



Subgroup: Coastal Zones

Case-study: Rising Sea Level: Ílhavo and Vagos
municipalities (South to Aveiro City)
(FFCUL, Portugal)

Date

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Project:

FP7/ Project BASE [2012-2016]

Date of release:

30/09/2015

Purpose of this document:

"The Case Studies Living Document (CSLD) will be the document that each case study leader will use to share the information that (i) characterize and give context to its case study, (ii) the goals within BASE, (iii) the methods used and mainly (iv) a synthesis of the results that that case study is providing to BASE project. This will allow the CS leader to understand how its own case is going (having a good overview), but also (v) will allow the sub-group to which the case study belong to know what is happening and what can be done (mainly on synergies and so on) as well as to (vi) WP4 & 5 coordinators to use that information to report (including each WP task leaders). These living document will also (vii) allow WP6 & 7 partner to know the information."

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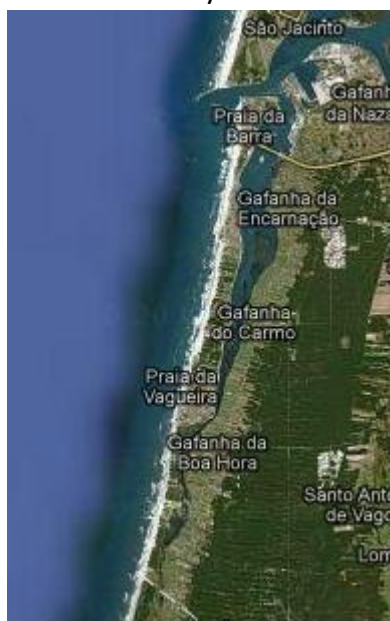
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1. General Case Study Description

A. Location

This case study area extends from the South of Aveiro Harbour (Barra de Aveiro) along a coastal stretch of nearly 20 km, until Vagueira. This coastal stretch faces the Atlantic coast on the west side and on the east the estuary of the Aveiro Delta (Ria de Aveiro), a vast estuary lagoon of the river Vouga that connects



12 municipalities and is crucial for economic activities and natural balance in the region.

This 10 km of coast line includes the coastal stretch of 4 different parishes (freguesias) of Ílhavo and Vagos Municipalities, from the south end of the Aveiro harbour (Praia da Barra), to Costa Nova do Prado and Vagueira beaches. In this territory 3 different coastal urban settlements were developed, each of them with a distinct history and social composition.

Barra, right next to the Aveiro Harbour and Aveiro's (Capital of District) main beach, grew from the beach summer residencies and is presently composed by a mix of permanent and summer residencies. To the South, Costa Nova is the most ancient settlement, traditionally occupied by a mix

of fishermen and summer residencies (high social classes from the inland of the region), is presently a famous tourist reference for its picturesque architecture. Vagueira was only a small fishermen village until the late 80s and is presently the main beach and summer residential area of Vagos Municipality.

Apart from the coast line, vast areas of all the 12 municipalities surrounding the delta are located in very flat lands, being subject to frequent floods.

GPS: 40,62 N; -8,74 W

Area: 1000 km²

B. Case Study Summary

The study has advanced through a participatory action-research approach. The study is prospective and represented a first attempt to produce with local stakeholders an inter-municipal adaptation plan.

Locally, according to interview results, stakeholders are well aware of the coastal vulnerability (this was equally a finding in previous studies – see O’Riordan et al., 2014). Despite this, local municipalities have still not yet designed or implemented any form of long-term action plan to address the problem collectively. According to local experts interviewed, there has been a halt in constructions on the first line of the coast. This is interpreted as an advancement in land use planning that contributes as a response to the problem.

Leadership and participation are both important and both were missing (according to a review of previous studies), before BASE. Therefore, at the beginning of BASE’s research intervention, interest was showed in developing an inter-municipality collaboration and engaging with the action-researchers in meetings with local administrators and decision-makers. BASE researchers were committed to include political actors in the participatory processes. It was also clarified that the objective was to promote collective decision-making, to facilitate consensual, shared future visions, and to co-design an adaptation action-plan for the coastal stretch. Thus, central to this research was the possibility of engaging different stakeholder groups (i.e. residents, national, regional and local administrators, policymakers, NGOs, fishermen and farmers, business owners) in a collective dialogue, informed by expert knowledge on climate impacts and adaptation options for the region.

Scenario Workshop is the methodology implemented between October, 2013 and July 2014. This methodological approach also integrates the Adaptation pathways method. We also use a Multicriteria analysis and have named this set of methods the SWAP.

C. Context

In the winter of 2014 (a few months after BASE initiating its research in the area), winter storms hit the region and resulted in damages to beach infrastructures, endangering shoreline residencies. Images of these storms appeared on national TV and for a few week climate change and coastal adaptation were topics on Portuguese news channels. Due to this storms the Portuguese Minister of the Environment, Spatial Planning and Energy entitled a group of researchers and experts (where FFCUL was included) to make an assessment of measures needed for coastal protection. This group – entitled the Littoral group – has reported on its findings and its recommendations are being integrated in the National Strategy for Coastal Zones. Regarding this case study area, the group recommended sand nourishment operations (integrated in an action-plan for the long-term) and in some instances the relocation of urban settlements. The recommendations of the Littoral Group are now part of the “Strategic Reference Framework” (i.e. the law and the recommendations

that an action-plan should follow) of the governmental Shoreline Management Plan (in Portuguese known as the POC – Plano da Orla Costeira) for the region of Ovar-Marinha Grande, which includes the case study area. The POC are action binding plans with a legislative component for coastal regions. Moreover, the Minister for the Environment, Spatial Planning and Energy allocated a budget of 300 million Euros for protecting the littoral between 2014 and 2015¹.

Thus, the winter storms have been key drivers for adaptation in this region.

D. Brief General Information on Climate CHANGE and related issues

The sediment balance in this area has been strongly affected by harbour infrastructures built since the early 1800s. Main economic activities in the area are services, fisheries (sea and lagoon) and agriculture. The natural balance of the “ria” (lagoon) is fundamental for these activities. Recent flooding events - such as a coastal inundation in November 2011, South to Vagueira – caused damages to farming fields, as salted water reached the lagoon. Here, the stretch is really narrow and the risk of breaching is high and recurrent. According to recent monitoring studies, the shoreline has receded 26 m at this point, from 2002 to 2010 (Bernardes, 2010).

This is also considered one of the most vulnerable stretches to storm surge in Europe. Vagueira is particularly vulnerable, as part of the buildings (from the late 80s) are below sea level and the urban beach, which is vital for touristic activities has been retreating rapidly over the last decade, despite a seawall and groynes built to protect the seafront.

Possible adaptation measures were initially dredging sand; building embankments, building a dike and relocating population.

E. Existing Information on Case Study’s adaptation history

Up to date, only sand nourishment operations have been done, although not in the context of climate change adaptation. These interventions have been done periodically, by the Aveiro Harbour Administration, over the past 10 years. Although not was a part of an action-plan or policy guideline. Sand was retrieved in dredging operations North of the Aveiro Harbour and placed on a longitudinal drift current, to the South of the Aveiro Harbour Southern groyne. The goal was to increase beach sand, which every winter is steadily depleted.

¹ News is available on the website of the Portuguese Minister for the Environment; Spatial Planning and Energy, following this link: <http://www.portugal.gov.pt/pt/os-ministerios/ministerio-do-ambiente-ordenamento-do-territorio-e-energia/mantenha-se-atualizado/20141017-maote-litoral.aspx> (last accessed 9th July 2015)

F. Connection with other research projects:

Project summary (including date of end of project):

This case study has been “passed on” by a previous research project – Project CHANGE [<http://www.projectochange.ics.ul.pt/home/os-casos-de-estudo/vagueira>] which has now ended. CHANGE project was successful in engaging local stakeholders in a discussion on climate change, but no decision was made regarding adaption measures and implementation of an adaptation plan. BASE main objective is to facilitate a decision-making process, including co-designing with local stakeholders adaptation pathways, assess environmental, economic and social impacts of possible adaptation measures, as well as costs and benefits, and promote implementation of chosen measures. The process has been participatory and stakeholders were engaged throughout the research.

Institutions involved:

ICS (lead) + FFCUL

G. Case ID, Typologies and Dimensions

Having in mind the following BASE Objectives; Categories of Case Studies, please fill in the following table.

