

Fonte da Telha Sustainable Management



1. Introduction

Fonte da Telha is a coastal community located at the southern tip of Costa da Caparica coastline, within the protected landscape of the Costa da Caparica Fossil Cliffs (PPAFCC). This protected area stretches along the coast from the Costa da Caparica cluster to the Albufeira Lagoon, covering parts of the municipalities of Almada and Sesimbra. Through the PPAFCC, the region is subject to efforts aimed at restoring natural and landscape values, conserving, and rehabilitating natural resources, as well as promoting scientific research and raising public awareness.

Near the sea, the landscape features white sand and dunes rich in vegetation. Further inland, we encounter fossil cliffs that were once in direct contact with the sea. Over time, these cliffs have receded because of the sediment accumulation, leaving them set back from the coastline.

The area is surrounded by a scrubland of trees that have been increasingly destroyed by the construction of new buildings and residential developments. The structures, particularly those located in the central part of Fonte da Telha and along the main road, Rua Eduardo Luis, have been built without any urban planning guidelines. As a result, this area has become an urban agglomeration, but due to the lack of regulation, it is urbanistically disorganized and suffers from a degraded landscape.

The current situation is the result of an initial wave of illegal residential construction in the early 20th century. As a result of the anthropogenic activities that have occurred in the area, carried out without any guidelines or regard for the natural habitat, this zone has become semi-natural. This development is closely linked to fishing, which has been the dominant economic activity in the region and has shaped its social and cultural identity. In fact, a specific type of artisanal coastal fishing, known as Arte Xávega, has been practiced in the territory since the 17th century.

It is also worth noting the presence of an area to the south with exceptional floristic and landscape value, a pine forest with distinct, well-defined layers known as Mata dos Medos, which is classified as a Botanical Reserve.

Besides the identification of the current situation in this vulnerable area, the work intends to incorporate Fonte da Telha in a requalification strategy in a perspective of improvement of recreation and leisure conditions preservation of ecological systems and prevention of possible risks by delineating strategies for sustainable management of the coastal area. strategies in favour of sustainable management of the coastal area under study.

2. Methodology

To achieve the objectives of the study, multiple approaches were utilized to investigate the main themes. The methodology was structured in the following sequence of steps:

- Bibliographic research and information gathering,
- Identification of territorial management instruments,
- SWOT and TOWS analysis,
- Research best practices,
- Questionnaire,
- Definition of strategy proposal,
- Recommendations.

First, in the bibliographic research and information gathering, several articles were collected referring to the subject, focusing on similar cases and documents that provide information about the study area and the interventions carried out. The territorial management instruments were the primary source of information consulted as they contain comprehensive, official, and reliable data.

The SWOT and TOWS analysis followed, with a synthetic characterization identifying and differentiating aspects of this territory based on the territorial analysis presented. The SWOT analysis identified strengths, weaknesses, opportunities, and threats. In addition to this analysis, strategies were developed to capitalize on the strengths of the studied area, maximize the opportunities, mitigate the threats, and address the weaknesses. The TOWS matrix matches internal strengths and weaknesses with external opportunities and threats to determine the most effective courses of action.

Next, we researched best practices to identify successful approaches used in similar contexts to identify the most effective strategies and actions implemented in other territories, which could be adapted and implemented successfully in the study area. To have a better understanding of the stakeholder's view of Fonte da Telha, its problems, and its vulnerability to climate change, we conducted a questionnaire on the site.

Based on the results of the previous steps, we defined a sustainability strategy proposal for the central part of Fonte da Telha, between the Terminus Beach club and Bambu Bar. The strategy includes a set of objectives, actions, and measures to promote the sustainable development of the study area. This proposal aims to address the challenges and opportunities identified in the study area, ensuring the protection of the environment and the promotion of economic and social development while being flexible, adaptable, and open to adjustments as new information and challenges arise.

3. Territorial characterization

Fonte da Telha is a coastal village in the municipality of Almada, in the district of Setúbal, in Portugal. It is situated on the western coast of the Setúbal Peninsula and is part of the Costa da Caparica coastline.

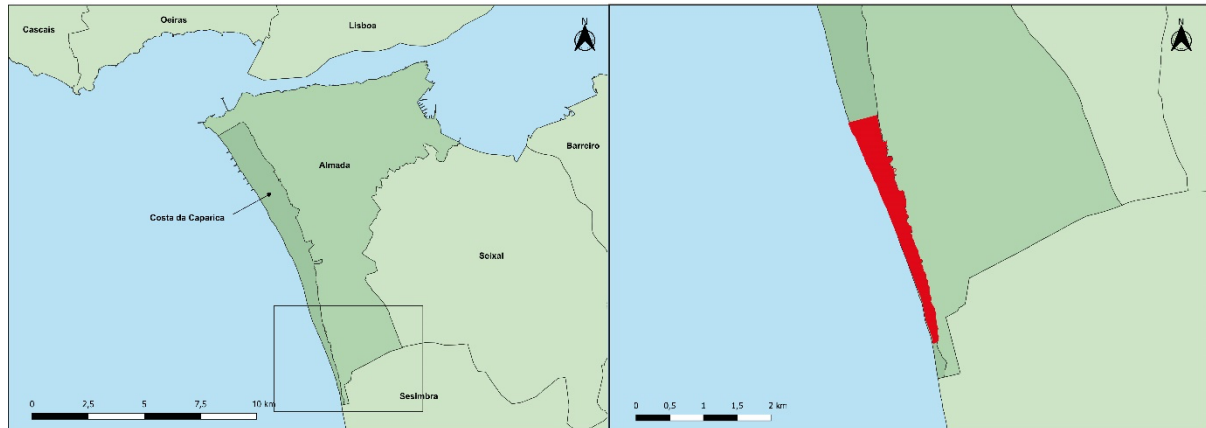


Figure 1 – Territorial framework of Fonte da Telha

It presents a diverse range of features, natural and anthropogenic. The area encompasses several natural elements, including the beach, dunes, cliffs, and forest zone, as species of interest to conservation. Despite the frequency of people visiting for recreational activities such as bathing, there is a notable scarcity of permanent human settlements in the area, save for a few beach support facilities and the piscatory community, made of around 400 people and which develop their activities mainly in the central part (CMA, 2015; Ramos et al., 2010).

