BASE

BOTTOM-UP CLIMATE
ADAPTATION STRATEGIES
TOWARDS A SUSTAINABLE EUROPE

Adapting to Climate Change: Comparison of Case Studies

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BASE BOTTOM-UP CLIMATE ADAPTATION STRATEGIES TOWARDS A SUSTAINABLE EUROPE

Title: **Adapting to Climate Change: Comparison of Case Studies**

Summary: This document aims to offer a synthesis and discussion of the methodological process and results of implementing climate change adaptation case study research, reporting on the key messages and lessons learnt through a critical comparison of case studies that equally accounts for the stakeholders' perspectives. The deliverable is structured in four chapters. Chapter 1 provides a critical assessment of the Case Study Living Document- a methodological instrument developed in the context of a collaborative case study research, and provides the framework for the analyses developed in the following chapters. Chapter 2 is a comparative synthesis and meta-analysis of key messages from WP5 case study research results. Chapter 3 provides a meta-discussion on participatory experiences, which adds to the work developed in deliverable 5.3 (i.e. *Participation in Climate Change Adaptation*). Chapter 4 is centred on the perspectives of BASE case study stakeholders, and discusses and analyses the main challenges, successes and opportunities for climate change adaptation from the perspective of the stakeholders involved throughout BASE casework. The conclusions of the four chapters are distilled in the final conclusion, which offers insights regarding top-down/bottom-up dynamics, as well as contributions for future research. This final section equally offers a synthesis of how case study research tools and incremental innovations to methods and tools for climate change adaptation research and practice may inform the European Environmental Agency (EEA) and the European Adaptation platform Climate-ADAPT.

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BASE report

Contents

Adapting to Climate Change: Comparison of Cases 7
General introduction 7
1 BASE collaborative case study approach 10
1.1 Introduction 10
1.2 Methodology 11
1.2.1 Case study ID categories and groups 13
1.3 Results 16
1.4 Discussion: the role of CSLD in collaborative case study research 21
1.4.1 Cloud version of CSLD 22
1.5 Conclusion 23
2 A synthesis of BASE case study research – key messages for climate change adaptation practitioners 25
2.1 Introduction 25
2.2 Lessons learnt and key messages from International experiences: Literature review and four BASE International case studies 27
2.2.1 Lessons learnt from literature review of International (European and non-European) experiences (based on D4.2) 27
2.2.2 A Synthesis of BASE International case studies 28
Country 29
Case Study 29
BASE Partner 29
Sector 29
2.2.3 Lessons learnt & key messages from BASE International Case Studies 32
2.3 Overview of BASE European case studies 36
2.3.1 Process Direction: Bottom-up and Top-down 40
2.3.2 Methodologies and data sources 47
Case Study 48
Analysis, Models & Tools 48
2.4 Lessons learnt and key messages from BASE European case studies 56
2.4.1 Key messages by meta-groups of case studies across European regions 59
2.4.2 Agriculture & Forestry/Biodiversity & Ecosystem Services 60
2.4.3 Water Resources & Health 62
2.4.4 Coastal Zones/Human Settlements & Infrastructure 63
2.5 Discussion and Conclusion 67
3 Meta-analysis of Participatory experiences in BASE case studies 75

3.1 Introduction 75
3.1 Methodology 76
3.2 Results 76
3.2.1 Stakeholders in adaptation decision-making 76
Civil society stakeholders 77
Decision makers 79
3.3 Conclusion 80
4 BASE European case studies: stakeholder perspectives 82
4.1 Introduction 82
4.2 Methodology 82
4.3 Results 84
4.3.1 Group discussions 84
4.3.2 World Café 86
4.3.3 Evaluation from BASE case study stakeholders 87
4.4 Discussion: stakeholders perspectives on BASE research 92
4.5 Conclusion 95
General conclusion 96
Reference list 98
Appendixes 103
Appendix 1 103
Appendix 2 104
Appendix 3 118
Appendix 4 119

List of Tables

Table 1-1 Structure for the CSLD 12
Table 1-2 List of BASE CSLD 15
Table 1-3 Qualitative assessment of the CSLD 19
Table 2-1 BASE European case study characterised by European region, country, BASE partner, meta-group and relevant sector(s) (cells marked with “x” indicate the sector involved) (source: CSLDs) 25
Table 2-2 BASE International case study characterised by country, BASE partner and relevant sector(s) (cells marked with “x” indicates the sector involved) (source: CSLDs) 29
Table 2-3. BASE International case study typology and characterization: main goal(s), specific focus, objectives, category, territorial zones, scale, process direction and temporal definition (see Section 1.2.1 and Chapter 1 Section G of CSLD for full descriptions; source: CSLDs) 29

Table 2-4. BASE International case study climate change adaptation strategy/plan/measure/initiative (Source: CSLDs) 30

Table 2-5. BASE International case study climate change adaptation analysis, models and tools (Source: CSLDs) 31

Table 2-6. BASE European case study typology and characterization: main goal(s), specific focus, objectives, category, territorial zones, scale, process direction and temporal definition (see Section 1.2.1 and Chapter 1 Section G of CSLD for full descriptions; source: CSLDs; D.5.2 and D.5.3) 36

Table 2-7. BASE European case study climate change adaptation strategy/plan/measure/initiative (Source: CSLDs; D5.2) 42

Table 2-8. BASE European case study climate adaptation analysis, models and tools (Source: CSLDs; D5.2; D5.3).. 48

Table 2-9. BASE European case study key messages by sector meta-group and European region (Source: CSLDs).. 57

Table 2-10. Advancement in Climate Change Adaptation through BASE: Lessons learnt from International Case Study Review and Addressing Knowledge Gaps..... 68

Table 3-1 Case studies analysed in deliverable 5.3..... 75

Table 4-1 Synthesis of Discussion groups results on the success stories and challenges of adaptation processes developed or analysed through BASE case studies 84

Table 4-2 Barriers to adaptation identified by stakeholders, concerning the topics *resources, awareness and knowledge, and institutions*..... 86

Table 4-3 Overcome barriers to local adaptation: perceived triggers and drivers for adaptation, according to the results of the world café discussions 86

Table 4-4 Future prospects for climate change research, policy and action highlighted by workshop participants..... 87

Table 4-5 Notes from workshop participants on participatory processes: questions and reflections 87

Table 4-6. Synthesis on the successes and challenges of climate change adaptation in BASE case studies, from the perspectives of case study owners (drawing from the workshop discussions and world café results) 94

List of Figures

Figure 1-1 Level of comprehensiveness of CSLD for BASE case study owners on scale from 1 (very low) to 5 (very high) 16

Figure 1-2 User-friendliness of CSLD for case study owners on a scale from 1 to 5..... 17

Figure 1-3 Ease of Reporting on CSLD for BASE case study owners on a scale from 1 to 5..... 17

Figure 1-4 Usefulness of CSLD for BASE cases study owners on a scale from 1 to 5..... 18

Figure 1-5 Role of CSLD in supporting case study clusters dynamics on a scale from 1 to 5 18

Figure 2-1. BASE European case studies adaptation process direction focus: top-down (no arrow), top-down followed by bottom-up (arrow pointing from top-down towards bottom-up), bottom-up followed by top-down (arrow pointing from bottom-up towards top-down) and bottom-up (no arrow) (Source CSLDs, D5.4) 41

Figure 2-2 BASE European case study participation matrix categorised by European regions and meta-groups (individual participation matrix retrieved from D5.3) 54

Figure 2-3 Evaluation approaches employed by BASE European case studies (source: CSLDs; D5.2; D5.3; Table 2-8) 55

Figure 2-4 Climate adaptation stages for all case studies based on adapted EU Adaptation Tool (Source: Climate-Adapt, 2015 and D5.4) 56

Figure 2-5 Novel approaches & applications of existing tools developed through BASE: Novel methods and tools for participatory approaches, including participatory add-ons to economic/evaluation; and BASE novel applications of existing methods and tools for economic/evaluation. 70

Figure 2-6 Economic Assessment Decision Tree: a) Viability assessment, b) Ranking projects and c) Input into decision-making process 72

Figure 2-7. BASE European case study synthesis: A regenerative cycle of bottom-up initiatives and top-down strategies 74

Figure 3-1 Participation Matrix 77

Figure 3-2 Civil society stakeholder groups by adaptation phase 77

Figure 3-3 Decision-maker stakeholder groups, by adaptation phase 79

Figure 4-1: Structure of the participatory workshop for a stakeholder's appraisal of BASE research 83

Figure 4-2 Relevant themes for case studies 88

Figure 4-3 Phase of the adaptation planning process impacted by BASE research 89

Figure 4-4 Involvement of stakeholders in BASE case studies 89

Figure 4-5 Average Evaluation of the relevance of BASE case studies 90

Figure 4-6 Evaluation of Base case studies from stakeholders involved 91

BASE report

Adapting to Climate Change: Comparison of Cases

General introduction

Inês Campos, Kiat Ng, and Gil Penha-Lopes

'Adapting to Climate Change: Comparison of case studies' offers an analytical synthesis of BASE case study research. The point of departure has been the case study research developed under BASE project's work package (WP) 5.