BASE OBJECTIVES

1. Compile and analyze data and information on adaptation measures, their effectiveness. (...)
2. Improve current, develop new and integrate methods and tools to assess climate impacts, vulnerability, risks and adaptation policies (...).
3. Identify conflicts and synergies of adaptation policies at different levels of policy making with other policies (including climate mitigation) within and between sectors. (...)
4. Assess the effectiveness and full costs and benefits of adaptation strategies to be undertaken at local, regional, and national scales using innovative approaches (mainly by integrating bottom-up knowledge/assessment and top-down dynamics/processes) with particular attention on sectors of high social and economic importance.
5. Bridge the gap between specific assessments of adaptation measures and top-down implementation of comprehensive and integrated strategies.
6. Use and develop novel participatory and deliberative tools to enhance the effective use of local contextualized knowledge in adaptation strategies to assess perceptions of adaptation pathways and their co-design by citizens and stakeholders.
7. Disseminate findings by sharing the results of the project with policy-makers, practitioners and other stakeholders. (...)

CASE STUDIES CATEGORIES

- A. Public administration (municipality, regional, national, european)
- B. Research and education Centres (universities, research centres, projects and groups, schools)
- C. Public companies
- D. Companies (farms, SMEs, big businesses)
- E. Social enterprises (cooperatives, non profit companies, woofing farms, etc)
- F. Consortiums (partnerships, campaigns),
- G. NGOs (environmental NGO, local development NGO, charities, etc)
- H. Transition Initiative

I. Ecovillage

J. Informal groups, Movements

Case ID			Typologies and characterization				
Country & Name of CS	BASE Objectives to be answered by the CS	Category of case study	Territorial zones	Scale	Process Direction	Temporal Definition	Timescale ²
PT, Vagueira	<input checked="" type="checkbox"/> Objective 1 <input checked="" type="checkbox"/> Objective 2 <input checked="" type="checkbox"/> Objective 3 <input checked="" type="checkbox"/> Objective 4 <input checked="" type="checkbox"/> Objective 5 <input checked="" type="checkbox"/> Objective 6 <input checked="" type="checkbox"/> Objective 7	A Public Administration	<input type="checkbox"/> Rural <input type="checkbox"/> Urban <input checked="" type="checkbox"/> Coastal <input type="checkbox"/> River Basin	<input checked="" type="checkbox"/> Local <input type="checkbox"/> Regional <input type="checkbox"/> National <input type="checkbox"/> Transnational <input type="checkbox"/> European /Global	<input checked="" type="checkbox"/> Bottom-Up <input checked="" type="checkbox"/> Top-Down	<input type="checkbox"/> Retrospective <input checked="" type="checkbox"/> Prospective	2012-2015

H. Impacts, Sectors and Implementation

Please tick the relevant boxes for impacts and implementation and insert the number 1 for primary sector and the number 2 for secondary sector.

Impacts		Sectors		Implementation	
Primary CC Impacts (Climate-Adapt)	Primary CC Impacts (BASE)	Primary and Secondary Sector (Climate Adapt)	Primary and secondary Sector (BASE)	Implemented ³	Phase of Implementation ²
<input type="checkbox"/> Temperatures <input type="checkbox"/> Water Scarcity <input checked="" type="checkbox"/> Flooding <input checked="" type="checkbox"/> Sea level Rise <input type="checkbox"/> Droughts <input checked="" type="checkbox"/> Storms <input type="checkbox"/> Ice and Snow	<input type="checkbox"/> Extreme temperatures <input type="checkbox"/> Water scarcity <input checked="" type="checkbox"/> Flooding <input checked="" type="checkbox"/> Coastal Erosion <input type="checkbox"/> Droughts <input type="checkbox"/> Soil Erosion <input type="checkbox"/> Vector Borne Diseases <input checked="" type="checkbox"/> Damages from extreme weather related events (storms, ice and snow)	<input type="checkbox"/> Agriculture and forest <input type="checkbox"/> Biodiversity <input checked="" type="checkbox"/> Coastal Areas <input checked="" type="checkbox"/> Disaster risk reduction <input type="checkbox"/> Financial <input type="checkbox"/> Health <input checked="" type="checkbox"/> Infrastructure <input type="checkbox"/> Marine and Fisheries <input type="checkbox"/> Water Management <input type="checkbox"/> Urban	<input type="checkbox"/> Agriculture <input type="checkbox"/> Biodiversity & Ecosystems <input checked="" type="checkbox"/> Coastal and Marine systems <input type="checkbox"/> Energy <input type="checkbox"/> Health and Social Policies <input type="checkbox"/> Transport <input checked="" type="checkbox"/> Production Systems and Physical Infrastructures <input type="checkbox"/> Water resources <input checked="" type="checkbox"/> Tourism	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> Ongoing <input type="checkbox"/> No	<input checked="" type="checkbox"/> Assessment <input checked="" type="checkbox"/> Planning <input type="checkbox"/> Implementation <input type="checkbox"/> Monitoring <input type="checkbox"/> Evaluation

² Please insert year of start and year of end of case study.

³ When the case study consists of a public administration with a top down approach, implementation can be an approved legislation or regulation. When the case study is about practical adaptation measures like a sand dune, for example, implementation should be considered finished when the dune is built in situ.

I. Importance and Relevance of Adaptation

Please tick the relevant box for the case study.

- ☒ Case developed and implemented as a climate change adaptation measure
- ☐ Case developed and implemented and partially funded as a climate change adaptation measure
- ☐ Case mainly developed and implemented because of other policy objectives, but with significant consideration on climate change adaptation aspects

2. Case study research Methodology

a) Research Goals

The case study's major goal is to design an adaptation plan, and support a decision-making process for needed adaptation actions. Questions 1, 3 and 6 are core for this case study, since the decision-making process is intertwined with local governance and deliberative process between top-down policies and bottom-up processes, but the weight of social and economic impacts of measures is a key issue when choosing and implementing adaptation actions.

b) Stakeholders involved

Presidents and vice-presidents of the Municipalities Ílhavo and Vagos

Representative of the regional municipalities' association

Representatives of the Portuguese Environmental Agency (APA)

Aveiro Civil Protection

Aveiro Harbour Administration

Three Local Parish Associations (Presidente Junta Gaf. Nazaré, Presidente Junta Gafanha Boa Hora (Vagueira), Presidente Junta Gafanha do Carmo, Presidente Junta Gaf. Encarnação)

Quercus (NGO)

Vagasplash (Tourism/business owner)

Local Fishing Association (APARA)

Local Residents

Beach business owners association

Farmers

Aveiro University

c) Methodology

The SWAP had the following research steps:

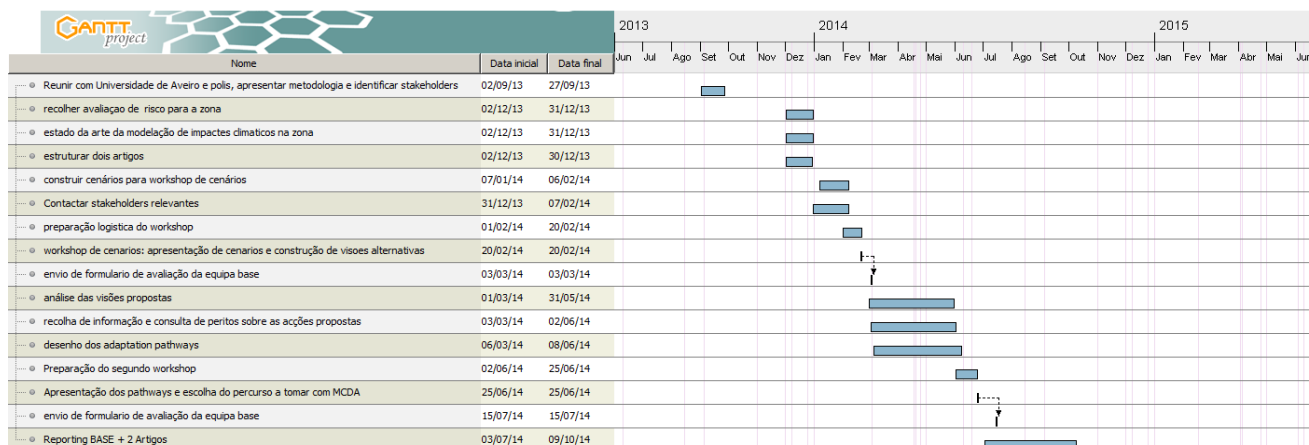
1. Update knowledge on the state of the art of climate change impacts and risk assessment studies for the region, by reviewing the results of previous projects.
2. Provide a knowledge base to all potential stakeholders, by organizing two seminars which report on the existing knowledge for local adaptation and on potential adaptation actions used in other parts of the world, namely the Netherlands. In one of the seminars, Ad Jeuken from Deltares did a presentation on coastal adaptation solutions in the Netherlands.
3. Design 3 alternative adaptation storylines, in order to make the information accessible to all stakeholders.
4. The storylines were presented to local stakeholder in the first day of the SWAP Workshop, people were asked to provide alternative scenarios and pathways.
5. Analyse the alternative scenarios suggested and collect relevant data for an exploratory multicriteria analysis that contributed to design the adaptation pathways.
6. Design 5 alternative pathways (one for each sub-region – the coast was divided in 5 sub-regions according to its geographical and socioeconomic characteristics).
7. The alternative pathways were presented in the 2nd workshop day and stakeholders were encouraged to reach a consensus. The result was an adaptation plan for the 5 subareas, which was then synthesized for the whole coastal stretch.
8. Follow up interviews to receive an assessment of stakeholders regarding the experience.
9. Develop a Cost-benefit analysis of the measures suggested in the SWAP adaptation plan.