The area is particularly susceptible to various natural hazards, including seismic events, tsunamis, mass movements in slopes, coastal erosion, and slope instability. In addition, the region is threatened by mixed environmental problems, such as forest fires, contamination of aquifers, and saltwater intrusion. These issues are aggravated by the impacts of climate change, such as rising sea levels and increasing storm frequency and intensity, all of which can impact the environment, the community, and economic activities (Schmidt, 2017; Schmidt & Mourato, 2015).

The dune system on the coastal plain is of significant interest due to its essential role in providing habitats for diverse flora and fauna species and working as a buffer to safeguard the coastline against storm surges. However, the development of Fonte da Telha was marked by an uncontrolled occupation characterized by the illegal construction of buildings in protected areas, and the lack of adequate regulation has resulted in significant damage to these systems (CMA, 2015; Jackson et al., 2019).



Figure 2 – Restaurant built directly on top of the dunes

Source: NiT

The relocation of the fishing community is a crucial issue, given the community's long-standing presence in the area. It makes the process complex and requires careful consideration of the social and economic ties to the territory. The community's livelihoods are closely linked to the sea, and any relocation would require adequate facilities, infrastructure, and employment opportunities in the new location. Moreover, the cultural and historical significance of the community adds to the complexity of the relocation process, necessitating a respectful and participatory approach that considers their values and traditions.

Because of these natural features, the administrative servitudes and public utility restrictions that cover Fonte da Telha include the National Ecological Reserve (REN), the Marine Public Domain (DPM), the Protected Landscape of the Fossil Cliff of Costa da Caparica, the Botanical Reserve of the Medos National Forest, the military easement area associated with the Iberian Satellite Communication Station, and the archaeological site of Concheiro.

Based on these servitudes, and to ensure the conservation and sustainable use of the coastal zone, promoting its ecological, cultural, and social values, the territorial management instruments, such as the Almada Municipal Master Plan (PDM) and the Alcobaça–Cabo Espichel Coastal Program (POC), act on the area. These instruments impose restrictions on various activities within the areas subject to the intervention of the plan, including constraints on land use, setback requirements, construction height, excavation, and land alteration.

Table 1 – Summary of recommendation for each plan

Plan	Recommendations
Almada Municipal Master Plan (PDM)	<ul style="list-style-type: none"> • Respect the protection areas indicated in the POPPPAFCC • Urban recovery (regulated by a detailed plan to be drawn up) • Condition the use of the soil
Alcobaça-Cabo Espichel Coastal Program (POC)	<ul style="list-style-type: none"> • Risk mitigation intervention in cliffs • Relocate population in the Safeguard Range in a situation of high danger • Preserve and restore priority ecosystems • Protect and enhance marine habitats and coastal lagoon systems • Recover and restore the dune system • Improve traffic and parking conditions on sea fronts • Value and qualify the sea beaches • Create conditions for non-motorized transport
Protected Landscape of Costa da Caparica Fossil Cliff Plan (POPPAFCC)	<ul style="list-style-type: none"> • Ensure the protection and promotion of natural, landscape and cultural values • Correct the processes that may lead to the degradation of the natural values • Ensure the active participation of public and private entities and the population in the conservation of natural values and the sustainable development of the region • Define models and rules for the occupation and transformation of the use and uses in the priority area for nature conservation, as well as in the other identified spaces • Define an integrated management model for the Protected Area • Manage the natural and landscape resources of the region • Promote the economic development and well-being of the population in line with nature conservation • Safeguard the historical, cultural, and traditional heritage of the region and promote integrated architecture in the landscape

4. SWOT analysis

Table 2 – SWOT analysis of Fonte da Telha

Strengths	Weaknesses
<ul style="list-style-type: none"> • Landscape • Dimension of the beach • Cultural heritage (Arte-Xávega) • Strong sense of community and awareness • High tourist activity 	<ul style="list-style-type: none"> • Slope instability risk zone • Susceptible to various natural hazards • Occupation of illegal genesis • Seasonal tourism • Lack of infrastructure • Areas with degraded landscape (due to lack of territorial planning) • Deterioration of the dune system
Opportunities	Threats
<ul style="list-style-type: none"> • Environmental Education • Ecotourism • Optimize land use • Better urbanistic management • Applications of NBS (nature-based solutions) 	<ul style="list-style-type: none"> • Climate change • Human pressure on a sandy shore • Difficulties to manage the urban growth • Contamination and Pollution • Disagreements between the government and the fishing community

Strengths

- **Landscape**

This is a territory where the natural landscape is abundant, with high scenic and ecological value. It is characterized by the presence of the Arriba Fossil, a geologically significant formation, and the Mata Nacional dos Medos, which features an Environmental Interpretation Centre and a network of pedestrian trails and includes a Botanical Reserve. This forest is highly sought after for environmental education activities, horseback riding, hiking, as well as adventure sports (CMA, 2015).

- **Dimension of the beach**

This area has an extensive beach of fine white sand, with the presence of a dune cord, and with exceptional natural characteristics for bathing use. Its wide extension allows a greater dispersion of its users, thus having a great allocation capacity and allowing other leisure activities such as sports (CMA, 2015). This region is prone to water sports since it has atmospheric and geomorphological conditions favourable to these activities. The fact that this beach has ample space, wind, and therefore, a rough sea with wave formation makes this territory appealing for practitioners.

- **Cultural heritage (Arte-Xávega)**

In this area, 30 to 40% of the resident population is made up of a fishing community that is active and still operates in traditional ways. In addition, this community still uses some artisanal fishing techniques, such as Arte-Xávega. This technique consists of using a net that works as a “wall” that “pushes” the fish towards the beach, surrounding them and making their capture easier. This technique does not damage the ocean floor, as it operates almost at the surface (CMA, 2015, 2021).

- **Strong sense of community**

In this place, there is a relatively young closed local community that has a strong sense of mutual help, with strong habits of sociability and coexistence. These characteristics of the population, adding their motivation for positive change, in the sense of improving the inhabited place, give these people a clear and coherent notion of the situations that should be the object of intervention and public investment.

- **High tourist activity**

As already mentioned, since this is an area with high scenic value and with good natural characteristics for bathing use, tourist activity in this location is high. In addition, there is an exploration, by the local population, of complementary activities to beach tourism, such as restaurants that support the beach, renting rooms in the bathing season and street sales of beach items. This exploration also contributes to the high tourist activity of the place.

Weaknesses

- **Slope instability risk zone**

This territory is classified as a risk zone by several studies, as it is considered highly vulnerable due to its high susceptibility to slope instability, with the additional risk of ocean flooding.