BASE project emerges in the context of a set of EU funded projects that are igniting a scientific research field which is aiming at building up Europe's adaptive capacity to the global climate change challenge. Some projects were initiated before BASE (e.g. MEDIATION), some have been developing in parallel (e.g. RAMSES). Prior to BASE, project MEDIATION recognized there was a lack of scientific and technical data on climate change impacts, vulnerability and adaptation options for Europe, and led forward a research focussed on gathering robust scientific information in this research field. MEDIATION sought equally to systematize data within congruent frameworks that would provide an adequate structure for sharing information and for analytical purposes. A set of eight case studies were studied across European regions (i.e. North, South, and West). More recently and focussing particularly on the economic dimension of climate change impacts and adaptation options, ClimateCost (The Full Cost of Climate Change) sought to determine long-term targets and needed mitigation policies, by developing robust and in-depth research on both the costs of inaction and on the benefits of climate change adaptation. RAMSES project equally aims at delivering evidence on costs and benefits of measures, as well as on the impacts of climate change with a focus on European cities. Similarly to BASE, RAMSES takes stock of stakeholder engagement and has developed a significant part of its research through participatory approaches, in order to co-determine appropriate adaptation strategies across Europe. One key difference between the two projects is that BASE focuses on bottom-up processes over a number of sectors (e.g. agriculture, coastal zones); while RAMSES focuses on cities. Taking into account the current landscape of EU funded projects, BASE research offers a unique focus, by addressing the integration of top-down policies and processes, and bottom-up responses and initiatives, with the goal of supporting more sustainable climate change adaptation pathways throughout Europe.

According to the BASE Description of Work (DoW), WP5 contributes to every project objective. The main goal however is to:

> 'Examine sectoral and spatial multi-sector case studies of planned and autonomous adaptation to climate change, in order to draw bottom-up lessons on the planning, impacts, costs, benefits and implementation of adaptation measures in Europe. WP5 will analyse adaptation approaches, strategy design, implementation and perception in selected cases across Europe and provide data in a framework that can be integrated and up-scaled. In particular, WP5 will extract, from all the case studies, quantitative information on cost benefit and effectiveness of adaptation measures that will be up-scaled and generalised in WP6; in doing so it will also provide useful data to improve/validate the calibration of adaptation cost/effectiveness embedded in top-down models used in WP3.'(DoW, p. 20)

WP5 has been at the heart of BASE project, providing data from a varied selection of bottom-up experiences throughout Europe. The description of tasks was designed with the goal of upscaling research results to WP6. WP5 case study work aims at providing data inputs for models (developed and used in WP6). These inputs are directly given by case study owners to those working on the models throughout WP5 tasks. Subsequently, WP7 would draw from the main outputs of WP6 and equally from WP5, in order to identify appropriate policy recommendations. Consequently, 'Adapting to Climate Change: comparison of case studies' is described in the DoW as an output which aims at providing a comparative assessment of case study experiences, highlighting key understandings, and providing

a critical synthesis of the main messages and conclusions from previous deliverables in WP5. The DoW's description of Deliverable 5.5 (henceforth referred to as D5.5) equally states it should provide a:

> 'Compilation of case study results and data formatting for further analysis, communication and development of tools/suggestions for adaptation planning'.

Case study research is described in the DoW, explicitly asserting that:

> 'Key sectors will be examined in BASE according to the following meta case study groups: urban areas and coastal management; water management and ecosystem services; rural areas and food production.'(DoW, p.20)

It is equally referred that 'International case studies will be considered comparative'. Therefore, D5.5 assessment focuses mainly on the European cases studies, since International cases studies, as noted in the DoW, offer experiences that can be comparable to European cases, but are not the empirical focus of the project. Nevertheless, International case studies are depicted in order to draw a few best practices that can be useful for European case studies. Their role is equally complementary, since they may have distinct socio-political, economic and geographic contexts and provide examples of different ways of perceiving and acting towards climate change.

This deliverable is similarly linked to task 5.5, described as a task that will 'elaborate and formalise the key methodological strategies, developed in WP4 and applied in WP5, in light of the experiences gained and results obtained, so that they could be readily documented and used as tools by those actors developing and accessing adaptation strategies and measures in Europe' (DoW, p. 23).

Guided by these descriptions and by the previous three years of case study research, this document aims at producing an assessment of the process of implementing a research within a collaborative consortium, and its main results to science and to society. The overall objective can be subdivided into the following:

I) Developing and accessing methodological approaches and tools,

II) Compilation and comparison of case studies,

III) Synthesizes of the results and key messages,

IV) Providing case study data in a format needed by WP6 and WP7

Four chapters make up the structure of the deliverable, and respond to these objectives. Chapter 1 provides a critical assessment of the co-creative process of designing and using the Case Study Living Document (CSLD) as a working tool. The CSLD has been a framework for case study research developed throughout WP5, and managed in the context of WP4, which is the work package responsible for case study management and tools. The structure for the CSLD was first idealized in light of the Climate-ADAPT Platform[1] (explained in more detail in Chapter 1). It is important to evaluate and reflect on the use of this structure, both analytically and regarding its capacity for providing relevant contents. The goal is that the CSLD can be integrated into Climate-ADAPT as a blue-print for the online tool. Therefore, the chapter contributes mainly to objective I. By explaining key concepts and designations used throughout the document, Chapter 1 will also contextualize and provide baseline information for the analyses developed in the subsequent chapters.

Chapter 2 is an analytical synthesis of the key messages of WP5, considering how case study research contributes to produce tangible climate change adaptation outputs and to inform climate change adaptation strategies and action-

[1] Climate-ADAPT: http://climate-adapt.eea.europa.eu/

plans throughout Europe. The chapter equally offers a critical insight into International adaptation research and practice, drawing from the four BASE International case studies, as well as from the case study state of the art provided by D4.2 (*Experiences in bottom-up adaptation approaches in Europe and elsewhere*). The chapter is mainly focussed on objectives II and III. However, objective IV is addressed at different sections throughout the analysis, and later synthesised in the final general conclusion.

Chapter 3 links D5.5 to D5.3 (i.e. *Participation in Climate Change Adaptation*) by providing a meta-analysis of the participatory research analysed in D5.3. This chapter addresses mainly objectives II, III and IV.

Finally, Chapter 4 offers an analysis of the perspectives of stakeholders who have been involved by BASE research. The analysis is informed by the results of a workshop and a questionnaire applied to the participants, where a number of case study stakeholders were invited to discuss BASE case study research from their perspectives. The chapter addresses objectives I, III and IV. A final conclusion links the chapters of the deliverable by offering key notes on how BASE contributed to promote climate change adaptation outputs, and how case study experiences aid in the upscaling of climate change adaptation action-plans and experiences across Europe. These include collaborative case study research tools such as the CSLD, and developing incremental innovations to methods and tools for climate change adaptation research and practice that can inform the European Environmental Agency (EEA), the European Topic Centre on Climate Change Adaptation (ETC-CCA), and the European Adaptation platform Climate-ADAPT[2].

[2] A number of outputs are being developed as supplementary to this deliverable, including: an Adaptation Inspiration Book 2 (BASE version to CIRCLE-2 project's book; an E-book on coastal adaptation solutions for the Portuguese Atlantic coast, which resulted from a report developed by a group of researchers (including FFCUL BASE partner) for the Portuguese Environmental Agency; and scientific articles drawing from this deliverable's chapters.

1 BASE collaborative case study approach

By Inês Campos, Kiat NG and Gil Penha-Lopes

1.1 Introduction

In scientific research, case study approaches have been received with some scepticism due to insufficient rigour and objectivity when compared with other methods (Rowley, 2002; Yin, 2013). However, the strengths of drawing from case study research rely on the flexibility of the method (Seawright and Gerring, 2008), particularly in a research concerned with complex processes of change in the real world (Füssel, 2007). A case study is defined as an 'empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident.' (Yin, 1994, p.13). Therefore, the scope of a case study research is not confined to a laboratory or controlled experiment, but is framed by real-life events. The option of doing case study research is equally related to the types of questions to be answered (i.e. Why, How?), to the level of control over events taking place and to the timeframe of the process being studied (i.e. contemporary, historical) (Rowley, 2002). According to Rowley (2002):

> 'Who, what and where questions can be investigated through documents, archival analysis, surveys and interviews. Case studies are one approach that supports deeper and more detailed investigation of the type that is normally necessary to answer how and why questions'. (Rowley, 2002, p. 16)

The 'how' and 'why' questions are central in climate change adaptation, because climate change impacts and the range of possible solutions are framed by spatial and temporal boundaries and are context-specific processes (Smit and Wandel, 2006). Case study research is equally useful for contemporary events, for which there is no certainty regarding future developments (Yin, 2011). Thus, climate change science is a field where case study research is a particularly relevant and appropriate method (Lim, 2005). However, the type of data collected through case studies can be challenging for comparative purposes. While in quantitative survey-based studies the extent of data available is larger, in case study research the level of detail and specificities is greater (Seawright and Gerring, 2008).