METHODS to be used in Case Studies ⁴	YES // NO
A) Methods for prioritizing adaptation options	
Cost-Benefit Analysis (CBA)	yes
Cost-Effectiveness Analysis (CEA)	
Multi-criteria Analysis (MCA)	
Analytic Hierarchy Process (AHP)	
B) Quantification of impacts and relationships between factors affecting adaptation	
Causal Diagrams	
Influence Diagrams	
Process-based Modelling	
Welfare variation analysis under restrictions	
C) Uncertainty and sensitivity analysis	
Probabilistic multi model Ensemble	
Monte Carlo simulations (PRIMATE uses this method)	
Real option analysis	
Climate risk management process	
D) Participatory Methods	
Scenario Workshop	yes
Participatory Cost Benefit Analysis (PCBA)	
Participatory add-ons to CBA	
Participatory add-ons to Multi Criteria Decision Analysis	
Participatory add-ons to Adaptation Pathways	yes
Other (add extra lines if necessary):	

⁴ For descriptions and references of the Methods please refer to Milestone 8. For data requests from specific Work Packages please refer to Deliverable 4.1

a) Case study Timeline

(Please insert an image/graph of the Timeline of your Research Approach, highlighting important milestones and deliverables.)



b) Collaboration with other Partners and Case studies

Collaboration within BASE partners/researchers (EX: for a specific competence):

Name: Bjorn Bebsted and Soren Gram; Partner: _DBT (Scenario Workshop)

Name: ___Ad Jeuken_____; Partner: _____Deltares_____

Name: _____; Partner: _____

Name: _____; Partner: _____

Name: _____; Partner: _____

Name: _____; Partner: _____

Name: _____; Partner: _____

c) Research Outputs

a. Scientific Publications

- Interim reports + final case study report for D5.5 (Month 30)

- Scientific papers: 2

Campos, I.; M. Alves; F.; Vizinho, A.; Dinis, J.; Penha-Lopes, G. (2015). Climate adaptation, transitions and socially innovative action-research approaches. *Ecology and Society Journal*, special issue on Societal Transformation. Accepted (to be published in January, 2016)

Campos, I.; Vizinho, A.; Coelho, C.; Pereira, C.; Alves, F.; Truninger, M.; Santos, F.D; Penha-Lopes, G. (2015). Scenarios and pathways - a long-term planning experiment for coastal adaptation in Portugal. In review: *Journal of Planning Theory and Practice*.

b. Other Publications

- Books/Books Chapters: # 1

Provisional Title: _____
_____; Month/Year: ____/____

c. Other

- Scientific conferences:

Vizinho, A., Campos, I., Coelho, C., Pereira, C., Roebeling, P., Alves, F., Rocha, J., Alves, M.F., Santos, F.D., Penha-Lopes, G. (2015); SWAP – Planeamento Participativo da Adaptação Costeira às Alterações Climáticas, Trabalhos do VIII Congresso sobre Planeamento e Gestão das Zonas Costeiras dos Países de Expressão Portuguesa, 14 a 16 de Outubro, Aveiro, Portugal, 4A6_Artigo_079, 18p. ISBN 978-989-8509-13-0.

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3. Participation in Climate Change Adaptation

Process overview

The objective of BASE research has been to bring together a group of relevant stakeholders to promote institutional dialogue and the co-design of an adaptation plan for the area. There is, however, a national adaptation strategy for Portugal – [ENNAC](#) though it is still at the beginning stages of implementation. Additionally, last winter's events (storm surges which threatened several coastal zones in Portugal), lead the Portuguese Ministry of Environment to create a working group for coastal adaptive management. The group is currently gathering data to advice on a plan for adapting the Portuguese coastline to both climate change impacts and coastal erosion.

Locally, political agendas are concerned with maintaining the functioning of the beaches during summer season, thus protecting investments and business in the tourism sector, but also in deterring the devaluation of real-estate investments.

The problem of this coast continues South to the district of Mira and Figueira da Foz, as well as North to Ovar; and an association of the municipalities that surround the Aveiro delta (CIRA) have created a joint strategy to supports implementation and fundraising strategies, which includes coastal adaptation and protection as part of its agenda. Thus, planning coastal adaptation in this smaller section of the affected territory can be an important pilot experiment for other regions to the North and South.

We began by presenting to stakeholders, individually, our methodological proposal based on the Scenario Workshop (Rasmussen, 2003) and the Adaptation Pathways and Tipping Points methods (Hassnoot et al, 2013) supported by a Multicriteria Analysis. The use of the Adaptation Pathways and Tipping Points method in a participatory context had, to our knowledge, not been done before. We complemented the workshops with follow-up individual interviews where we asked participants to assess their experience, as well as their views on local barriers, uncertainties and perceptions regarding climate adaptation. Finally, adaptation actions selected by local stakeholders are currently being economically assessed through a Cost-Benefit Analysis. These actions are mostly “hard measures”:

1. Beach sand replacement;
2. Reinforcing the dune system (by building sand dikes, and relocate farming fields); maintain existing structures (groynes);
3. build a longitudinal adherent construction on the existing groyne South of Vagueira Beach;
4. Re-align the direction of the Aveiro Harbour's Southern groyne;
5. Build an artificial reef in front of either Barra or Vagueira beach (or both).

Participation in the Process Phases

Process phases:

1. *Initiative/decision to act*

Stakeholders: citizens, experts, politicians

Stakeholders included in our case study approach - the scenario workshop - were representative of the following groups: national environmental agencies; Aveiro Harbor; environmental NGOs; local authorities – municipalities and parishes; association of the region's municipalities; local business association; local residents associations; fisherman and farmers.

Citizens

We've included in our stakeholders group representatives of local resident associations, local business associations, Environmental NGOs, fisherman and farmers.

This stakeholder group perceives their coastal area as a high risk and vulnerable area to extreme events. The danger of sea level rise destroying (in the event of storm surges) the dune barrier and reaching the lagoon, as well as a recurrent loss of beach sand and its negative repercussions on tourism are the biggest drivers for local action.

Workshop results show that citizens are determined to protect the coast and its urban settlements and maintain their socioeconomic activities.

Experts

Expert knowledge is fundamental to support local adaptation options, which are mostly hard measures (beach sand nourishment operations and sand dikes to protect the dune barrier). We've included in this group researchers and technicians from the Aveiro Harbour and from the Civil Protection agency.

Politicians

Including politicians is fundamental to support the implementation of adaptation options. We've included the mayors of the two municipalities involved, a representative of the regional municipalities' association, as well as the presidents of the three local parishes. We've also included representatives from national agencies.

Officials/legislators

We didn't include legislators, though we included representatives of the National Environmental Agency (who is, most likely, the institutional body responsible for coordinating the implementation of adaptation plans). This institution is currently concerned with coastal protection of vulnerable areas in Portugal and since the winter of 2013 (where some coastal areas suffered greatly with storm surges and flooding events) has been revising its plan for coastal management and protection. This case study has been seen by the participants in representation of the Portuguese Environmental Agency as a potential a pilot experiment.