- **Susceptible to various natural hazards**

Since this area is in a coastal zone, and as previously mentioned, it is a region with highly vulnerable to a range of natural hazards, including seismic events, tsunamis, floods, slope mass movements, coastal erosion, slope instability, forest fires, aquifer contamination, and saltwater intrusion (Schmidt, 2017; Schmidt & Mourato, 2015).

- **Occupation of illegal genesis**

This area presents a high degree of dispersion of buildings, which consist mainly of residential buildings, thus leading to a disorderly occupation reinforced by a lack of regulation, a lack of definition of the legal status of the property and an abusive occupation of someone else's property (CMA, 2023).

- **Seasonal tourism**

Fonte da Telha beach, for being classified as a beach with a strong demand despite the distance from the urban centre, can attract many visitors during the seasonal tourism season, when the weather conditions are favourable, and people are looking for places to enjoy beach activities. Thus, during the peak tourist season, this beach receives a large flow of tourists looking to enjoy its natural characteristics and amenities.

- **Lack of infrastructure**

This place lacks good infrastructure since car access is centred on a single road, access to the beach is not organized and is in a state of disrepair, the road network is inadequate for the demand that occurs during the bathing season, there are no rules for parking and there is excess of individual car pressure on the front beach. In addition, the public spaces are inadequate, they are not equipped and are in a state of disrepair, the housing stock is quite deteriorated, there is a lack of water collection systems wastewater and some dwellings do not have access to the municipal water supply network (CMA, 2015).

- **Areas with degraded landscape (due to lack of territorial planning)**

Besides the lack of land management and all the precariousness and illegality of some buildings, the abandonment and accumulation of garbage and deteriorated materials in the lots, and the occupation of a significant part of the beach with precarious structures for storing fishing preparations, will clash with the natural beauty of this region, eventually degrading the surrounding landscape.

- **Deterioration of the dune system**

The occupation of territory with unregulated buildings is incongruous with the geomorphology of dunes and soils that are primarily comprised of sand. This lack of planning renders areas such as Fonte da Telha and other coastal regions vulnerable to issues associated with erosion. Consequently, predictions for future developments indicate that with the reduction of sediment on beaches and an increase in sea levels, the coastline will continue to move inland, erosion will persist, and the dune systems will remain in jeopardy (Sytnik & Stecchi, 2015). Not only do dunes offer refuge for a variety of fauna and flora, but they also play a crucial role in safeguarding inland habitats. It is worth noting that the stabilizing function of dune vegetation on coastal sands is becoming more vital as the sediment shortfall in the Fonte da Telha region's coastline becomes increasingly apparent. Without proactive conservation measures, the consequences for local biodiversity could be significant (ICNF, 2019)

Opportunities

- **Environmental Education**

It is crucial to promote, disseminate, and implement an effective system of environmental information and education. In this sense, awareness, and protection of various environmental systems, such as the dune system, should be encouraged through actions such as environmental interpretation

trails, dissemination of their importance by responsible parties to the local and seasonal population through activities and written information, and informative signs along pedestrian accesses.

- **Ecotourism**

The area encompasses several natural elements, including the beach, dunes, cliffs, and forest zone, thus the opportunity to execute a tourism more concerned with the environment is a step towards the preservation of Fonte da Telha and at the same time is a source of income for the population. Our bet is to take the opportunity to achieve nature tourism and in the diversification of activities compatible with its preservation and conservation (e.g., maritime-tourist fishing) (CMA, 2015; Lengieza et al., 2023).

- **Optimize land use**

The urban occupation model will be reformulated through the redefinition of the urban perimeter, taking into consideration the maximum need for relocation of the fishing community, as determined based on information collected during the characterization studies, as well as the characteristics of the territory and the reconstruction of the urban settlement of Fonte da Telha. This will involve the creation of an urban front with commercial establishments that serve both beach users and the fishing community, the provision of housing for the relocation of families within the fishing community, the maintenance of existing collective local support facilities, the creation of public spaces with an urban character, and the protection and infrastructure development of the road network.

- **Better urbanistic management**

This location is already planning to improve its structure, with the following plans in mind: focusing on the economic, touristic, and recreational dimensions of Fonte da Telha by promoting fishing activity and other water sports activities, improving the supporting infrastructure for these activities, creating well-equipped leisure and recreational spaces, improving parking and access conditions to these spaces, as well as beach support facilities, which will consequently enhance the tourist potential of the area; structuring the accessibility system to the urban centre and the beach by diversifying the offering of public transportation and limiting the use of individual transportation, and finally, enhancing the urban and environmental quality of the entire area, restoring legality to the extensive occupation of Fonte da Telha through a plan of demolitions and promoting recovery and renaturalization of areas not included in the urban core.

- **Applications of NBS (nature-based solutions)**

The application of nature-based solutions is a good bet because they are a viable coastal protection alternative. They are multifunctional, provide a myriad of ecosystem services, such as creation of habitat, and they will protect the ecosystems and population. In this sense, re-establish the dune system's, in Fonte da Telha, would be a good strategy to implement because besides increasing the adaptive capacity and resilience of ecosystems and increasing coastal protection efficiency, they also serve as buffers for storm surge, wind, and waves.

Threats

- **Climate change**

Presently, coastal areas are facing substantial anthropogenic stress, including reductions in sediment supply, shoreline displacement, and dune degradation. Furthermore, climate change exacerbates these issues and contributes to the emergence of new phenomena, such as an increase in average sea level and alterations to storm and wave patterns along the coast. These factors are accountable for the erosion of beach profiles and coastal dunes, as well as occurrences of overtopping and coastal flooding, and shifts in the direction of sediment transport, among other consequences (Melo, 2009).

- **Human pressure on a sandy shore**

The reduction, and in extreme cases the loss, of coastal space at the behest of human activities has significant repercussions on biodiversity, causing the loss of valuable biotopes for many animals, particularly birds. Uncontrolled human activity, the numerous holiday homes along the coast, and commercial facilities designed to meet growing consumer demand is the primary cause of habitat deterioration and a barrier to the dispersal of wildlife and plants. In addition, species in these increasingly smaller areas may be forced to survive with fewer resources and a more limited genetic heritage. This points to the need to develop a strategically planned network of natural and semi-natural areas that helps species to move and spread throughout the landscape. Furthermore, the lack of planning tools for human activity does not guarantee the absolute protection of coastal environments, which are often targeted by purely economic interests, thereby diminishing ecosystem services.