Taking stock of this discussion, the aim of this chapter is to reflect on a main feature of BASE collaborative case study approach, namely the CSLD. The assessment of the CSLD draws from a short survey done after all partners delivered their final CSLDs, where relevant opinions, critiques and insights were attained from BASE partners who used the CSLD as a working tool throughout the project. This chapter's discussion provides also the context for the meta-analysis of key messages from BASE case study research presented in the following chapters 2 and 3.

However, before proceeding, it is relevant to clarify the meaning of a few designations used throughout the document: *BASE partners* refers to the institutional partners of the BASE consortium and their working groups. *Case study owners* refers to the research groups or individuals who have led a case study research in BASE. Case study owners are also BASE partners, although some partners may not have implemented a case study research. *Case study stakeholders* are all those who are not part of BASE scientific consortium, but who participated or co-developed the case study research with BASE researchers. Stakeholders are equally all those with vested interests in the case studies developed, and are better characterized in Chapter 3.

To implement the case study research in project BASE, two relevant WP were set out: WP4 was responsible for managing the case studies and design methodological frameworks, which would support a continuous coordination and harmonization of case studies throughout the empirical research; and WP5 has been responsible for coordinating and implementing case study research and provide the meta-analysis. At the outset of these two WPs, a few issues

were identified. First, both WPs would need to manage and implement a broad number of case studies throughout Europe, led by different teams, focussing on a variety of context-specific issues/topics within climate change adaptation, and potentially requiring the application of different methodologies. Second, there was a need to harmonize results of case study experiences that would appropriately be reported and integrated in different deliverables of WP5, 6 and 7. Third, there was a call for designing a reporting tool that could be co-developed and updated by all case study owners as the research progressed. This would help keep case studies as "uniform" as possible and at the same time avoid each deliverable leader to request the same information (but potentially in different formats) to case study owners. Finally, it was necessary to provide a broad methodological framework, which would set out the goals for each dimension of the research, such case as: baseline information on the case study; economic assessments, participatory approaches and implementation. Such framework should also be sufficient flexible for each case study owner to proceed and experiment with new methodological approaches, particularly in articulating participatory designs with the other dimensions of the research (e.g. economic assessments, modelling). To respond to these needs, the CSLD was developed. The tool was first presented in D4.1, and was co-created by WP4 and WP5 teams, as well as case study owners. The CSLD was commented and improved by the consortium members within the EEA that are responsible for the topic of case studies within the Climate-ADAPT European platform.

In what follows, the methodological section explains the framework for developing the CSLD and the process of co-designing the CSLDs throughout BASE. Afterwards, results are presented, and the main strengths, weaknesses and areas for improvement of this working tool are discussed. Finally, a set of conclusions is provided on the use of the CSLD. Conclusions highlight how CSLDs may be further improved for projects in climate change and sustainability research centred/based on case studies, with a particular focus on the application of the CSLD to the Climate-ADAPT platform.

1.2 Methodology

The structure for CSLD was first developed based on Climate-ADAPT Platform. This is an online platform created by the European Commission with the goal of supporting countries, regions and cities adapting to climate change, by sharing information and knowledge based on case studies across Europe. The platform includes a case study research tool, where users can browse through a database of adaptation policies/measures across Europe. Once a case study is selected in the platform, a page appears with a synthesis of keynotes regarding the adaptation policy or measure. This synthesis is organized in a set of sections, including: Case Study Description (e.g. Challenges, Objectives, Adaptation Options); Additional Details (e.g. Stakeholder Participation, Success and Limiting Factors, Costs and Benefits); and Reference Information (e.g. Contact, Website). Since BASE case study research could be used to provide data on climate change adaptation experiences throughout Europe, it has been important to produce data that would feed the Climate-ADAPT platform. Therefore, the CSLD was initially structured to include relevant information for the platform. However, following three years of research, the final structure was significantly broader than the climate-ADAPT structure, since it needed to include the relevant sections for BASE case study owners, as well as detailed information to fit into WP5, 6 and 7 deliverables. Still, in some Climate-ADAPT sections, such as the legal aspects section, BASE case studies would not be able to provide in-depth information, since legislation has not been a main focus of the research. On sections such as participation and cost/benefit analysis, BASE case studies were expected to provide robust and detailed data. Therefore, the CSLD started by taking stock of the Climate-ADAPT platform as basic structure, but gradually grew to account for a wider set of data. Throughout the process of designing the CSLD, each added section was tested in one or two case studies for fine-tuning, before it was sent to all partners. The first sections of the CSLD were developed in light of the Climate-ADAPT structure, yet the following sections were led by 5.2, 5.3, and 5.4 deliverable leaders, with the objective of setting in place a structure for retrieving information that could be easily reported by partners and able to feed the respective deliverable reports (see Table 1 below). The documents worked as a starting point to assemble information on methodologies and case study results, although all deliverable leaders had to contact every case study owner individually to build on the information provided.

Table 1-1 Structure for the CSLD

Structure for CSLD
Chapter 1. General Case Study Description
a. Location
b. Case study summary
c. Context
d. Brief general information on climate change and related issues
e. Existing information on case study's adaptation history
f. Connection with other research projects
g. Case ID; typologies and dimensions
h. Impacts, sectors and implementation
i. Importance and relevance of adaptation
Chapter 2. Case study research methodology
a. Research goals
b. Stakeholders involved
c. Methodology
d. Case study timeline
e. Collaboration with other partners and case studies
f. Research outputs
Chapter 3. Participation in climate change adaptation
a. Process overview
b. Participation in the process phases
c. Participation experiences
d. Learning through participation
Chapter 4. Climate change adaptation measures and strategies
a. Adaptation measures under analysis in case study
b. Adaptation measures selection and data availability prior to BASE
c. Full description of adaptation measures
Chapter 5. Impacts, Costs and Benefits of Adaptation measures
a. Preliminary risk assessment and identification of adaptation tipping points
b. Identification of adaptation measures
c. Evaluation criteria and method
d. Data collection
e. Net Present Value calculation and discussion of results
Chapter 6. Implementation analysis – understanding, leadership and governance of the implementation of adaptation measures

Taking stock of the CSLD experience, the main purpose of this chapter is to understand the role of the CSLD as a methodological strategy in the context of BASE collaborative case study research. To provide this analysis, a questionnaire was applied to BASE researchers who led the case studies throughout the past three years (see Appendix 1 with the questionnaire structure). The analysis of this chapter focuses on understanding if and how the working tool was useful to the group of researchers who both created and used it. The analysis draws insights regarding the strengths, weaknesses and areas for improvement, taking stock of the feedback questionnaire sent to partners. The questionnaire comprised a set of multi-choice questions regarding the usefulness of the tool, and asked for a qualitative assessment of case study partners, who were directly involved in leading deliverables and tasks. The results are presented and discussed in the following sections.

1.2.1 Case study ID categories and groups

Although deliverables 4.1 and 5.1 have described the case study categories and groups, this deliverable provides a reflexive structuring of the case study groups, by taking stock of the practical and theoretical developments within WP5 over the past three years. As noted in the CSLD template (Table 1 above), particularly in sections that make up Chapter 1, case studies started out by being classified in different typologies and dimensions. The case studies dealt with diverse impacts and consequently there was a focus on particular sectors. The case study ID Table in Chapter 1 of the CSLD provides a synthesis of this characterization. The table asks partners to fill out the territorial zone of the case study (i.e. Rural, urban, coastal or river basin); the scale (local, regional, national, transnational, European/global); the direction of the adaptation process (i.e. top-down or bottom-up) and the temporal definition (retrospective and prospective). These categories are equally used throughout this deliverable, particularly in the meta-analysis of the case study results in Chapter 2. Therefore, a clarification of concepts is required.

When the designation *regional case studies* appears, unless it is specifically mentioned *European* regions, the authors are referring to regions within countries where the case studies were developed. Regarding the *top-down* and *bottom-up* categories, these refer to the direction that the adaptation process has been or is taking. According to the BASE DoW, this distinction is understood according to two alternative definitions: a) *Top-down/bottom-up as a research process* – 'The gap between top-down strategic assessments of costs and benefits and empirical context-sensitive bottom-up analyses will be bridged using novel combinations of models and qualitative analyses' - and b) *top-down/bottom-up regarding where the stakeholder initiative starts* - 'Successful bottom-up initiatives will be studied'.

Since D5.5 provides a meta-analysis of the dynamics between top-down and bottom-up directions and their relevance for climate change adaptation processes, when top-down/bottom-up classifications appear throughout the deliverable these refer to definition b). Regarding definition b), there can be more than one direction or a loop of motions characterizing process directions. For instance, an adaptation process may start as a bottom-up initiative (e.g. a municipality or local organization), that is noted at higher levels of governance (e.g. a Minister or National Agency), where new initiatives emerge and may have or will have an impact on the bottom domains. Therefore, case studies are sometimes characterized as bottom-up/top-down processes throughout the following chapters.