2. *Development of potential adaptation options*

Stakeholders: citizens, experts, politicians

Citizens

Provide Local knowledge and risk perceptions

Experts

Provide expert knowledge for the discussion of potential adaptation actions

Politicians

Ask for expert knowledge on adaptation solutions in order to inform their decisions.

Officials/legislators

3. *Decision-making*

Stakeholders: citizens, experts, politicians

Citizens

In our case study, this stakeholder group was pivotal at the planning stages, and in deciding together what adaptation options would be most suited for this coastal stretch.

Experts

The group played a core role in gathering relevant information and advising other stakeholder groups on the best adaptation options. Information was shared regarding efficiency, costs, technical options and secondary effects of potential adaptation actions.

Politicians

This group is the leading the decision-making process.

Officials/legislators

4. *Implementation*

Stakeholders: citizens, experts, politicians, legislators

Citizens

If the plan co-created at the scenario workshop reaches its implementation stages, we believe citizens will be called at the stage to integrate the plan and possibly contribute with soft measures. It was also suggested that small soft measures (such as planting vegetation to support dune structures) could be carried out by local volunteers, mobilized by local and national environmental NGOs.

Experts

For measures 3 and 4 (see process overview in this section) a study would need to be conducted by experts, before these options could be considered and integrated in a final plan.

Politicians

For all adaptation measures until 2025, participants referred there should be a joint financial plan (70% to 80% the EU; and 30% to 20% Government agencies and local authorities). It would be up to the local administrators and the national environmental agency to design the implementation project and apply to financial mechanisms for joint funding.

Officials/legislators

Two of the adaptation measures selected imply the expropriation of agriculture lands. At the implementation stages legislators would have to be involved.

Participation Experience

Strenghts Having for the first time a group of relevant stakeholders designing together an adaptation plan for this coast Creating a space for dialogue between different institutional bodies. Clarifying myths and misconceptions about adaptation options Access in real time to both expert knowledge and local knowledge to support the analysis and selection of adaptation options	Weaknesses There are no guarantees that the plan will be implemented There could be no commitment to the implementation of the plan by local stakeholders
Opportunities Testing new methodologies that are assimilated by stakeholder groups and can be replicated at their institutions, groups or associations. Promoting the implementation of an adaptation plan Promoting political dialogue Increasing knowledge on local adaptation possibilities for the region. Using the case study as a pilot project for the whole coast of Portugal.	Threats If the plan is not implemented stakeholders may be demotivated and less likely to engage in future discussions. There has been a clear call for action throughout the planning process that may not be fulfilled.

Learning through Participation

In order to capture how participation could improve the climate change adaptation process, please report with regards to your case study:

a) Your view whether and how participation influenced the strategies and measures decided in your case?

Participation was important to support institutional dialogue and consensus on potential adaptation measures. There was a noted absence of a culture of participation.

Although (as observed through our initial meetings and exploratory interviews with local stakeholders), resident associations, local surfing associations and beach business owners were gradually developing together efforts to collectively address the problem, other social actors (fishermen, farmers) were for the most part disengaged, although concerned with the issue. Previous studies had shown social actors were concerned but were not being involved by local policymakers, nor organized in groups that could support some form of collective action for coastal protection and adaptation. The participatory process was central to contribute to overcome this obstacle. As the research progressed other subsequent obstacles had to be addressed. First the lack of trust on the results of engagement from most social actors initially approached, and also some scepticism regarding climate change on the part of municipality actors, who later became key advocates of the adaptation plan proposed. Yet, during the research period, there were some changes in the context/framing of climate change. Storms destroyed beach bars, a few months after BASE research started. The 2014 winter left one of the most important beaches for local tourism almost without sand, and endangering residencies built on the shoreline. Images of these storms appeared on national TV and media coverage brought a significant attention to the need for coastal protection against extreme events. Local policymakers became more interested in BASE research and the issue of climate change. The storms also affected other coastal zones in the country and resulted in a new political agenda concerned with finding solutions to protect the Portuguese Coast.

b) How you think the participatory process in your case could be/have been improved?

Other actors should have been integrated, namely experts on legislation, to support discussions on legislation. The adaptation options proposed are extremely expensive and as was concluded by the stakeholders themselves during the workshops sessions, the measures will require an additional co-financing

from the EU. Local municipalities were specific at this level by stating that adaptation options proposed would need around 75% of EU funds, and 30% of funds from central government and 5% municipal funding. At this stage the process is very much in the hands of local municipalities who are attempting to apply for grants in order to implement the suggested measures and attain the necessary funding. However, central administrative bodies are responsible for implementation, namely the National Environmental Agency. Therefore, any plan must include this entity. Members of the National Environmental Agency were included in the workshop, nevertheless their involvement could have been stronger.

c) Any novel (use of) participatory methods observed in the case studies

Yes, we combined the Scenario workshop method with the adaptation pathways tool and a multi-criteria analysis.

4. Climate Change Adaptation Measures and Strategies

a) Adaptation Measures under analysis in your case study

(Please identify your Adaptation Measures considered in this case-study and provide a short description of each)

Adaptation Measure(s):

1. Beach sand replacement;
2. Reinforcing the dune system (by building sand dikes, and relocate farming fields); maintain existing structures (groynes);
3. build a longitudinal adherent construction on the existing groyne South of Vagueira Beach;
4. Re-align the direction of the Aveiro Harbour's Southern groyne;
5. Build an artificial reef in front of either Barra or Vagueira beach (or both).

Short description for each Adaptation Measure (Máx 50 words):

Beach sand replacement will have possible technical options still under discussion, these include the origin of the sand and the amount of sand used for each operation.

Likewise, reinforcing the dune system may be done with sand dikes, but the sand used for these dikes could either be from Lagoon dredging operations or from other sources.

The groyne referred in measure 3 is not effective in protecting the dune barrier, therefore it needs to be strengthened with a longitudinal adherent construction inland.

Both measures 4 and 5 would need to be studied further and assessed. With the existent knowledge their efficiency is still uncertain. Regarding the artificial reef there is little experience with this type of construction on Atlantic shore.

b) Adaptation Measures selection and data availability prior to BASE

(Please describe how and why where these specific measures selected for further research and analysis under BASE and what is the baseline data already available for each specific adaptation measure. Máx 500 words)

In this case study there were no adaptation measures selected prior to BASE. There was also no adaptation plan.

c) Full description of Adaptation Measures

(Please provide a full description on each of the Adaptation Measures regarding this 21 leading questions under. If more than one Adaptation Measure please copy paste the structure provided.)

Process

- I. Would, or at which part would, institutions and private stakeholders implement the measure autonomously to adapt to climate change (Adaptive capacity)?

In a context where various institutions are involved in decision-making and participation has not been embedded in local culture and policymaking practices, the case study benefits from establishing a forum for collective dialogue and decision-making. This can be done by using participatory approaches. This forum should be informal, allow the sharing of information through accessible and easily understood format. This forum should equally encourage consensus, dialogue and mutual understanding among the different stakeholders involved. Political actors and all those with the responsibility for implementing the plan need to be involved from the beginning, but also all those who can substantiate the plan, both by providing local lay knowledge and expert knowledge. Choosing who to involve in the participatory planning process is fundamental for implementation. In this case different stakeholder groups were fundamental, but political actors were a must. This case study could have gained from including experts on local and regional regulatory frameworks. This information was missing in the discussions.

II. Does the measure initiate further activities for adaptation to climate change? (Y/N)

It may increase local awareness and create synergies with mitigation actions

Yes

III. Does adaptation aim for flexibility and reflexivity (i.e. the ability to change as CC and other factors develop)? (Y/N)

Yes

IV. Is the measure effective under different climate scenarios and different socio-economic scenarios? (Y/N)

Yes, though more studies need to be developed to explore the plan's effective in the case of extreme events. Climate sensitivity has still not been properly addressed.

V. Is the adaptation measure iterative? (Y/N)

Yes

VI. Does the measure contribute to overall sustainable development, alleviate already existing problems and bring benefits for other social, environmental or economic objectives than adaptation (no regret measures)? (Y/N) Yes

a. Please describe briefly how

A set of actions (described in section 3) is referred as one measure. These actions can bring benefits in quality of life, economic benefits have been assessed, but additional technical studies would need to be developed to understand the impact (secondary effects) of some of the technical options proposed (e.g. submerged detached breakwater).