- **Difficulties to manage the urban growth**

The lack of management of urban development in the area has led to the definition of an agglomeration of scattered habitations that has led to a deterioration of the territory. This lack can lead to the development of a phenomenon known as sprawl, which can consequently increase the surface area of housing units, affecting the rational use of environmental and climatic resources. The uncontrolled development of the Fonte da Telha area, particularly due to the economic activity of fishing, has led to an increase in man's physical and environmental "footprints" and this phenomenon leads to the destruction of the faunal habitat and the fragmentation of the remaining natural areas. This failure is primarily due to the lack of commitment of those responsible at all levels, from the neighbourhood to the conurbation, to the European urban system, in a net of correlations and shared responsibility for better political integration.

- **Contamination and Pollution**

As already mentioned, the abandonment and accumulation of garbage and deteriorated materials in the lots and on the beach can not only deteriorate the landscape but also cause problems of contamination and consequently problems with pollution in these areas. In addition, the susceptibility to some hazards such as aquifer contamination, and saltwater intrusion are also of great concern. However, according to the Portuguese Environmental Agency (APA, 2022), the quality of the water at the beach is excellent.

- **Disagreements between the government and the fishing community**

At the start of the 20th century, Fonte da Telha was home to a small community of fishermen who resided in unauthorized dwellings. In 2008, measures were taken to address the lack of territorial planning, including studies and plans under municipal and supra-municipal territorial management instruments to preserve the piscatory communities' history, identity, and memory. Despite these efforts, in 2017, the government halted the demolition of nearly all structures between the Costa da Caparica cliff and the dune system because the detailed plan approved in 2015 did not provide for the complete relocation of all local residences. It was determined that the implementation of this or any other plan/intervention would require a shared management and execution model among the various entities responsible for it. After several years, the situation remains mostly unchanged, and no significant project has been carried out in the area. As a result, tensions between the government and the local fishing community persist.

Table 3 – TOWS analysis of Fonte da Telha

	Strengths	Weaknesses
Opportunities	<ul style="list-style-type: none"> • Use the strong sense of community and the environmental awareness of the fishing community as an incentive network for nature protection based on environmental education. • By using the natural features of Fonte da Telha and making it known to the large number of tourists that visit the area, it is possible to promote ecotourism. 	<ul style="list-style-type: none"> • The reformulation of the urban perimeter, respecting the limits of land use, allows territorial planning that does not impose excessive anthropogenic pressures on the dune system. • By applying nature-based solutions, the degraded landscape of Fonte da Telha can be re-established, increasing the resilience of an area naturally susceptible to environmental hazards, such as seismic events, tsunamis, floods, slope mass movements, coastal erosion, and slope instability.
Threats	<ul style="list-style-type: none"> • Use environmental awareness of the fishing community to decrease the vulnerability of fish populations (biodiversity) to climate change by promoting sustainable fishing practices that increase the resilience of these species to climate change impacts. 	<ul style="list-style-type: none"> • Establish measures that act on the degraded landscape of Fonte da Telha, which reinforce the resilience of the territory and the community against climate change impacts. • With infrastructure improvements, it is possible to decrease the anthropogenic pressure on the coastal area since the access and parking will be more organized. In addition, with the development of public transportation and the possibility of using the Transpraia train, there would be a decrease in the number of vehicles on site.

5. Best practices

Studying the best practices is crucial because it allows us to learn from successful examples and experiences from other areas, identify common challenges and opportunities faced by different coastal zones, and apply them to our context, developing strategies tailored to the specific needs and circumstances of the location. It can help to avoid mistakes and ensure that policies and interventions are effective and sustainable, leading to a more successful implementation of ICZM and contributing to the conservation and sustainable use of coastal resources.

5.1. Dune erosion

The fishery and industry living, tourism and nature, and the explosive population growth in the littoral zone, partly due to tourism, have increased the pressures on the coast. In addition, the impacts of climate change can bring with it the rising sea levels, floods, and storms. The main consequence of these phenomenon, especially on the coasts near the Atlantic Ocean, such as Fonte da Telha, is the

erosion of the dunes. This can be natural due to wind and wave action, but human activities such as levelling the dunes to build urban settlements can exacerbate it (Cascais, 2022).

One possible way to address the deterioration of the study area is to proceed with the construction and restoration of dunes, which is one of the most relevant techniques to counteract coastal erosion and the impacts of sea level rise along sandy beaches, as to preserve the functions of dunes, not only as sand reserves but also as ecosystems.

Dune construction encompasses the engineering design of artificial dunes by reproducing the shape of natural dunes, often in a chained manner. The dunes are built with sand gathered from an outside pick-up area and shaped into dunes using bulldozers. The vegetation required to maintain air biodiversity involves the selection of species for siltation, wind, and salinity and then regular monitoring and replanting of vegetation when appropriate.

To further protect the entire system, it is necessary to carry out dune thatching, inserting a cover on the surface with plant debris and branches to stabilize the sand, promote its accumulation and protect the dune vegetation. The materials used for thatching can be biodegradable and encourage the growth of plants and grass.

Furthermore, constructing wooden walkways and demarcated paths can protect them and continue to welcome residents and tourists to the beach, making access easier and more comfortable walking.

However, interventions on the dunes can only be successful if implemented simultaneously with other practices, such as biodiversity preservation and eco-tourism. The effectiveness of such measures can be further enhanced when accompanied by the restoration or construction of the entire coastal strip. These interventions must be carried out through adaptive governance processes that involve the trust and full participation of local communities (PAP/RAC, 2021).

5.2. Stakeholder participation

Stakeholder participation is a critical component of ICZM because it ensures the hearing of all voices, including local communities, businesses, NGOs, and government agencies, in decision-making processes related to coastal areas. Engaging these groups in ICZM can lead to better-informed and more effective decision-making, as increased community support and ownership of coastal management initiatives (European Commission, 2000, 2011).

The Wadden Sea Forum and the Delta Programme are two examples of successful stakeholder participation initiatives in ICZM in Europe.

The Wadden Sea Forum is a collaborative platform that aims to encourage sustainable development and preservation of the Wadden Sea region by bringing together stakeholders from Denmark, Germany, and the Netherlands. The area is a coastal ecosystem that harbours a diversity of plant and animal species and is also a popular tourist destination, making it crucial the orientation to sustainable development. A biannual plenary meeting takes place for an exchange of ideas and discussion about the issues and developments in the area, resulting in a common position and recommendations. The countries are also collaborating on the development of a Coastal Green Deal specifically for the region, in addition to the European Green Deal (Wadden Sea Forum e.V., 2022).