Concerning the *retrospective* and *prospective* categories, these refer to the temporal dimension of the case studies. If the case study is an analysis of an adaptation process that has already happened, it is classified as a retrospective analysis. If the adaptation process is now commencing and expected to continue in the future, it is categorised as a prospective analysis. In a few case studies, the analysis is both focussed on past experiences as well as on present or future adaptation processes, such studies are classified as retrospective and prospective.

As stated in the DoW, BASE case study research should set up a framework based on 'meta case study groups' (see citation on the General Introduction, p.8). Therefore, one of the first tasks of WP4 (responsible for managing the case study research) was to set up a proposal for case study groups, which were subsequently called 'clusters'. D4.1 presents these groups, based on a sectoral perspective. These case study groups were to reflect the different emphasis of the case study research, which dealt with diverse impacts and affected different and multiple sectors. The initial cluster groups proposed in D4.1 were the following:

- Coastal Zones
- Agriculture and Forestry
- Water Resources
- Human Settlements and Infrastructure
- Biodiversity and Ecosystem Services
- Human Health

These groups were made at the beginning of WP5. In practice, case studies evolved and sometimes focussed on impacts or addressed sectors, which had not initially been contemplated. For instance, the Cascais case study began as part of the human settlements and infrastructures group, but is also a coastal city, and the research process revealed

local stakeholders were concerned with coastal impacts such as rising sea levels. Therefore, as the research progressed, the clusters became more of a dynamic framework. Although case study owners decided to include their case studies in the most relevant cluster, from a sectoral point of view, some case studies could be part of one or more groups. These dynamics were equally reflected on WP5 deliverables, which did not always use the same group structure as had been proposed in D4.1. How case studies were set up within a group structure was also dependent on the focal point for each analysis. Deliverables had different focuses, D5.2 was concerned with the economic analysis of specific measures; while D5.3 mainly focussed on participatory approaches. D5.4, for instance, provided an implementation analysis based on five sectoral groups (i.e. cities, coasts, agriculture, health, biodiversity), acknowledging that case studies will have impacts on sectors such as water and forests, but that these were considered secondary from the point of view of implementation analysis.

Finally, D5.5 sets out to do a meta-analysis of case study research results from WP5. To achieve this purpose and support the analysis made in the following chapters, D5.5 established meta-groups that account for the various impacts and adaptation processes studied. The meta-groups provide a structural basis for the meta-analysis developed in the following chapters.

Drawing from the original case study groups provided by D4.1, D5.5 combines the clusters in meta-groups based on the similarities, complementarities and points of intersection between the different focuses of the case studies. First, since most case studies in the agriculture and forestry sectors, also address biodiversity and ecosystem services dimension, these clusters were grouped together. Second, while the water sector was secondary to the implementation analysis done in D5.4 (because only one case study had water as its main focus - i.e. Kalajoki); in D5.5 meta-analysis, water is transversal to human health issues and is relevant for a few case studies. Therefore, water resources and health are combined as a meta-group. Finally, all coastal zones studied have also human settlements and infrastructures, and conversely many large human settlements are also in coastal zones (e.g. Cascais, Venice). Therefore these two clusters were grouped. These observations resulted in the basic framework for a case study meta-comparison developed in the following chapters. The framework establishes the following case study meta-groups (based on D4.1 cluster groups):

- Agriculture and Forestry/Biodiversity and Ecosystems Services
- Water Resources and Health
- Coastal Zones/Human Settlements and Infrastructure

The list of case studies presented on Table 1-2 is based on the list of CSLDs and integrated in these meta-groups. The finalised set of CSLDs is provided in the following online link: BASE CASE STUDY LIVING DOCUMENTS. The CSLDs refer to a total of 27 case studies, 23 European case studies and four International (see Table1-2 below).

Some case studies in the list below appear as one in the CSLD, and were implemented by the same research team, but can be sub-divided in two or three sub-cases. These case studies refer to the same geographical territory. However, from a thematic and methodological perspective they are different. The Alentejo case study, for instance, actually comprises three sub-cases, because it includes an analysis of adaptation actions for the whole Alentejo region, and two distinct analysis done to two different adaptation process: one at Tamera Ecovilla (i.e. economic assessment of a measure for water retention in the landscape); the other at the Amoreiras Village Convergence Centre (i.e. a grassroots innovation to deter land abandonment, see Campos et al., 2015). Similarly, the Holstebro and Lolland CSLD refers to two sub-cases in a rural region in Denmark.

Finally, it is important to note that while the CSLDs aim at providing a coherent structure for Climate-ADAPT, the platform might request that BASE sub-cases become full case studies. One example is the Tamera case study already in Climate-ADAPT platform, as a good example that benefited significantly from the Tamera component of Alentejo BASE CSLD[3]. Table 1-2 below shows the list of BASE case studies, and their subgroups.

[3] See more at: http://climate-adapt.eea.europa.eu/viewmeasure?ace_measure_id=5401

Table 1-2 List of BASE CSLD

European case studies (23)

Agriculture and Forestry/Biodiversity and Ecosystem Services

1. Alentejo [Tamera; Convergence Centre of Aldeia das Amoreiras]
2. Holstebro and Lolland
3. Dartmoor
4. Šumava
5. South Moravia
6. Donãna
7. Ústí

Coastal Areas/Human Settlements and Infrastructures

8. Cascais
9. Copenhagen
10. Ílhavo and Vagos
11. Jena
12. Kalundborg
13. Leeds
14. Prague
15. Rotterdam
16. South Devon
17. Timmendorfer Strand
18. Venice

Water Resources and Health

19. Cornwall
20. IJsselmeer
21. Kalajoki
22. England
23. Madrid

International case studies (4)

A. Rio de Janeiro
B. Cuba
C. Mekong
D. U.S. East Coast

International case study owners did not complete all the sections of the CSLD. This happened because the international cases had a focus that diverged from the main lines of exploration pursued by the European case studies (i.e. economic assessments, participation and implementation). In some instances, the methodologies used and the objectives of the empirical research were set out prior to the design of the CSLD. Therefore, every case study owner provided a shorter CSLD, with the characterization and main findings of the research. This was to be expected since the goal of the International case studies, as proposed in D4.1 and D5.1, was to provide lessons learnt that could be comparable to ongoing European experiences and contribute to develop the European cases.

1.3 Results

The researchers involved in leading the studies offered their assessment on the CSLD as an analytical tool. In total, 15 case study owners responded to the questionnaire. Although a total of 27 case studies have been developed, some case study owners responded to the questionnaire for more than one case for which they were responsible.

The responses of case study owners for questions 2 to 6 are presented in Figures 2-1 to 2-5 below. Question responses were provided according to a scale from 1 to 5, where 1 is 'very low'; 2 is 'low'; 3 is 'moderate', 4 is 'high', and 5 is 'very high'.

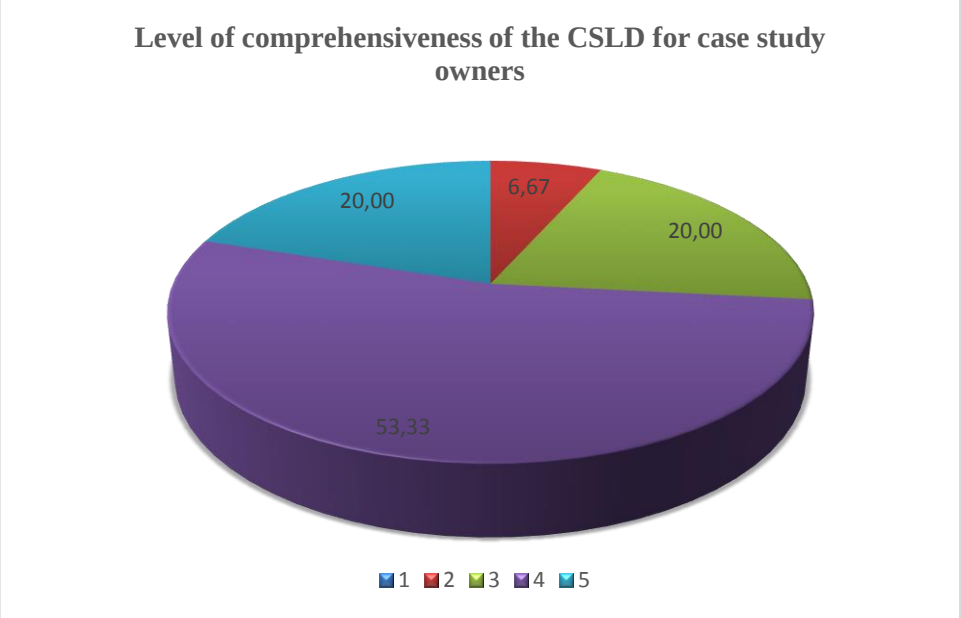

Figure 1-1 Level of comprehensiveness of CSLD for BASE case study owners on scale from 1 (very low) to 5 (very high)

The level of comprehensiveness was considered high by the majority of respondents. Nevertheless, 20% attributed 3 (moderate) to the level of comprehensiveness, while 20% considered the level of comprehensiveness was very high. Although three people thought the CSLD was moderately comprehensible, and three attributed a higher value, the majority of BASE researchers seem to have been able to easily understanding the requests provided by each section.