- VII. Can adjustments be made later if conditions change again or if changes are different from those expected today? (Y/N)

Yes, that is the purpose of using the Adaptation Pathways and tipping points tool – to highlight future flexibility and the possibility for alternative trajectories.

Outcome

Relevance and effectiveness of adaptation measures

- VIII. How important is the climate change threat addressed by the measure? What economic values, ecosystem functions and socio-cultural values are at stake, and to what extent are they affected by climate change impacts? Is there an indication of overriding public interest, e.g. critical infrastructures, public health ?

The measure is completely focussed on reducing local vulnerability and exposure to climate impacts. At stake is also the protection of the tourism industry, central for local economic activities. No indication of overriding public interest.

- IX. What portion of the targeted potential damages can be avoided by implementing the measure? (0-100%)

Still no information to answer this question.

Efficiency

- X. How high are the benefits of the measure relative to the costs? Are the costs justified by the benefits (Please refer to results of economic evaluation in chapter 5)

Benefit assessment has been done for real-state, economic activities (tourism related); beach uses

- XI. What are the costs of the administrative implementation of the measure? Are there potential funding under the umbrella of other European policies(eg. CAP/Cohesion policy ?

The main costs concern: construction, implementation; legal and expropriation of land (for building a sand dike).

Yes, there is a potential funding under EEA Grants programs and European 2020 program.

XII. Does the measure give an incentive for innovation to different actors (e.g. SMEs) / can it deliver a competitive advantage for the local economy? (Y/N)

Yes, it allows beach users, and small business that depend on the beach to continue their business.

XIII. Does the measure have effects on employment? (Y/N)

Yes, if beach bars are kept from closing to due vulnerability to extreme events, there should be benefits for employment. New jobs (related to engineering and construction) will also result from implementing the measures.

XIV. How long is the time-lag between implementation of the adaptation measure and the effect of the measure? __20 to 40 years__

XV. What is the timeframe during which the measure will have an effect? __20-100 years__

XVI. Does the measure create synergies with mitigation (i.e. reduce GHG emissions or enhance GHG sequestration)? (Y/N)

No

XVII. Does the measure alleviate or exacerbate other environmental pressures? (Explain briefly)

This was not studied, but it should alleviate coastal erosion

Equity

XVIII. What are the impacts on different social or economic groups, are there expected impacts on

Yes, coastal residents, beach business owners, fishermen and farmers are the most vulnerable groups and their interests have been integrated at the planning stages.

particularly vulnerable groups? (distributional impact)

XIX. Does the measure enhance well-being and quality of life (e.g. in the urban environment)? (Y/N)

Yes

5. Impacts, Costs and Benefits of Adaptation measures

a) Step 1 – Preliminary Risk Assessment and identification of adaptation tipping points (max 1500 words)

(some of these questions might be already answered in section 1 – if so, just copy&paste)

What is the climate change related problem/risk you would like to reduce by adaptation?

- Which problems already exist, what is/are the current risk/s?

Rising Sea Level

- Which assets and sectors are at risk under current climate variability?

Tourism, Health sectors

- Which adaptation or protection measures are already in place? (refer to typology of measures in D6.1, table 2)

Groynes, Sand dredging operations

- How do these risks presumably change due to climate and socio-economic change?

Risks increase

- What are the main drivers, impacts and affected sectors (refer to BASE impact and sector categories, see also Table 1 of D6.1)

Costal protection; Rising sea Level; Human and infrastructure security; tourism sector is most affected.

- Which climate and socio-economic scenarios are used?

Fourth intergovernmental Panel on Climate Change [IPCC] (Parry et. al., 2007; Solomon et al. 2007).

Which adaptation tipping points can be identified?

- Can adaptation tipping points, critical levels for adaptation, be defined for this current strategy? (=when objectives are not met anymore due to changes)
Refer to otherwise expand on Table 3 of D6.1

Tipping points are rising sea-level and coastal erosion, and have been identified for 2020 2040; 2070; 2100

- When (roughly) will these critical levels be reached due to climate change or socio-economic change
2020; 2040; 2070 dates correspond to tipping points in rising sea level

- Give appropriate period (2015-2030, 2030-2050, after 2050) for each considered combination of climate and socio-economic scenario.

Periods considered were from 2020 to 2100.

b) Step 2 – Identification of Adaptation Measure and Adaptation Pathways (max 1500 words)

(some of these questions might be already answered in section 4 – if so, just copy&paste)

What are the alternative adaptation measures?

- What are the primary and secondary objectives of adaptation?
Primary objectives are to protect the coast, human settlements and infrastructures. Secondary objectives it to protect the tourism industry (by maintaining beach sand) and maintain and improve quality of life.
- What are potential measures to meet these objectives?

Beach sand replacement;

Reinforcing the dune system (by building sand dikes, and relocate farming fields); maintain existing structures (groynes); build a longitudinal adherent construction on the existing groyne South of Vagueira Beach;

Re-align the direction of the Aveiro Harbour's Southern groyne;

Build an artificial reef in front of either Barra or Vagueira beach (or both).

- (refer to typology of measures in D6.1, table 2)
Hard measures
- What is your baseline option (the “business-as-usual”-option)?
 - What is the ambition level of this baseline strategy?: Maintaining current risk levels or current protection levels (implying with CC risks may increase)? – the ambition is the decrease current risk levels
 - Is current backlog of investments for adaptation measures included or excluded? - included
 - Does it include only planned adaptation or also autonomous, non-planned adaptation? – all adaptation has been planned in this case
- Are there complementary measures? Is it appropriate to bundle these measures? – Complementary measures include stronger regulations for coastal construction and awareness raising.

What are alternative adaptation pathways?

- What is the “sell-by”-date of the measures or bundles of measures? I.e. when will they – under conditions of climate change – not any longer be able to meet the defined objectives?

According to existing information the “sell-by” date would be 2100

- What would be alternative measures or bundles of measures at these “tipping points”? Alternatives have not been considered

d) Step 3 - Evaluation Criteria and Method (max 2000 words)

e) Step 3a Selection of evaluation criteria

Which evaluation criteria should be used?

- What are the relevant positive and negative properties of the measures (costs and benefits) to be considered in the evaluation process (economic, ecological and social effects)?
- What is the appropriate unit to measure each of these criteria? Is the performance of the adaptation options measured in qualitative, monetary or other quantitative terms?

Performance of options is measured in qualitative and monetary terms (i.e. costs and benefits, secondary environmental, social and economic effects).

f) Step 3b Selection of evaluation method(s)

What is the appropriate evaluation method?

- Is it possible to express all relevant cost and benefit criteria in monetary terms?
(→ cost-benefit analysis) No
- Is it possible to express the positive effect (objective) by a single non-monetary indicator?
(→ cost-effectiveness analysis) No

Benefits were determined based on Land values, insurance prices and region-specific overall house price index obtained from different sources: Fidelidade (2015), INE (2011), INIR (2011)

- Are there several relevant criteria which cannot or cannot easily be expressed in monetary terms?
(→ multi-criteria analysis, PCBA) Yes

g) Step 3c Weighting of evaluation criteria (applicable only to multi-criteria analysis)

What are the preferences of stakeholders regarding the different evaluation criteria?

- Are there different stakeholder groups with varying preferences regarding the evaluation criteria?

No, the main preference is for monetary evaluation and for reducing vulnerability to extreme events (efficacy)

- Which weight do stakeholders and/or decision makers attach to a substantial change in the performance of the adaptation options regarding each evaluation criterion? This is not known
(see D4.1, chapter 4.10.2 for guidance for the Swing-Weight method)

h) Step 4 - Data collection (max 2000 words)

What are the costs and what are the benefits of the alternative adaptation options?

Scenario simulation results show that neither Scenario 1 nor Scenario 2 is expected to provide positive returns to investment. Although these scenarios completely halt land cover losses and reduce flooding risk, investment and maintenance costs are up to almost 70% larger than the expected benefits. Scenario 3 is expected to provide positive returns to investment as it halts land cover losses and eliminates. Flooding risk, while entailing lowest recurrent investment and maintenance costs. Across all scenarios, largest benefits are obtained when artificial beach nourishments take place once every two years. The sensitivity analyses, on discount rates as well as cost and benefit variations, show that these results are consistent. Decreasing costs and discount rates as well as increasing benefits lead to improved performance indicators for all scenarios. A 10% reduction in costs or increase in benefits is, however, not sufficient to provoke positive returns to investment for Scenario 1 and 2, although returns to investment are approaching the minimum required levels for Scenario 2. Cost overruns of 50% would put the viability of Scenario 3 in question.