The Delta Programme is a coastal management initiative in the Netherlands that aims to protect the low-lying delta region from the impacts of climate change and sea-level rise through a participatory approach. For example, the programme involved the local communities in the decision-making process for the construction of a storm surge barrier that protects the area against flooding while preserving the area's cultural heritage (Ministry of Infrastructure and Water Management et al., 2023).

6. Questionnaire

To gain insight into the stakeholders' perspectives on integrated coastal zone management and the impacts of climate change on Fonte da Telha, we conducted a questionnaire to identify the area's main issues. These responses are valuable to a better understanding of the current relationship between the community, decision-makers, and the territory in question, and, consequently, design a sustainability strategy better suited to the specific challenges of the area. On May 1st, 2023, we applied the questionnaire at Fonte da Telha, obtaining 21 responses from bathers, beach bar workers and fishermen. The latter group showed significant reluctance when approached to respond to the survey, so we only got to interview three people.

Table 4 – Results of the questionnaire

Questions for the general public	(n)	(%)
1. What kinds of problems do you think exist at Fonte da Telha?		
Accesses	13	61,9%
Traffic	10	47,6%
Parking	6	33,3%
Transportation	4	19,0%
Habitation	2	9,5%
Work	2	9,5%
Seasonal infrastructures	2	9,5%
Buildings on the cliffs and dunes	1	4,8%
Police presence	1	4,8%
Pollution	1	4,8%
2. Are you satisfied with the way the regional and local authorities manage the coast?		
Yes	6	28,6%
No	10	47,6%
Yes/No	5	23,8%
3. Do you know any actions already implemented by the authorities?		
Yes	9	42,9%
No	12	57,1%
4. Do you think that interested parties should be included in this process?		
Yes	19	95,2%
No	0	0,0%
5. Do you think climate change could affect Fonte da Telha?		
Yes	20	95,2%
No	1	4,8%
Questions for fishermen	(n)	(%)
6. Do you think climate change could affect your area of work?		
Yes	2	66,6%
No	1	33,3%

The findings shed important light on how the general public and the local fishermen in Fonte da Telha view the problems associated with integrated coastal zone management and the effects of climate change. Most respondents identified access, traffic, and parking as the primary issues in the area. There is only one car access point to Fonte da Telha and few parking spots, and it gets crowded during the hot season, negatively impacting the local population's quality of life, discouraging tourists, and pressuring the dunes.

These issues reflect in the responses of the interviewed, as nearly half of the respondents are dissatisfied with how the regional and local authorities manage the coastal zone, suggesting a need for increased stakeholder participation and engagement in the decision-making process. The answers to question 3 also support this necessity, as most of the respondents do not know any actions implemented by the authorities in the area, and those who know mentioned the improvement of the infrastructure, referring to the road paving completed in 2020.

On the positive side, most respondents believe that stakeholders should be involved in the process, which indicates a willingness to collaborate towards a common goal of sustainable development. Furthermore, the high awareness of the potential threat of climate change to the area underscores the need for adaptive measures and resilience-building strategies to mitigate its impacts. One of the interviewed workers specifically identified the increase in temperature as a problem because it causes an influx of people in the area during the summer, exacerbating the impacts of the existing problems.

Regarding the fishermen's responses, two out of three expressed concerns about how climate change would affect their line of work, showing that this group is aware of the dangers and unknowns caused by climate change. These responses underline the necessity of a more participatory method of coastal management that considers the worries of all stakeholders, including the fisherman.

Overall, these responses emphasize the value of an ICZM strategy that considers the requirements and viewpoints of all stakeholders. This knowledge is beneficial for the development of a more effective sustainability strategy that tackles the unique issues in the study region, makes the most of the opportunities, reduces the risks, and strengthens the ability of the ecosystems and local populations to withstand the effects of climate change in the future.

7. Sustainability strategy

7.1. Principles and objectives

The primary mission of this strategy is to guide the community of Fonte da Telha to sustainable development, guaranteeing an improvement of resilience against climate change and protecting the environment while respecting the territorial dynamic and activities.

It is crucial to work towards these four specific objectives to achieve this mission:

SO1 – Enhance coastal access and mobility,

SO2 – Increase stakeholder participation in coastal governance,

SO3 – Improve the resilience of the territory and the community,

SO4 – Monitor and evaluate the processes.

7.2. Targets

a) SO1 – Enhance coastal access and mobility

To enhance accessibility and mobility in Fonte da Telha, the strategy includes a wide range of goals, including creating efficient, sustainable and accessible mobility options, reducing private vehicle circulation in the area, reducing traffic congestion and greenhouse gas emissions, and providing community members with accessible transportation information.

The first target is to ensure efficient, sustainable, and accessible mobility options for residents and visitors. This goal will entail a large investment in the area since it will require the construction of several infrastructures. The implementation of the transportation network will also require the adoption of an integrated transportation plan.

The second objective of the strategy is to decrease private vehicle circulation in the bathing area/fishing village, minimize traffic congestion and reduce greenhouse gas emissions. This goal, combined with the first, can improve coastal areas' accessibility, reduce congestion and pollution, and preserve the natural beauty and environmental integrity of Fonte da Telha while encouraging sustainable development.

Finally, the third goal is to ensure that mobility-related information is available and accessible to the community and visitors. A well-informed and environmentally aware population is essential to adopting sustainable measures and behaviours. To achieve responsible travel behaviour, the

surrounding community must have access to information regarding both transport options and the benefits of choosing a sustainable mode of transportation.

b) SO2 – Increase stakeholder participation in coastal governance

The multiple challenges related to maritime affairs need to be shared between various public and private actors at different levels of governance, from the United Nations to small coastal communities, because an integrated approach at each level is a fundamental tool for policy formulation and implementation that cuts across sectors and levels of governance and transcends borders so that synergies or inefficiencies can be systematically identified.

Apart from financial constraints, the main difficulties that can slow down the implementation of an integrated approach are generally linked to the lack of collaboration and coordination structures between the actors involved and the slowness of administrations and stakeholders to adopt a fully integrated approach. Clear communication on the policy to be followed and the establishment of a dialogue is therefore indispensable for the success of this strategy.

In addition to improving dialogue and information sharing directly with local communities, there is a need to include not only the administration, but also the various industries and services that depend on the sea for their economic activities, social partners, environmental and other NGOs, universities and research centres, and maritime heritage organizations.

These actors should adopt an integrated approach by forming 'maritime clusters' that can in turn collaborate with other actors in the sector within civil society dialogue fora and networks bringing together maritime stakeholders.

