must have access to a range of information on different issues and perspectives. Although information from stakeholders is valuable, it proved very difficult and time consuming to bridge the gaps between expert and local knowledge and to collate and combine these different types of data and information in the case studies). It is therefore essential to find a process to address this challenge from the outset. Coastal management is a long-term process (Antunes do Carmo, 2019), and the many actors involved in coastal management – government agencies, NGOs, businesses, research institutes and coastal communities – need to be coordinated and flexible. Everyone needs to work together, with the public

having an input. However, public participation can only work if it has a coordinated structure that needs to be founded.

6. FINAL REMARKS

Coastal communities are frequently affected by extreme coastal events, which form a collective memory that contains valuable lessons. Despite this, it is challenging to integrate past experiences into plans, inhibiting communities' resilience. Collaborative efforts are essential to harmonise coastal research with societal needs. However, coastal erosion, exacerbated by human infrastructure and dense development near the coast, continues to be a significant issue affecting the environment and local communities.

According to surveys, people are aware of the risks associated with coastlines and the effects of climate change. Nevertheless, a lack of connectivity between local stakeholders and coastal management institutions hinders the effective participation of the local population. To address coastal erosion risks, overcoming the existing assessment frameworks is necessary. It is necessary to reassess the dominant role of experts in coastal management, emphasizing the significance of inclusive decision-making processes and incorporating different perspectives.

A contextualized framework for erosion vulnerability provides a holistic understanding of erosion vulnerability by considering physical, environmental, socio-political, and spatial interconnectedness factors. By applying this model, coastal erosion challenges are more comprehensively understood. This model contributes to a more comprehensive understanding of coastal erosion challenges by acknowledging the broader social, economic, and political context within which coastal communities exist.

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