Largest benefits continue to be obtained when artificial beach nourishments take place once every two years.

- What potential data sources are available, including damage & impact assessment methods or existing CBA studies on adaptation measures?

Costs were determined based on construction and maintenance of coastal protection measures. The analysis was based on expertise and publications of Universidade de Aveiro researchers: Perreira (2014), Roebeling, Coelho, Reis (2011), Roebeling et al (2012)

- If no relevant data sources are available and modelling cannot be undertaken: Which experts can estimate proxies for assessing the performance of measures regarding the respective criterion? I
- How do the adaptation options perform with regard to each of the cost and benefit criteria selected in step 3a?

Hence, scenarios involving large artificial beach nourishments and minor hard intervention measures are not attractive from an economic perspective, due to the high recurrent investment costs associated with the beach nourishments; scenarios combining small artificial beach nourishments and major hard intervention measures are attractive from an economic perspective, as they entail lowest recurrent costs while equally providing considerable benefits.

What is the evaluation time frame?

- What is the lifespan of the measure with the longest lifetime?
The measures assessed with the longest lifespan are:

A longitudinal adherent construction on the existing groyne South of Vagueira Beach; Re-align the direction of the Aveiro Harbour's Southern groyne;

Which discount rate should be applied?

A fixed discount rate of 3% was applied

- Which discount rate is recommended by national guidelines for climate change adaptation measures (or public investments)?
- Is it a linear discount rate or any other type (i.e. declining, hyperbolic, etc.)
A declining discount rate was also applied: 3.0% - 1,9%
- (In addition, for testing the sensitivity of the results with regard to the discount rate(s) used, also apply a low and high discount rate (1% and 5%)).)

For testing, the following sensitivity rates were applied:

1.0 % - 0.6%
3.0% - 1.9%
5% - 3.2%

How to deal with data uncertainty?

- Can uncertainties related to the performance of the measures regarding certain evaluation criteria be described by a range (min-max), a triangular distribution (min, most likely, max) or any other kind of probability distribution?

i) Step 5 – Evaluation and Priorization (max 1500 words)

What is the ranking order of alternative adaptation options (measures, bundles of measures or pathways)?

To answer this section we require the final cost-benefit report still being completed.

- For cost-benefit analysis:
 - What is the net-present value (discounted benefits – discounted costs) of the alternative options?
 - What is the benefit-cost ratio?
- For cost effectiveness analysis:
 - Which alternative achieves a defined objective at lowest costs?
 - What is the cost-effectiveness ratio?
- For multi-criteria analysis:
 - Which adaptation option performs best?
 - (e.g. for PROMETHEE approach: which option has the highest net flow?)
- What are the uncertainties associated with the performance of the different options?
- Is there and, if so, to what extent uncertainty in the ranking of options?
- Is it possible to determine which option most likely performs best or is it necessary to gather further information to reduce uncertainty (go back to step 4)?

6. Implementation Analysis – Understanding, Leadership and Governance of the implementation of adaptation measures

(Please describe the process of implementation of adaptation measures in real world contexts, namely key barriers and opportunities, governance dynamics and the concrete use of scientific knowledge and economic analysis in political decision-making. Please address Policy Questions from WP2&7 on the CSLD_Support doc)

Checklist

When answering the main questions below ensure you consider each factor listed in the checklist below that might have had a role in the implementation of your case study work. Write in the table how important each factor has been to the implementation of your BASE work and adaptation in general at your case study; where 1 = unimportant, 2 = slightly important, 3 = Important, 4 = Very important, and 5 = Critical). The checklist might not be all-inclusive, so feel free to discuss other factors that are not listed.

Key factors:	Rank from 1 – 5
i. Knowledge and information about climate adaptation	5
ii. Actors (e.g. leadership, perceptions, understanding of climate adaptation, participation, decision making, stakes, conflicts/synergies)	5
iii. Framing of climate adaptation (e.g. as sustainability concern, (urban) planning or environmental issue, disaster risk mitigation topic)	3
iv. Local and regional context (e.g. culture, history, geography, environment,	3

economy)	
v. European, national, regional and local regulatory framework (e.g. be specific about laws, strategies, policies)	0
vi. Institutional context (e.g. integration of adaptation into existing structures/activities/strategies, decision making, conflicts/synergies, governance arrangements, incentives for engagement)	4
vii. Resources (e.g. financial, human)	4
viii. Nature of adaptation measures (e.g. no regret, flexibility, important co-benefits, side-effects)	4
ix. Other (specify _____)	

Summary Information (based on your answers to the questions below)

- Specify sectors covered (e.g. coast, city, agriculture):
Coastal area
- Specify adaptation measures covered (e.g. altering cultivation practices, building defences; explain why they were chosen):
Coastal defence measures: sand nourishment operations; detached submerged breakwater; sand dike for protecting the dune system; palisades and walkaways; monitoring sea-levels.
- Specify climate change impacts covered (e.g. flooding, heat stress, sea level rise):
Sea-level rise, extreme weather events, flooding
- Specify main results of activities (e.g. changes, outputs):
A proposal for an adaptation plan was made by a representative group of major stakeholders in the region

Questions

Answer these six questions giving specific evidence and examples where possible. In principle all implementation activities should be included, i.e. adaptation activities supported by BASE partners as well as those by other actors. If it is possible to

inform about the implementation of those adaptation measures assessed for task 5.2, it is very important to do so in order to comply with the DoW. The measures covered can be extensive and/or particular to a case study. They can include for example, the development of plans and strategies, vulnerability/risk assessments, economic assessments such as CBA, MCA, the development of participatory processes/public dialogue, through to the implementation of actual measures including physical measures such as engineering developments and land use change, incentives/subsidies for behavioural change, etc. This list is not all-inclusive and is merely a guide. Your own case study may have very different measures. However, **you must be clear what measures you are refereeing to when answering these questions.**

1. How have climate change adaptation measures and strategies been advanced in the case study? Describe the process!

The study has advanced through a participatory action-research approach. The study is prospective and represented a first attempt to produce with local stakeholders an inter-municipal adaptation plan.

Locally, according to interview results, stakeholders are well aware of the coastal vulnerability (this was equally a finding in previous studies – see O’Riordan et al., 2014). Despite this, local municipalities have still not yet designed or implemented any form of long-term action plan to address the problem collectively.

According to local experts interviewed, there has been a halt in constructions on the first line of the coast. This is interpreted as an advancement in land use planning that contributes as a response to the problem.

Leadership and participation are both important and both were missing (according to a review of previous studies), before BASE. Therefore, at the beginning of BASE’s research intervention, interest was showed in developing an inter-municipality collaboration and engaging with the action-researchers in meetings with local administrators and decision-makers. BASE researchers were committed to include political actors in the participatory processes. It was also clarified that the objective was to promote collective decision-making, to facilitate consensual, shared future visions, and to co-design an adaptation action-plan for the coastal stretch. Thus, central to this research was the possibility of engaging different stakeholder groups (i.e. residents, national, regional and local administrators, policymakers, NGOs, fishermen and farmers, business owners) in a collective dialogue, informed by expert knowledge on climate impacts and adaptation options for the region.

To make an action plan, the Scenario Workshop method was used - participants meet over two-full day workshops to first find a shared consensual vision for the territory, second to design an action-plan. Although the needed adaptation options were fairly consensual, following the first workshop day there were various doubts concerning the different technical options. To address these doubts a first multi-criteria analysis of the different technical options was done and presented to participants, on the second workshop day. To account for climatic uncertainty the Adaptation Pathways and Tipping-Points method (Hassnoot et al 2013) was used. This allowed producing a set of dynamic adaptation pathways, since specific measures

change according to tipping-points – e.g. if sea-levels would rise above 40cm sand nourishment wouldn't be enough and a breakwater would have to be built. Following the second workshop a set of final pathways was agreed by all. These pathways (i.e. the adaptation actions represented over time) were then analysed further through a cost-benefit analysis. To address technical uncertainty, the methodology included a second multi-criteria analysis (MCA), done after the participatory workshops, which integrated more robust information on the different possible technical options for each of the final prioritized measures (e.g. sand nourishment operations, submerged detached breakwater, sand dike). The MCA provided important comparative data on the efficacy of the different options, possible secondary effects and uncertainty regarding the claimed efficacy (e.g. a detached breakwater could have a high level of efficacy if it worked on an energetic Atlantic coast – where it has never been tried).