In addition to this, improved cooperation, coordination, and sometimes even coherence of maritime surveillance bodies and the interoperability of their surveillance systems at the European level also require a more integrated approach to maritime governance at the appropriate levels of competence.

Without this integrated approach, it will be impossible to coordinate the different sectoral activities carried out at sea (fisheries, combating criminal activities, port security, pollution, rescue at sea, border controls, etc.) and to generate synergies between these different sectors.

c) SO3 – Improve the resilience of the territory and the community

To improve the resilience of the territory and the community, the strategy encompasses targets like enhance coastal protection measures, the support for the diversification of economic

opportunities, the establishment of partnerships with local stakeholders, and the development of an environmental education program.

One of the key targets of our strategy is to enhance coastal protection measures to strengthen the resilience of the territory's ecosystem. It involves implementing a range of initiatives to safeguard the coastal areas, especially the dune system, from the impacts of climate change, such as rising sea levels, erosion, and extreme weather events.

Another vital target of our strategy is to support the diversification of economic opportunities within Fonte da Telha in the next five years. By expanding and diversifying the economic sectors, we aim to reduce dependence on any single industry and create a more resilient and sustainable local economy.

The third target of strategic objective 3 is to create collaboration and partnerships with local stakeholders. Even though SO2 focus on increasing stakeholder participation in coastal governance, collaborations can strengthen the relations, improving the resilience of the community.

The last target is to provide environmental education initiatives that reach at least 50% of the community members within the next five years. Empowering the community with knowledge and understanding of environmental issues is essential for building a resilient and environmentally conscious society.

d) SO4 – Monitor and evaluate the processes

While the supervisory entity of this implementation process should be the City Council of Almada, it is crucial to highlight the need to include various relevant entities in the working groups, such as the local community of Fonte da Telha (local workers, residents, and fisherman), the scientific community (FCT NOVA, Egas Moniz School of Health & Science, research centres), government agencies and institutes (APA, ICNF), non-governmental organizations operating in the area, public transportation companies, the local councils of Costa da Caparica and Charneca da Caparica e Sobreda, specific departments of the Municipality and entities responsible for coastal protection and security (Maritime Police and Municipal Civil Protection Service).

It is crucial to conduct regular meetings within the collaborative decision platform throughout the entire process, ensuring the timely adjustment of the strategies to be implemented and prompt and informed responses to unforeseen events that may arise during their implementation. In this regard, even after the strategies have been fully implemented, it is imperative to establish an effective monitoring system (e.g., utilizing sustainability indicators) that facilitates continuous updates of

relevant parameters in anticipation of potential future changes. The monitoring and implementation reports should be disseminated to the public in a clear and transparent manner, annually.

As a result of implementing this model, it is anticipated that new solutions will emerge to mitigate the challenges of the area, based on the alignment of proposals from other official guideline documents, such as PDM, POPPAFCC, and POC, and the aspirations and feedback from the local community, which will be the most directly affected by the implemented changes. In this regard, a new sustainable management strategy for the Fonte da Telha area, which fosters community participation and accountability, becomes feasible. As an outcome of this collaborative process, it would be pertinent to establish an awareness-raising system, such as conducting tourism awareness campaigns during the summer season, which could be initiated by both the local community and competent entities.

The authorities must ensure the implementation of the strategy, along with the participation of the stakeholders. Additionally, a monitoring system for the outcomes of the executed measures should be implemented, along with the enforcement of corrective action if necessary.

7.3. Measures

a) SO1 – Enhance coastal access and mobility

Coastal areas face unique challenges and characteristics that must be considered in integrated transport planning. Planning efficient and accessible transportation systems that link coastal communities with inland regions is crucial to sustainable development. In this way, providing a public transportation network with effective connectivity between different modes of transport, such as integrating bus stations with cycling facilities or creating transfer points between buses, would improve and increase accessibility to Fonte da Telha. As a result of this seamless connection, commuters will benefit from increased convenience and be encouraged to select sustainable transportation options.

Public transportation typically requires less space per passenger than individual cars for the same number of passengers. As a result, land is used more efficiently, infrastructure needs reduce, green spaces are preserved, and urban development is more compact and environmentally friendly. Furthermore, through public transportation, all members of society can access affordable and accessible transportation options, even those who cannot afford or access a private car. It reduces transportation barriers and social disparities and promotes social inclusion, which reinforces social equity. In addition, buses and trains can carry large numbers of passengers on a single trip, reducing private vehicles on the road, emitting fewer GHG, improving air quality and reducing traffic congestion.

Another measure to improve accessibility to Fonte da Telha and decrease traffic and parking pressure in this area is the development of parking and commuter facilities located outside Fonte da Telha. Parking is available in designated areas and visitors can use shuttle services or public transport to reach their destinations. For this to work, there needs to be an effective public transport network to bridge the gap between the facilities and the destination. Further, soft mobility, such as cycling or walking, should be encouraged. This type of mobility is a non-motorized means of transport and is environmentally friendly because it produces no direct emissions and minimizes dependence on fossil fuels. In addition, walking and cycling are economical modes of transportation as individuals can save money on fuel, parking fees, vehicle maintenance, and public transportation fares.

b) SO2 – Increase stakeholder participation in coastal governance

To maintain a strong link with the community and the territory, the area's municipal administration encourages the involvement of its stakeholders through a three-pillar approach: information, consultation, and participation.

The authorities must guarantee the dissemination of information through the publication of the contents, such as the performance plan, the transparency and integrity program, and other management tools, including the European Charter of Sustainable Tourism, the contents of the Environmental Quality Mark Department, and the documentation concerning ISO and EMAS certification. This disclosure of the results achieved may involve various channels such as website, newsletters, conferences, thematic meetings, and press releases. Furthermore, the consultation of municipal achievements, including studies, research papers, and theses, can also occur. The aim of these measures is to foster transparency, accessibility, and engagement, allowing stakeholders and the wider community to stay informed and actively participate in the initiatives.

Consultation shall include questionnaires, meetings with different stakeholder categories, sample interviews, and the organisation of thematic forums and training seminars.

Participation takes place through the involvement of stakeholders in the definition of guidelines for the drafting of planning instruments, the organisation of working meetings open to stakeholders, and the promotion of sectoral working tables, related to specific issues.