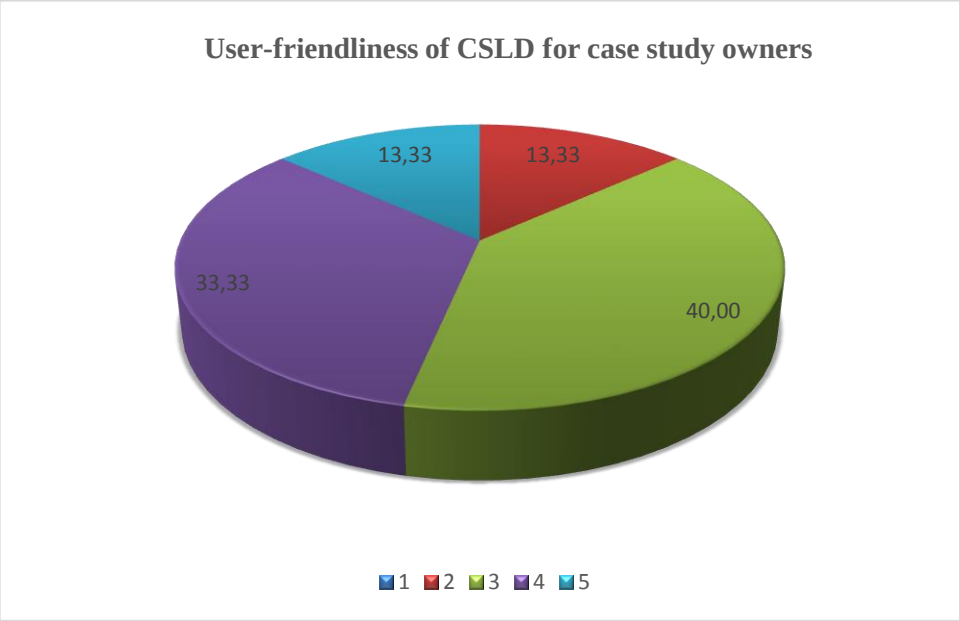

Figure 1-2 User-friendliness of CSLD for case study owners on a scale from 1 to 5

Despite the level of comprehensiveness, 40% of respondents found the CSLD was presented in a moderately user-friendly format – the information requested was easily understood. Moreover, 33% thought the document had a high level of user-friendliness. Yet four respondents attributed a low level to user-friendliness.

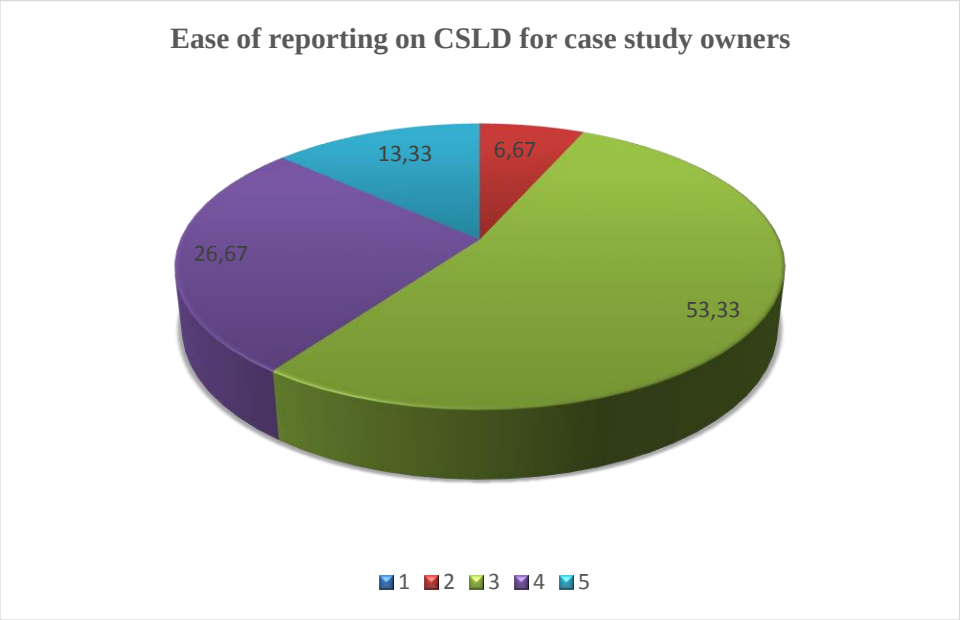

Figure 1-3 Ease of Reporting on CSLD for BASE case study owners on a scale from 1 to 5

Regarding the ease of reporting (i.e. the facility in reporting on their case studies, via the use of the CSLD), the majority of BASE case study owners thought it was moderately easy to report on the CSLD, and only two respondents considered the ease of reporting to be very high.

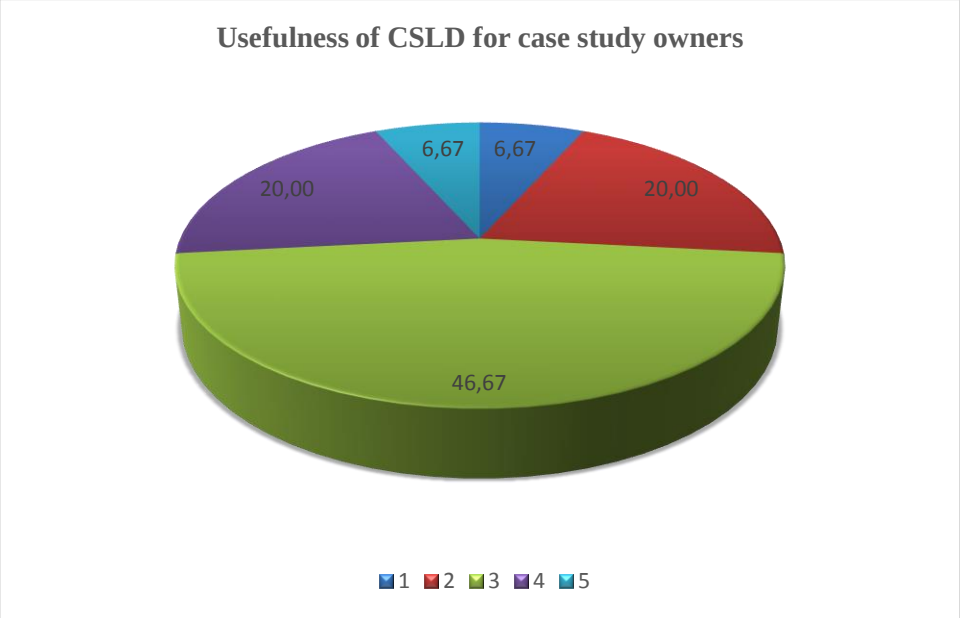

Figure 1-4 Usefulness of CSLD for BASE cases study owners on a scale from 1 to 5

Only one respondent attributed a very high (option 5) usefulness to the CSLD for the process of supporting the case study methodology and to avoid multiple reporting for different deliverables. 46% considered the CSLDs were moderately useful (option 3), while 20% thought the tool was highly (option 4) useful. Nevertheless, in the comments provided later (see Table 1-3 ahead), WP coordinators and tasks leaders refer that in the context of producing the deliverables, they often had to engage directly with case study owners to review the data which had been provided through the CSLDs. Thus, it is likely that the usefulness referred concerns mostly to the ability of the CSLD in supporting the development and implementation of case study methodologies.

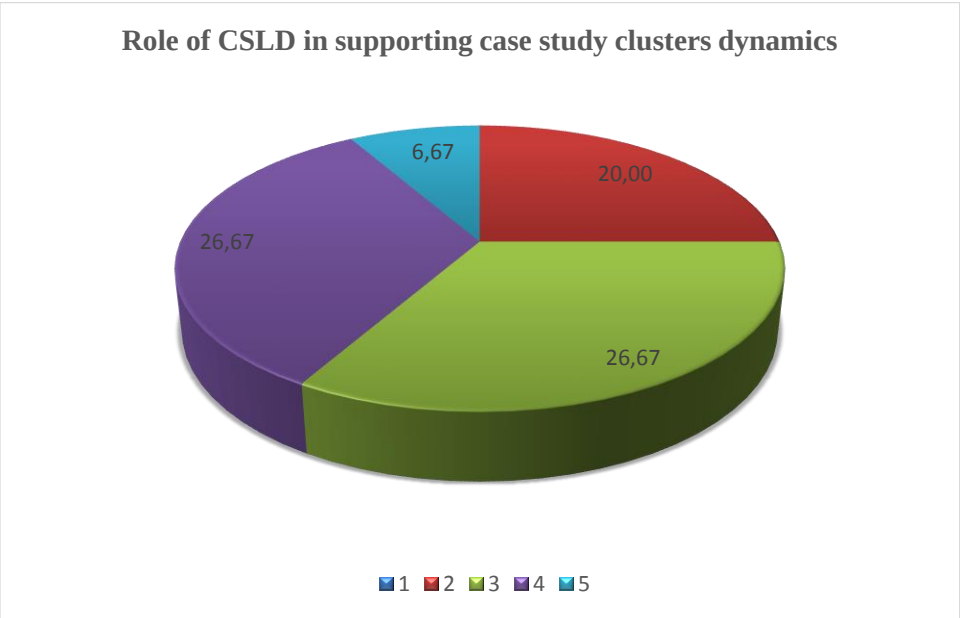

Figure 1-5 Role of CSLD in supporting case study clusters dynamics on a scale from 1 to 5