Thus, clarifying and thoroughly understanding the nature of the adaptation measures has been an important factor to support decision-making.

All workshops used visual methods, namely Geographical Information Systems maps and graphical representations (e.g. adaptation pathways) of potential futures. This contributed to establish a strong territorial context and illustrate the risks posed by rising sea-levels. This methodological option has been central to communicate potential future risks to all participants.

Throughout the participatory events, facilitators were concerned with keeping the discussions focused on concrete tasks. Throughout this stage, participants were able to build trust and reflect together on different, and in some cases controversial, adaptation options, reaching consensus and mutual understanding. In the final workshop, fears that the research outcomes would not be implemented were expressed. Mistrust was geared towards central administrators, and voiced by the local administrators themselves, and residents. It was pointed out that if a “flawless [adaptation] plan” was designed and there were the necessary resources to implement it, they would still face the risk that central administrators “sitting in their Lisbon offices, just decide it's a no-go in the last moment” (workshop transcript). The project had attempted to address this risk (i.e. administrative uncertainty/lack of political commitment) by including decision-makers and policy actors. Nevertheless, this uncertainty remained and all respondents in follow-up interviews pointed it out, as one of the main weaknesses of the planning process.

Policy-makers and technicians agreed PAR had initiated a governance process that created a new mode of planning and deciding together in the region. They also agreed that collaborative long-term planning was fundamental in addressing the region's problems and expressed their desire (according to workshops and interview transcripts) to continue experimenting with this process in their institutions.

Following the workshops a cost-benefit analysis of the main measures was done. The results were then presented to participants on a final event, where stakeholders from neighboring municipalities facing similar problems were also present.

Up to date, only sand nourishment operations have been done, although not in the context of climate change adaptation. These interventions have been done periodically, by the Aveiro Harbour Administration, over the past 10 years. Although not was a part of an action-plan or policy guideline. Sand was retrieved in dredging operations North of the Aveiro Harbour and placed on a longitudinal drift current, to the South of the Aveiro Harbour Southern groyne. The goal was to increase beach sand, which every winter is steadily depleted. Nevertheless, placing sand on this coastal stretch as part of a concerted action-plan for the long term requires a much higher quantity of sand than the one retrieved from the Aveiro Harbour dredging operations. The results of the MCA confirm this information. Thus, a long-term perspective and the potential climate change impacts in the region, lead to a number of alternative technical options for sand nourishment operations as part of a long-term action plan. Options include dredging sand offshore or using sand from inland forest areas.

2. What and who drives (or enables) the adoption and implementation of adaptation measures and strategies/policies? Please explicitly refer to the factors mentioned in the checklist, highlighting the factor in bold, and be specific about any relevant policies!

Following a literature review, initial conversations with local groups and individuals confirmed that local actors perceived coastal erosion as a serious problem in the region (i.e. framing). Therefore, the threat of another factor aggravating this situation (i.e. climate change) was motivating for developing a collective action-plan for the future. Consequently, though knowledge and information on climate change is important, the risks and economic losses posed by costal erosion (e.g. flooding; lack of sand on the beach threatening tourism activities) are a critical factor driving action. This action can be linked to climate change, since the perceived vulnerabilities and risks may be aggravated by extreme weather events already felt in the region (according to literature review of previous studies, workshop discussions, and feedback interviews). In the winter of 2014 (a few months after BASE initiating its research in the area), winter storms hit the region and resulted in damages to beach infrastrutres, endangering shoreline residencies. Images of these storms appeared on national TV and for a few week climate change and coastal adaptation were topics on Portuguese news channels. Due to this storms the Portuguese Minister of the Environment, Spatial Planning and Energy entitled a group of researchers and experts (where FFCUL was included) to make an assessment

of measures needed for coastal protection. This group – entitled the Littoral group – has reported on its findings and its recommendations are being integrated in the National Strategy for Coastal Zones. Regarding this case study area, the group recommended sand nourishment operations (integrated in an action-plan for the long-term) and in some instances the relocation of urban settlements.⁵ The recommendations of the Littoral Group are now part of the “Strategic Reference Framework” (i.e. the law and the recommendations that an action-plan should follow) of the governmental Shoreline Management Plan (in Portuguese known as the POC – Plano da Orla Costeira) for the region of Ovar-Marinha Grande, which includes the case study area. The POC are action binding plans with a legislative component for coastal regions. Moreover, the Minister for the Environment, Spatial Planning and Energy allocated a budget of 300 million Euros for protecting the littoral between 2014 and 2015⁶.

Thus, the winter storms have been key drivers for adaptation in this region.

The local economic context is strongly intertwined with the sea – from sand beach tourism to local fishing activities. Not surprisingly, a key factor in the participants’ shared view for the territory is to stop beach erosion, and maintain a “sandy beach”, supporting tourism activities. The dunes were also perceived as a protective layer against flooding. Aside from the economic, the cultural context seems also important, although BASE research did not explore these factor in debt. However, local stakeholders interviewed also express their attachment to the region, and appreciation for its beauty. Thus, keeping the natural beauty of the coast is also important.

Nevertheless, the main framing for promoting an adaptation planning experience was reducing the risk of disasters and emergency situations, due to extreme events. As a participant (an expert from the local Harbour administration, referred during a workshop session: “What cannot happen is to act on emergency situations, it’s dangerous and expensive.”

Workshops and interview results confirm that implementation is very much in the hands of national and regional administration, with the support of local municipalities. Thus, though a first proposal for a plan has been made, this proposal needs to be converted into an actual policy, strategy or integrated in municipal program for coastal defence, until it can reach the implementation stages. According to feedback received in follow-up interviews, the experience demonstrated to local practitioners that a more collaborative and

⁵ National Strategy for Coastal Zones Littoral Group report available at:

http://www.apambiente.pt/_zdata/DESTAQUES/2015/GTL_Relatorio%20Final_20150416.pdf

⁶ News is available on the website of the Portuguese Minister for the Environment; Spatial Planning and Energy, following this link: <http://www.portugal.gov.pt/pt/os-ministerios/ministerio-do-ambiente-ordenamento-do-territorio-e-energia/mantenha-se-atualizado/20141017-maote-litoral.aspx> (last accessed 9th July 2015)

participated decision-making process supports the making of a common action-plan for the future. It was also suggested that an economic cost-benefit analysis of the chosen adaptations could help reduce political uncertainty (this had also been suggested in the workshops). Therefore this analysis was made for the chosen priorities (see D.5.2). Yet, to assure the actual integration and implementation of the plan in coastal spatial planning policies, participants believed that other governmental stakeholders would need to be involved, and that the workshops should be replicated at higher governance levels. Regulatory frameworks were not addressed throughout the planning stages, although representatives of the institutions who would be responsible for implementing the plan were included as stakeholders – namely from the National Environmental Agency and the mayors' of the two municipalities involved. There was no reference to EU regulatory frameworks. However policy integration of adaptation in other coastal policies, specifically the Portuguese shoreline management plans (in Portuguese: POCs) are extremely important sectorial policies for coastal adaptation, that as of 2015 integrate the recommendations of the working group of the Littoral and of the National Adaptation Strategy – both however are non-binding policy guidelines used in the POC as recommendations/guidelines. There is not a binding legislation specifically targeting climate change adaptation

Nevertheless, most measures considered in the plan (that resulted from the workshops) are grey measures. Namely: sand nourishment operations, a sand dike and a submerged detached breakwater. Concerning the last measure, participants agreed that it would need robust technical studies, since this type of structure has never been done in Atlantic coasts. Concurrently, this case study is still at its early stages in terms of climate adaptation implementation. Except for sand nourishment operations, no measure has been implemented. However, sand nourishment operations have not been done as a result of this planning exercise, but as a response to the current situation (there was very little sand in one of the beaches on this coastline, threatening coastal constructions and residents). No planned measure that resulted from the BASE research has been implemented. Yet, sand nourishment operations benefit from the Portuguese coastal land use plans (i.e. POOCs). Municipal leaders also push for this measure, due to the referred economic context (i.e. Tourism) and the need to maintain the beach. Yet, it is not possible to say how regulatory frameworks, local contexts and the nature of measures can hinder or enable the implementation of the action-plan that resulted from BASE research. However, it is possible to understand the relevance these factors may have. No doubt the local context (economic, cultural) seems important. Regulations still need to be studied in depth, taking into account the technical options for the measures. EU regulations were not brought to the discussion by participants. The EU was referred as a potential source of financial mechanisms that would be able to support the (expensive) implementation of grey measures (such as the sand dike).