To ensure the participation and involvement of civil society and non-state actors in the definition and implementation of public policies, the mapping and formalisation of existing actors and processes, recognising their roles and responsibilities, is fundamental and preliminary. The aim is to support and strengthen long-lasting and dynamic networks of exchange and learning, ensuring maximum representativeness of sustainability actors, consistent with the principle of "leaving no one

behind" and favouring continuous and structured listening and dialogue with future and younger generations. Equally important is the recognition and formalisation of places dedicated to discussion and collaboration between institutions, civil society, and non-state actors.

Fundamental to ensuring participation is the role of 'Culture for Sustainability', since good participation requires a shared culture, not understood as a mere set of transferable notions, with rigid and impermeable roles between teachers and learners, but as a generative process in its formal, informal, and non-formal character.

c) SO3 – Improve the resilience of the territory and the community

The implementation of NBS and sustainable coastal management practices in Fonte da Telha is crucial to enhance the resilience of the ecosystem in the face of climate change impacts. By restoring coastal habitats and promoting natural processes, we can strengthen the ecosystem's ability to adapt to changing conditions, protect the coast against erosion, and promote the diversity of plant and animal species. Additionally, the target emphasizes sustainable coastal management practices that consider the community's ecological balance, social well-being, and economic benefits. Through these strategies, Fonte da Telha can improve the resilience of its ecosystem, ensuring its preservation and the provision of vital ecosystem services for the benefit of present and future generations.

One way to support the diversification of economic opportunities in Fonte da Telha is to invest in the establishment of new businesses or initiatives that foster sustainability and promote the area. The region has a range of beautiful natural landscapes, namely the Medos National Forest, and by encouraging the development of environmentally friendly enterprises, such as eco-tourism ventures, we can create opportunities that align with the sustainable development of the area. These new businesses will not only contribute to the local economy but serve as a solution to the problem of seasonal tourism. By supporting the establishment of such initiatives, Fonte da Telha can diversify its economic opportunities while embracing a more sustainable and resilient future for the community.

A measure to foster collaboration with stakeholders in Fonte da Telha is the establishment of formal partnerships or initiatives with the local communities, like the fishermen, NGOs, and government agencies. These collaborations aim to promote open communication, mutual understanding, and shared decision-making processes. By establishing formal partnerships and collaborations, Fonte da Telha can benefit from the collective strengths and capacities of all stakeholders, fostering a sense of ownership and shared responsibility for the coastal zone.

To promote environmental education in Fonte da Telha, we propose the development and implementation of a comprehensive program. This program will raise awareness and provide

knowledge about the importance of the coastal environment and sustainable practices, and it will include educational activities, workshops, and outreach programs targeting residents, businesses, and community organizations. By fostering environmental stewardship and responsible behaviour, we aim to empower individuals to contribute to the conservation and sustainable management of the coastal area. Through accessible and interactive educational opportunities, we will inspire a culture of environmental consciousness and active participation in protecting the coastal environment. The environmental education program will contribute to building a knowledgeable and engaged community dedicated to preserving the coastal ecosystem for present and future generations.

d) SO4 – Monitor and evaluate the processes

In this regard, a Collaborative Governance Model is proposed to address the challenges in defining an integrated and sustainable management strategy for the Fonte da Telha area. Thus, the main objective of this model will be to enable the definition and implementation of a suitable strategy for the area under study through a collaborative process, fostering shared responsibility between government entities and the local community, based on a bottom-up approach.

The monitoring body will be a central hub for collecting, analysing, and interpreting data and information related to the strategy's progress and outcomes. It will be responsible for developing monitoring frameworks, defining performance indicators, and conducting regular evaluations to measure the effectiveness and impact of the implemented measures. The monitoring body will also play a vital role in promoting accountability and transparency.

7.4. Indicators

a) SO1 – Enhance coastal access and mobility

Regarding ensuring efficient, sustainable, and accessible mobility options for both residents and visitors, one indicator that we can use is the "percentage of stakeholder involvement in sustainable transport planning processes." By tracking the rate of stakeholder involvement, we can measure the level of interest and cooperation in promoting sustainable mobility practices.

We propose two indicators to decrease private vehicle circulation in the bathing area/fishing village, minimize traffic congestion, and reduce GHG emissions. The indicator "percentage of trips made by sustainable transport modes" monitors the shift from private cars to more sustainable mobility options by showing the level of adoption of more eco-friendly modes of transport. The second indicator is the "proportion of circulation of private vehicles and park utilization". Monitoring parking

facility usage provides information on the need for private vehicles to park, along the effectiveness of alternative transport options. Parking utilization rates suggest a reduction in particular vehicle use.

Concerning the assurance that mobility-related information is available and accessible to the community and visitors, we chose three indicators. First, the “number and quality of public transport route maps around the area”. By monitoring the number of maps distributed in the area, we can gauge that more people are informed. Furthermore, the number of maps and their quality are relevant so that the entire population can understand them easily. The second indicator is the “number of visitors informed about mobility options”. Among the ways to measure this indicator is through surveys that assess community members' awareness of mobility options and their willingness to engage in responsible travel. Finally, the “percentage of the total budget allocated to information sharing and activities”. Budget allocations for information sharing indicate that more resources are being devoted to informing the public about the topic. This shows a commitment and effort to disseminate information.

b) SO2 – Increase stakeholder participation in coastal governance

Indicators used to develop greater stakeholder participation are necessary to monitor whether there is stakeholder participation within the dynamics of policy creation and activities aimed at building greater sensibility on the issue of coastal zone protection and development.

It is essential to estimate the number of participants in the discussion tables and to map and indicate which stakeholders participate and the main tasks performed concerning maritime management issues. The indicator chosen is the “number of actors making progress in ratification, acceptance, and implementation through legal, political, institutional and other frameworks”.

After that, to assess the sharing of information in a direct and effective manner, it is necessary for the administration to first see the need to exert economic support for the area's sustainable development. The indicators chosen were the “percentage of the total budget allocated to research, information sharing and activities on marine conservation”, the “percentage of the total budget for the development of discussion centres”, and the “percentage of the budget dedicated to land protection development in integrated plans”.

These indicators are also essential for analysing individual performance and are measured according to each person's contribution to achieving the objectives assigned to the various levels, together with the evaluation of professional and organisational behaviour.

c) SO3 – Improve the resilience of the territory and the community

The indicator used to measure progress in enhancing coastal protection measures and improving the resilience of the ecosystem is the “number of restored or rehabilitated coastal habitats”. This indicator quantifies the success of implementing nature-based solutions and sustainable coastal management practices. By tracking the number of coastal habitats that have been restored or rehabilitated, we can assess the effectiveness of the efforts in enhancing ecosystem resilience.