As explained in section 1.2.1, case studies were framed within cluster groups, which were set out at the beginning stages of WP5. Therefore, it was equally relevant to ask whether the CSLD supported research exchanges and dynamics among case study clusters. Respondents attributed 26% to levels 3 and 4, indicating that the CSLDs were considered to moderately encourage case study cluster dynamics. However, as referred before, case study clusters followed different dynamics. According to case study owners, the reasons for these differences relate mostly to the (dis)similarity of case studies in each group. While some clusters (such as case studies in the agriculture and forestry sectors), were able to align and coordinate their methodological approaches and research, in others (such as case studies in coastal zones), the empirical research dealt with more than one sector, relevant for climate change adaptation, which posed challenges in aligning tightly the work among various research teams. The Agriculture and Forestry's group benefited from having a set of case studies developing prospective analysis on climate change adaptation actions for agriculture. Conversely, the coastal group was formed by case studies with quite distinct characteristics. For instance, the study of Ílhavo and Vagos coast (Portugal), was a prospective research with a participatory component, and with the purpose of initiating an adaptation process, while the Timmendorfer Strand case study (Germany) was a retrospective analysis of an adaptation measure, which had been already implemented.

Case study owners were also asked to provide a qualitative assessment regarding the capacity of the CSLD as an instrument for retrieving research results. The qualitative assessment indicates there were some pitfalls, such as repetition, complexity of documents and difficulties in maintaining updated versions of the research outputs (see Appendix 1 for a complete listing of the characteristics of the methodological tool referred). Additionally, to provide a more thorough evaluation of the working tool, task and deliverable leaders of WP5, WP6 and WP7 were asked a set of questions concerning their use of the CSLD. Two questions were asked: what was the level of usefulness of the CSLDs for monitoring the progress on tasks, and what was the level of usefulness of the CSLD for producing deliverable reports on a scale from 1 (very low) to 5 (very high). The mean value attributed to the usefulness of the CSLD for monitoring tasks was 3.25. Similarly, the mean value attributed to the usefulness of the CSLD for producing reports was 3.5. Respondents were equally asked to provide a qualitative assessment of the CSLD, taking into account the strengths, weaknesses, opportunities and threats of this working tool. Table 1.3 provides the results of this assessment. The last line – 'Other comments' – shows more general comments that could not been appropriately inserted in the other categories.

Table 1-3 Qualitative assessment of the CSLD

Strengths	**Qualitative Assessment of the CSLD from deliverable and task leaders**
	'CSLD cover all potential research done in case studies. It is a "living" document which can be updated constantly. Section 6 of the CSLD, for instance, provided a set framework for case study owners to report on.'
	'The CSLD provides a consistent base upon which to compare across cases and allows sufficient space to delve deeper in what is happening in particular cases. This allows for the drawing of common comparative experiences, and understand issues that are more specific to a case or a cluster of cases.'
	'Overall, the CSDL have been a successful exercise, as it provided a template for a constant approach across very different cases conducted by teams with very different skills.'
	'Clearly a tool to monitor progress'
	'Case study owners could provide inputs in a very structured manner, which facilitated analysing the data and prepare the presentation of the input data in the deliverable.'
Weaknesses	'It doesn't allow for International case studies reporting.'
	'You can't identify new text added to a previous version and can seem repetitive for case study owners.'

	‘Data reported for D5.4 still had to be extracted from the CSLD and reformatted for analysis. Many corrections and clarifications by case study owners were done via email which was quicker and more direct.’
	‘Requires synthesizing data form the CSLDs, there is a lot of information to synthesize.’
	‘Overlaps of sections should be avoided or better managed. Some relevant information was reported in section 4 what we would have expected to be reported in section 5. Impossible to screen entire document of all cases for updates.’
	‘Added value of section 4 unclear. Would have helped, if case study owners would have linked to other relevant parts of the CSLD. Ease of linking should be improved.’
	‘No binding update periods.’
	‘It could have been useful, but we were relying on D5.2 people to safeguard that the right content was developed in the individual cases.’
	‘There was no section where case study owners could explain the theoretical framework guiding the study. Although for adaptation practitioners reading the CSLD this may not be important, to publish the case study results it becomes important to have a theoretical framework section. Most peer reviewed journals require this. I felt this was missing. Also, while leading a deliverable that had to tie together different case studies, I felt that case studies were disconnected from a broader analytical lens. This made it difficult to find links and comparable experiences.’
Opportunities	‘It could be combined with a software that allows for distinguishing updates and quicker navigation through the text.’
	‘Determination of binding dates for updates. Updates of the entire document, including timelines etc. Representing the current state of work (not just partial updates that might create contradictions). Automatic notation of date of last updates.’
	‘Strict formatting rules should be implemented (e.g. through a macro). This includes formatting of text, figures, tables, captions etc.’
Threats	Threats can include task leaders missing some new text or the questions not covering all case study findings.
	If the case study is analysed merely using the CSLD, it is unclear what the general theoretical framework was. The case study’s more qualitative dimension is missing, it becomes unclear what were the aims of the study, why the case study was chosen and how the research provides a clear advancement on current societal challenges in the scope of climate change adaptation.
Other comments	‘We (WP6) developed a data collector. In addition to get more targeted answers to the needs from WP6 also because we noticed that cases did not always follow the guidance set out before for the CSLD.’
	‘One thing that would have aided synthesis in hindsight would have been for each section of the CSLD to have a summary at the end outlining key policy and economic aspects.’
	‘Implementation of macros would have been one option to enforce harmonization of reporting.’
	‘A face-to-face introduction (no webinar etc.) of the tool would be very helpful after a certain period of time (some info should already have been collected), e.g. at a first GA.'

1.4 Discussion: the role of CSLD in collaborative case study research

The analysis of the CSLD for a collaborative case study research highlights key lessons learned while applying this methodological instrument. The CSLD was created to address some of the challenges referred in literature on case study approaches. Namely, the lack of rigour and robustness; as well as difficulties in comparability and in extracting quantitative data in case study methods (Rowley, 2002; Seawright and Gerring, 2008). Yet, the CSLD went beyond its original function of providing a structure for joint reporting and case study management.

Literature on approaches and tools to support comparable case study approaches is still under-developed (Yin, 2011). In this context, the CLSD experience adds to current literature on the methodological frameworks for collaborative case study research. The role of the CSLD in BASE case studies offers a context for a wide range of methodological approaches. The consortium set out to study sustainable climate adaptation strategies across Europe. Case studies are infused by the complex dynamics of local communities and their perceptions and worldviews, within particular socioeconomic and governance contexts (Lim, 2005; Sayce et al., 2013). In the context of climate change, the challenge for articulating research is amplified by the characteristics of the studies, since adaptation is a context-specific (Smit and Wandel, 2006) and a culturally influenced process (Adger et al. 2012). Research frameworks ideally allow the integration of local knowledge and shared goals for more sustainable and resilient futures, mapped out by a wide variety of social actors, from scientists, to decision-makers and practitioners (Füssel, 2007; André et al., 2012). In BASE research, although there was some collaboration between partners, most case studies were implemented by a single team that integrated the consortium with a specific skill or thematic competence. Nevertheless, in the context of BASE, running the case studies required a transdisciplinary approach (Stokols, 2006). This means that partners either managed to find the necessary skills and competences within the institution; or collaborated with other partners within the BASE consortium, and/or engaged with case study stakeholders as research partners. Therefore, the set of CSLD is built on a variety of methodological frameworks, which span from action-research and transdisciplinary approaches (Stokols, 2006). Transdisciplinarity is a research ontology able to address 'complex societal concerns' (Hardorn et al., 2006, p. 122), by working across scientific fields and multiple disciplines, as well as moving beyond science, and involving multiple knowledge domains, including local and traditional knowledge (Folke et al., 2005). Among the set of CSLD, can equally be found survey-based and model methods, where stakeholder involvement was reduced. Some studies provided quantitative data as part of the research (e.g. see CSLDs for Cascais; Holstebro and Lolland).

The CSLD offered a systematic tool for harmonizing the collaborative research process. Research was developed by a large group of partners, from different countries, and with a variety of skills and competences. Despite the variety of approaches and methodologies used, case study owners had to provide results that would be easily communicated to every partner. By co-designing the various sections of the CSLD – on economic analysis, participation, and implementation analysis –, and testing each new section with one or two case studies for fine-tuning the structure, partners were able to articulate their methodological frameworks in a coherent framework. Since partners were expected to report on their studies, the CSLD gained a monitoring and assessment role. Thus, while addressing the challenge of managing a collaborative research process, the CSLD allowed for harmonization of reporting on results; clarified the expectations of case study owners regarding the needed information and knowledge; and provided a continuous monitoring and assessment tool of the research process. Additionally, the CSLD equally managed to highlight needs for stronger collaborations among partners. For instance, while applying the InVEST model to a case study in Portugal (Alentejo) and another in the Check Republic (Green Roofs); the research partners from both countries collaborated tightly by exchanging knowledge, skills and competences.