3. What obstacles were encountered during the adoption or implementation of adaptation measures and strategies/policies? Please explicitly refer to the factors mentioned in the checklist, highlighting the factor in bold, and be specific about any relevant policies!

The following factors were directly reported by participants during the workshops as being critical for implementing an adaptation plan: High cost of adaptation measures considered priorities (large scale sand nourishment operations, sand dike, detached submerged breakwater); lack of participation and collective engagement; lack of institutional dialogue.; complexity of technical options for potential adaptation measures, climate uncertainty, and political skepticism.

Actors in the region have been largely disengaged and there has been no concerted action-plan for dealing with the coastal problem. Also, various administrative entities are responsible for coastal protection, yet the existent panoply of institutions is often disarticulated, and inter-institutional collaborations have been scarce. Local residents and business owners claimed their participation in previous studies had never converted into real action. This initial disbelief in the potential outcomes of the research proposed was perceived as an obstacle. Political actors were included in the participatory processes. It was claimed, by BASE researchers, that it would be up to the local group to agree on collective visions for the future, create a plan, and promote its implementation. By making these statements, researchers sought to be clear on what their role would be – that of facilitators in a planning process. These statements intended also to prepare participants for a constructive discussion geared towards finding consensus, rather than focusing on attributing blames. Some stakeholder groups (particularly the fishermen, farmers, and business-owners) appeared to be more inclined to express their frustrations and blame institutional and administrative bodies for not adequately protecting goods and people in the region, than to finding consensus and contributing to the elaboration of an adaptation plan. Once communication and participation are established, the main obstacle is no doubt financial. The suggested adaptation options are extremely expensive: e.g. sand nourishment operations over the long-term, a sand dike, submerged detached breakwater. Local stakeholders will need to continue leading the process forward in order to find appropriate means of financing. Related to the financial issue is the high technical complexity of the adaptation options. Sand nourishment operations, for instance, could imply using offshore sand deposits (very expensive), or sand from local forest areas (which could have consequences for local biodiversity). The current sand deposits used (i.e. from a beach north of the Aveiro Harbour) will last only a few more years considering the amounts of sand needed for coastal protection in the region. Likewise, the detached submerged breakwater has never been done in an Atlantic coast and there is a high level of technical uncertainty, as well as high level of uncertainty regarding the efficacy and

secondary effects of this option. This is why it was agreed at the final workshop that more studies would be needed for implementing this option.

4. If any obstacles were overcome, how was this achieved?

The financial obstacle is critical, the only form of integrating this problem in the research was to produce a cost-benefit analysis of the chosen adaptation measures and the different technical options (as presented at D.5.2). Another obstacle addressed through the research was to contribute to reduce a high level of technical uncertainty, therefore a detailed MCA was done, after the Scenario Workshops to explore the different technical possibilities for each of the final priority measures. Finally, the absence of a culture of participation was equally addressed by implementing a participatory approach

Although (as observed through our initial meetings and exploratory interviews with local stakeholders), resident associations, local surfing associations and beach business owners were gradually developing together efforts to collectively address the problem, other social actors (fishermen, farmers) were for the most part disengaged, although concerned with the issue. Previous studies had shown social actors were concerned but were not being involved by local policymakers, nor organized in groups that could support some form of collective action for coastal protection and adaptation. The participatory process was central to contribute to overcome this obstacle. As the research progressed other subsequent obstacles had to be addressed. First the lack of trust on the results of engagement from most social actors initially approached, and also some scepticism regarding climate change on the part of municipality actors, who later became key advocates of the adaptation plan proposed.

Yet, during the research period, there were some changes in the context/framing of climate change. Storms destroyed beach bars, a few months after BASE research started. The 2014 winter left one of the most important beaches for local tourism almost without sand, and endangering residencies built on the shoreline. Images of these storms appeared on national TV and media coverage brought a significant attention to the need for coastal protection against extreme events. Local policymakers became more interested in BASE research and the issue of climate change. The storms also affected other coastal zones in the country and resulted in a new political agenda concerned with finding solutions to protect the Portuguese Coast. These new conditions created a window of opportunity for a closer engagement. Policy groups were more interested in collaborating in the making of a collective long-term plan, and other stakeholders were more motivated to participate.

Throughout the workshops two other important obstacles emerged: Technical uncertainty and climate uncertainty. As explained in question 1, as well as in BASE project D. 5.3, both types of uncertainty were dealt with by incorporating a Multi-Criteria analysis (MCA), the Adaptation Pathways (AP) and Tipping-Points methods in the Scenario Workshops, and the Cost-Benefit Analysis (CBA). To use methods in a participatory context, the first versions of the MCA and of the AP were done by researchers, then presented to participants for discussion - in the case of the AP participants designed the pathways. The outputs of these exercises were then re-analysed by researchers for producing the final MCA and AP which were presented to all in a final event. These knowledge exchange dynamics seem fundamental. They've allowed addressing the different types of uncertainty, supporting decision-making with technical and scientific data, while also providing participants the opportunity to *own* the process, by continuously interacting and integrating the different types of information in their own learning experiences. This sense of ownership has led to a higher motivation of those engaged in continuing leading the process forward. – “We need to collaborate and work together to make this happen”, says a municipal policymaker.

Nevertheless, regarding technical uncertainty and complexity, although the MCA and the CBA provided some additional data, additional technical studies are still needed before the submerged breakwater can be implemented. Concerning the sand dike and sand nourishment operations, the MCA and the CBA have already provided important data to contribute to overcome this obstacle. However the necessary funding is still needed. Although the case study has recently (since 2014) benefited from additional funds allocated to coastal protection.

5. What are the future prospects of the climate change adaptation activities in the case study?

It is important that locally a continuous political commitment will support implementation. Moreover, even though more funds are available for coastal protection in Portugal (particularly since 2014), the adaptation options proposed are extremely expensive and as was concluded by the stakeholders themselves during the workshops sessions, the measures will require an additional co-financing from the EU. Local municipalities were specific at this level by stating that adaptation options proposed would need around 75% of EU funds, and 30% of funds from central government and 5% municipal funding. At this stage the process is very much in the hands of local municipalities who are attempting to apply for grants in order to implement the suggested measures and attain the necessary funding. However, central administrative bodies are responsible for implementation, namely the National Environmental Agency. Therefore, any plan must include this

entity. Members of the National Environmental Agency were included in the workshop, nevertheless no follow-up action has been done by this institution.

One of the most discussed measure has been a submerged breakwater, which has never been done in an Atlantic coast. This is currently a process in study. The cost-benefit analysis also showed the benefits of this measure would be higher than the costs, and local and regional policymakers are interested in moving forward with a project for implementation.

6. What is the key message from this case study (and which could work in other cases as well)? Don't forget to consider any specific policy recommendations that arise in your case study!

The key message is that in a context where various institutions are involved in decision-making and participation has not been embedded in local culture and policymaking practices, the case study benefits from establishing a forum for collective dialogue and decision-making. This can be done by using participatory approaches. This forum should be informal, allow the sharing of information through accessible and easily understood format. This forum should equally encourage consensus, dialogue and mutual understanding among the different stakeholders involved. Political actors and all those with the responsibility for implementing the plan need to be involved from the beginning, but also all those who can substantiate the plan, both by providing local lay knowledge and expert knowledge. Choosing who to involve in the participatory planning process is fundamental for implementation. In this case different stakeholder groups were fundamental, but political actors were a must. This case study could have gained from including experts on local and regional regulatory frameworks. This information was missing in the discussions.

Creating an action-group that will be able to lead the adaptation process to its next stages seems essential. This can only be achieved by a genuine engagement process. The participatory experiences should be well-facilitated and a rewarding experience for those involved. This can be attained by carefully choosing methods and conveying as much as possible baseline information on impacts and measures. The more stakeholders are prepared for the discussions, the better are the chances to reach consensus. It is also important to simplify complex decision through clear, easy to use, yet robust scientific tools such as the Adaptation Pathways. Methods and tools should be able to integrate different systems of knowledge – both scientific and local knowledge.

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