Regarding the support for the diversification of economic opportunities, the indicator is the “growth rate of sustainable economic sectors (%)”. This indicator allows the assessment of the expansion and development of sustainable economic sectors within the specified timeframe. By tracking the growth rate of these sectors, we can determine the success of the efforts in promoting economic and social resilience in Fonte da Telha.

Concerning collaborations and partnerships between stakeholders, the chosen indicator is the “number of cooperative initiatives or projects with local/regional/national organizations”. By quantifying the number of projects undertaken, we can measure the level of engagement and collective action in addressing the shared challenges and pursuing common goals in the territory.

In the environmental education target, the indicator utilized is the “percentage increase in community awareness and knowledge on environmental issues”. This indicator may be measured through surveys, assessments, or interviews that gauge community members' knowledge, attitudes, and behaviours related to the environment, and it determines the extent to which the efforts have successfully disseminated information and promoted a better understanding of environmental issues.

d) SO4 – Monitor and evaluate the processes

To assess the extent to which the stakeholders are actively involved and adequately represented in workgroups, we chose the indicator “number of non-members of the guardian entity in the workgroups”. It recognizes the importance of inclusive decision-making processes, where various categories of stakeholders contribute with their expertise, perspectives, and interests. This indicator serves to monitor and promote collaborative and participatory approaches to governance, in which different sectors work together for sustainable development and well-being of the Fonte da Telha community.

Regular assessment of the representation level helps identify any gaps or imbalances in the participation of key stakeholders. The results can inform strategies for enhancing inclusivity, fostering dialogue, and strengthening collaboration among these diverse entities. Because of that, the chosen indicator is the “number of reports made available annually”. This indicator reflects the commitment

to timely and consistent reporting, allowing stakeholders to stay updated on the project’s activities, milestones achieved, and any potential changes or adjustments made along the way. The positive progress in this indicator demonstrates the commitment to effective communication, transparency, stakeholder engagement, and accountability.

The target “Communicate the progress: The communication of reports to the population must be done in a clear, accessible, and transparent way” corresponds to the indicator “Number and frequency of updates on the sustainability strategy, either in the form of newsletters, social media posts, website updates, press releases, or community forums”. Various channels, such as newsletters, social media posts, website updates, press releases, or community forums, are utilized to disseminate information and engage with the population. By providing updates on the sustainability strategy, the project demonstrates its dedication to sharing progress, achievements, and challenges with the community. These updates are designed to be clear, accessible, and transparent, enabling the population to understand the project's goals, actions, and outcomes.

Table 5 – Summary of the measures, targets, and indicators of the sustainability strategy for Fonte da Telha

Measures	Targets	Indicators
SO1 – Enhance coastal access and mobility		
1.1 Implement a public transportation network with connectivity between different modes of transport	Ensure efficient, sustainable, and accessible mobility options for both residents and visitors	% of stakeholder involvement in sustainable transport planning processes
1.2 Adopt an integrated transport plan		
1.3 Encourage the use of sustainable transport modes	Decrease the circulation of private vehicles in the bathing area/fishing village, minimize traffic congestion, and reduce greenhouse gas emissions	% of trips made by sustainable transport modes
1.4 Develop Park and ride facilities		Proportion of circulation of private vehicles and park utilization
1.5 Provide information to visitors regarding the mobility options available	Ensure that mobility-related information is available and accessible to the community and visitors	% of visitors who are informed about mobility options
1.6 Encourage responsible travel behaviour and raise awareness about the benefits of sustainable transportation choices		Number and quality of public transport route maps around the area
		Participation of the community in collaborative initiatives
SO2 – Increase stakeholder participation in coastal governance		
2.1 Mapping and formalizing existing actors and processes	Guarantee an integrated approach at each level	Number of actors making progress in ratification, acceptance, and implementation through legal, political, institutional frameworks
2.2 Development of a shared culture on sustainability through the organization of meetings and working tables open to stakeholders	Clear communication on the policy to be followed and the establishment of a dialogue with civil society	% of total budget allocated to research, information sharing, and activities on marine conservation

Measures	Targets	Indicators
2.3 Construction of maritime clusters and the realization of thematic forums and training seminars	Include not only administration but also the various industries and services that depend on the sea	% of total budget for the development of discussion centres
2.4 Stakeholder involvement in the definition of guidelines for drafting of planning, protection, and monitoring instruments	Cooperation, coordination with maritime surveillance bodies	% of total budget allocation to land protection development in integrated plans
SO3 – Improve resilience of the territory and community		
3.1 Implementation of nature-based solutions and sustainable coastal management practices	Enhance coastal protection measures to improve the resilience of the ecosystem	Number of restored or rehabilitated coastal habitats
3.2 Establish new green businesses or initiatives	Support the diversification of economic opportunities within the next 5 years	Growth rate of sustainable economic sectors (%)
3.3 Establish formal partnerships or collaborations with local communities, NGOs, and government agencies.	Create collaboration and partnerships with the local stakeholders	Number of cooperative initiatives or projects with local/regional/national organizations
3.4 Develop and implement an environmental education program	Guarantee community environmental education reaching 50% of community members within the next 5 years	Percentage increase in community awareness and knowledge on environmental issues
SO4 – Monitor and evaluate the processes		
4.1 Create a monitoring body	Incorporate the local stakeholders in the workgroups of the guardian entity (City Council of Almada)	Number of non-members of the guardian entity in the workgroups
	Guarantee regular reports on the progress	Number of reports made available annually
	Communicate the progress	Number and frequency of updates on the sustainability strategy, either in the form of newsletters, social media posts, website updates, press releases, or community forums

8. Recommendations

Following the sustainability strategy proposal, it is crucial to consider a set of recommendations that will guide its implementation for Fonte da Telha, as it is designed to ensure the long-term success and resilience of the initiatives proposed in the strategy.

Because of the distrust of the stakeholders, especially the fisherman and local workers, towards the authorities responsible for the area, the measures included in the second strategic objective may encounter some difficulties in their implementation. However, if well communicated and promoted, it can emerge as a form of commitment with the population and the territory and be seen as an opening for participation and partnership.

Besides, the information about every step of the planning, implementation, and monitoring of the strategy must be available and with uncomplicated access to all those interested. Transparency is a fundamental aspect of any institution and is essential to the implementation of participative governance and integrated coastal zone management.

By embracing the sustainability strategy and these recommendations, Fonte da Telha will move towards a more sustainable future, ensuring the well-being of both the community and the territory.

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