Lastly, the CSLD was idealized to fit the Climate-ADAPT case study structure, so that information related on the documents would be easily transferable to the online platform. However, by attempting to frame the various knowledge needs within one document, the CSLD grew to be too complex for a synthesis document (some CSLDs have 50 or more pages). On the other hand, partners referred the CSLD was also too simplistic to draw robust information on the studies, and every WP task leader eventually had to approach directly case study owners for additional clarifications and information. Thus, the CSLD became too complex for a synthesis document and would

need to be substantially abridged to provide adequate information to the online platform, but was equally too simplistic to account for the depth of data and information gained through the case study research.

It is challenging to find the right balance between the two conflicting goals of simplicity for dissemination of research results and in-depth information for analysis. This balance would possibly require two versions of the CSLD – a complete version and a synthesis page. This need, however, was not clear to research partners at beginning of BASE. The CSLD itself was an experience and a work in progress characterized by a 'learning-by-doing' and 'doing-by-learning' approach (Armitage et al., 2008). One possibility for addressing this issue in future research is to explore a 'cloud version' of the CSLD, as was hinted by the partners' comments on the tool (see table. 1-3).

In synthesis, the CSLD addressed three main challenges highlighted in literature for collaborative case study research:

- Harmonize and coordinate reporting
- Rigour and objectivity
- Flexibility and standardization

Additionally, the importance of dissemination (Vogel et al., 2007) was a concern of the case study framework developed. However, despite the goal of developing a structure through the CSLD that will be easily adaptable to fit the Climate-ADAPT platform and provide the needed information and dissemination on climate change adaptation experiences, disseminating the contents of the CSLDs to stakeholders throughout BASE was not a priority. As one partner commented:

> 'The CSLD was good idea, but needs to be developed further. One problem was the size of the document, which became too big for easy communication (e.g. for emailing)' (see Table 1-2)

With some exceptions, such as Cascais, where a polished and simplified version of the CSLD was shared with local stakeholders, other case studies were not able to fulfil this goal. This relates to the priorities of case study owners who primarily felt they needed to complete the CSLDs, as well as the various BASE tasks they were involved with. Cascais similarly benefited from the strong collaboration of local stakeholders involved, who contributed to draft the simplified version of its CSLD, which was presented as the 'Cascais Progress Report'.

The challenge of dissemination for case study owners also points to the need for acknowledging that the ability to develop a strong dissemination of scientific research requires adequate human resources and competences, which are not always among the expertise of those leading and implementing a case study research. One possibility for future projects is to include a communication specialist as a member of the research team. The sole task of this communication specialist would be to simplify scientific information and continuously relate it to case study stakeholders.

1.4.1 Cloud version of CSLD

Regarding the areas for improvement suggested by partners (see Table 1-3), the hypothesis for a Case Study Living Platform is explored. Drawing from the responses and suggestions of BASE case study partners, it seems clear the CSLD would have benefited from a 'cloud' prototype that could be editable and updated by case study owners, rather than having the format of a word document.

Comments from case study owners refer to: 'lack of synthesis'; 'repetition of information'; need for 'updates'; 'document becomes too long'; 'using an online version […] would enable easier updates'. Responds overly stressed these issues and frequently refer to the option for a 'cloud version', rather than 'word documents'. Subsequently, comments from deliverable and task leaders emphasise the need for either editing sections of the CLSD or directly approaching case study owners to retrieve further information needed. The need for continuous updates made the document 'too long' and at times 'repetitive' (see Appendix 1 and Table 1-3).

To address these bottlenecks, one possibility would be to develop a Case Study Living Platform. Recent literature has explored the need for articulating interdisciplinary research through platforms and instruments (Zhao et al., 2010; Mansilla et al., 2015). One example developed has been the open source software 'Duckling'[4]. Yet, these attempts offer the technical structure and tools to share updated information and data, but still fall short of the potential for a cloud version of the CSLD, as a structure for achieving a high level of social impact of the research process, through an open dialogue with stakeholder groups and individuals involved. The CSLD were meant to be a tool usable by researchers throughout their case study investigations that could later be converted into case study data to integrate into the Climate-ADAPT Platform. Nevertheless, given the need to respond to BASE deliverables and tasks, the CLSD grew beyond this initial structure. The CLSD has been equally a working document and not a readily available synthesis report on case studies, as those listed in Climate-ADAPT. However, the CSLD could work as a blueprint for a tool that would integrate these two distinct roles. This tool could take up a form of an online platform.

Through a Case Study Living Platform, the CSLD could be an editable file where case study owners would share real-time information. This could play out as an alternative framework for leading case study research, where case study owners would be directly reporting to each other, through a co-developed reporting design, which is updated and co-produced as the research progresses. Hosting the CSLD in an online platform could also include the interactive development of an analytical and methodological framework, through a methodological 'tool kit' webpage that could be updated continuously (much like a 'wikispace') to support the choice of methodologies. The framework would equally gain from the multidisciplinary competences of case study research teams, both from a theoretical and methodological perspective. Case study owners using the platform would be able to directly report on their case study progresses to local practitioners, who could register on the site and view relevant documents. Stakeholders could ask to receive updated information on studies in progress, and the platform could integrate a newsletter service. Finally, the use of smart phones could allow people on the ground to record evidence on a real-time basis (e.g. height and scale of flooding damage; landslide disruption). This would result in an active co-monitoring process, as people would be fully integrated as part of the process. Local stakeholders and communities would be active co-managers of the adaptation process, through a dynamic social learning experience. Aside from establishing multidirectional communicative links, this dynamic research framework could benefit the implementation of cyclical methodological approaches to support decision-making in the context of climate change adaptation, such as the Adaptation Pathways and Tipping Points (used in several case studies). Thus, the interactive platform would allow case study owners and stakeholders to co-develop and co-report on their study process and results.

A CSLD based on an online platform would establish multiple communication links between research teams; researchers and stakeholders. Such platform would represent equally a new way of practicing science – based on a strong collaborative framework, and on a real time science-practice interface. Furthermore, for developing reports and collaborative research papers, the platform could have a space for user groups working together, including an online archive of data, relevant documents and references, and a cloud document tool for co-writing and discussion forums.

1.5 Conclusion

BASE case study experiences have been accompanied by the use of Case Study Living Document. This management tool equally enabled and defined the research processes developed. Its central benefits relied on the potential to address the key challenges for case study research (i.e. data availability; comparability and coordination for harmonizing reporting; rigour and objectivity; flexibility and standardization). Its main weaknesses were the growing complexity of the documents, while not allowing for sufficient depth of information for those leading deliverable reports. Nevertheless, the CSLDs provide a synthesis of BASE case study research results and embody the continuous dialogue and collaborations developed within the consortium. The final revised CSLDs offer a representative number of case studies, across sectors and European regions, from which key messages for designing climate adaptation storylines across Europe (WP6) can be distilled, as well as useful policy recommendations and guidelines for decision-makers at multiple scales and levels of governance in Europe (WP7). The CSLDs are the blueprint for a template for

[4] http://duckling.sourceforge.net/

uploading a set of case studies, to inform climate policy and practice across Europe, onto the Climate-ADAPT platform. As a synthesis of the case studies, the CSLDs point equally to some research gaps in European climate change adaptation research, namely regarding the choice of case studies. Some case study categories initially screened were clearly absent, such as the role of insurance companies; of market-based adaptation processes; and more case studies touching on urban-rural synergies for climate resilient regions. This chapter´s analysis of the functionality of introducing the CSLD management tool for collaborative research, highlights future methodological trajectories for a multi-level climate change adaptation research. A wider diversity of topics and of science-policy-practice interactions should be integrated in future research, and robust frameworks for coordinating case study research approaches should make use of computational and web-based tools.

2 A synthesis of BASE case study research – key messages for climate change adaptation practitioners

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2.1 Introduction

Climate adaptation strategies and policies designed at global, regional and national scales might not be corresponding to local needs (Sharma et al., 2014), or in synergy with local way of living (Ng et al., 2014). Top-down strategies and policies may get lost in translation when applied to the local scale (Agarwal et al., 2012). Consequently, through in-depth analyses of cross-sectoral case studies throughout Europe, BASE research strives to fill a knowledge gap between top-down and bottom-up strategies. In this research, 23 case studies (in some instances including sub-cases of varying climatic, environment and socio-economic settings, as well as varied dimensions regarding geographical areas covered, and scales and levels of governance), were selected to best encompass diverse contexts across Europe (Table 2-1). Taking into consideration the sub-regional classification of the IPCC Europe region based on Metzger et al. (2005) (Figure 1 in Kovat et al., 2014) and the map showing the main biogeographic regions of Europe (EEA, 2012), case studies are divided into four main European regions, namely Northern, Western, Central-Eastern and Southern. Spanning multiple and diverse range of sectors, case studies are further grouped into three general meta-groups, namely Agriculture & Forestry/Biodiversity & Ecosystem Services, Water Resources & Health, and Coastal Zones/Human Settlements & Infrastructure (see Section 1.2.1 for a full description of meta-groups).

Table 2-1 BASE European case study characterised by European region, country, BASE partner, meta-group and relevant sector(s) (cells marked with "x" indicate the sector involved) (source: CSLDs)

European Region	Country	Case Study	BASE Partner	Meta-Group	Sector								
					Cities	**Coasts**	**Agriculture**	**Water Resources**	**Biodiversity**	**Infrastructure**	**Tourism**	**Health**	**Education**
Northern Europe	Denmark	Holstebro and Lolland	AU	Agriculture & Forestry/Biodiversity & Ecosystem Services	x		x						
		Kalundborg	DBT	Water Resources & Health		x	x						
		Copenhagen	DBT	Coastal Zones/Human Settlements & Infrastructure	x	x							

	Finland	Kalajoki	SYKE	Water Resources & Health			x	x					
Western Europe	The Netherlands	Rotterdam	Deltares	Coastal Zones/Human Settlements & Infrastructure	x	x							
		IJsselmeer	Deltares	Water Resources & Health				x					
	UK	Cornwall	UniExeter	Water Resources & Health								x	
		England	UniExeter	Water Resources & Health								x	
		Dartmoor	UniExeter	Agriculture & Forestry/Biodiversity & Ecosystem Services			x		x				
		Leeds	UniLeeds	Coastal Zones/Human Settlements & Infrastructure	x								
		South Devon	UniLeeds	Coastal Zones/Human Settlements & Infrastructure	x	x				x			
Central-Eastern Europe	Czech Republic	Šumava	CzechGlobe	Agriculture & Forestry/Biodiversity & Ecosystem Services					x		x		
		Prague	CzechGlobe	Coastal Zones/Human Settlements & Infrastructure	x								
		South Moravia	CzechGlobe	Agriculture & Forestry/Biodiversity & Ecosystem Services			x						
		Ústí	CzechGlobe	Agriculture & Forestry/Biodiversity & Ecosystem Services			x						
	Germany	Timmendorfer Strand	EI	Coastal Zones/Human Settlements & Infrastructure	x	x					x		
		Jena	UFZ	Coastal Zones/Human Settlements & Infrastructure	x							x	
Southern Europe	Italy	Venice	CMCC	Coastal Zones/Human Settlements & Infrastructure	x	x							
	Spain	Donãna	UPM	Agriculture & Forestry/Biodiversity & Ecosystem Services		x	x	x	x				
		Madrid	UPM, BC3	Water Resources & Health	x			x				x	
	Portugal	Ílhavo and Vagos	FFCUL	Coastal Zones/Human Settlements & Infrastructure		x							
		Cascais	FFCUL	Coastal Zones/Human Settlements & Infrastructure	x	x					x		x
		Alentejo	FFCUL	Agriculture & Forestry/Biodiversity & Ecosystem Services			x				x		x

BASE European case studies show that climate adaptation strategies are far from a "one-size-fits-all" approach, and need to be tailored to the local context in order to ensure successful implementation. This is inferred through the comparative analysis of diverse social contexts, climate change adaptation approaches and implementation processes depicted throughout this chapter. Therefore, the outcome of the case study research does not attempt to provide a single representative "optimal" solution, but rather impart a comprehensive thought and design process that serves towards sustainable adaptation strategies, plans or measures at the local context. To provide a broader perspective of the issues and challenges involved when considering climate adaptation strategies, these case studies range from being driven by a full/partial climate change adaptation measure to being initiated by other policy objectives that take into account climate change adaptation aspects. Using quantitative and qualitative models and tools, this analysis is grounded on a set of major themes, namely climatic impacts, economic costs and benefits, participatory approaches, and opportunities and challenges for implementation of adaptation, at a local scale. To this end, Deliverable 5.2 (from here on referred to as D5.2) presented an in-depth economic assessment, D5.3 focused on the participation process, and D5.4 examined the implementation analysis of climate change adaptation options. Furthermore, to understand and learn from global climate adaptation strategies or measures, a comprehensive literature review of International cases (European and non-European) was presented in D4.2, and four in-depth BASE International case studies were presented and discussed in Section 2.2 of this chapter. An overview of BASE European case studies will be provided in Section 2.3, followed by lessons learnt and key messages from the European case studies characterized and analysed in Section 2.4. Therefore, this chapter integrates the analyses carried out through BASE case study research on European cases, and informs on lessons learnt from International case studies. By sifting through the full set of BASE case study research, the chapter aims at offering practical guidance, feasible methodologies, effective development pathways and challenges involved in achieving efficient local adaptation that promotes positive real-life impacts and favourable societal changes, from both local and global perspectives. Outcomes from this critical synthesis will feed into WP 6 and 7, and support synergistic top-down and bottom-up policies and strategies.

2.2 Lessons learnt and key messages from International experiences: Literature review and four BASE International case studies

This section provides a synthesis of lessons learnt from an extensive literature review of International (European and non-European) experiences in climate change adaptation planning and measures to date (described in detail in D4.2: Experiences in bottom-up adaptation approaches in Europe and elsewhere), as well as lessons learnt from four applied BASE International case studies (Section 2.2.2; CSLDs). The International case study examples (Section 2.2.1) are not to be confused with the four BASE International (Section 2.2.2) and 23 BASE European case studies (Section 2.2.3) that were assessed in-depth in WP4&5. The former refers to case study example that provides "a particular instance of implementation of climate change measure(s) that can be studied for the purposes of this exercise" (D4.2 pg.4), while the latter refers to a more comprehensive case study with climate change adaptation evaluations that are documented in each CSLD that can be accessed in the following link: BASE CASE STUDY LIVING DOCUMENTS.

2.2.1 Lessons learnt from literature review of International (European and non-European) experiences (based on D4.2)

A literature review of a total of 136 case study examples from 19 countries around the world were included in the general assessment, of which 91 were European cases and 45 were non-European cases. The selected case studies span across global geographical regions, different sectors, rural and urban contexts, developing and developed countries, and a representative mix of individual or combinations of grey, green and soft climate adaptation measures. Taking into consideration the multi-level governance of developing and implementing climate change adaptation measures, these case studies also included a mix of bottom-up initiatives and top-down strategies. With regard to scale, most case studies focused on local (69%) and regional (sub-national) scales (29%). In terms of sectors, biodiversity, ecosystems and coastal marine systems were the most represented sectors, while transport and tourism sectors were the least represented sectors (Figure 5 in D4.2). Following the EEA classification (EEA, 2013), technological and engineering solutions are considered grey measures, nature-based or ecosystem-based solutions are classified as green

measures, while managerial, legal and policy approaches are grouped under soft measures. The D4.2 report reviewed the range of methodologies and tools used to evaluate climate adaptation options, with a particular focus on the types of participatory and economic methods and tools used in the case studies. Further in-depth assessments were carried out on nine case studies. Details of these analyses and results can be found in Section 4.2 of D4.2. This International case study review inferred that, across global geographical regions (Europe and non-Europe), the most frequently implemented type of measures are soft measures (Figure 2 in D4.2) and the most included stakeholder groups are public administrative organisations of varying levels (Figure 3 in D42.). However, taking stock of the pros and cons of the different types of measures (i.e. green, grey and soft), a combination of types of measures is usually applied in many cases. In addition, D4.2 determined that participatory methods are more frequently used than economic methods as decision-support tools in these reviewed case studies (Figure 6 in D4.2). Specifically, stakeholder/public workshops were identified as the most employed participatory decision-support tool (Figure 7 in D4.2), while cost-benefit analysis (CBA) was found to be the most employed economic decision-support tool (Figure 8 in D4.2). The in-depth analyses on selected case studies further showed that participatory methods were perceived as both productive and essential. Engaging local participants has been pointed out as a challenge, while establishing a structured communication strategy was recommended as an effective approach for overcoming this challenge (D4.2 p. 53). With regard to funding sources, the main source for both European and non-European case studies came from public funding (Figure 9 in D4.2). In comparison to the European case studies, non-European case studies received a relatively bigger share of private and other funding sources (private National: 18% higher; private International: 10% higher; others: 5% higher; Figure 9 in D4.2), and correspondingly a smaller percentage of case studies that included public administrative organisations (4% lower) and a much stronger presence of private organisations (informal groups and movements: 30% higher; companies: 6% higher; social enterprises: 6% higher; Figure 3 in D4.2). Of note, research and education centres were included in about half of the reviewed European case studies (56%), while a much smaller percentage were observed in the reviewed non-European case studies (27%) (Figure 3 in D4.2).

2.2.2 A Synthesis of BASE International case studies

BASE International case studies take stock of climate change adaptation in four countries or regions across three different continents, namely Rio de Janeiro in Brazil (South America), Cuba (Caribbean Sea), Mekong in Vietnam (Asia) and U.S. East Coast (North America). The goal of BASE International case studies aims at drawing lessons from adaptation practices in various regions in the world. In addition, these case studies are complementary to BASE European case studies as they examined climate change adaptation aspects that are not central in BASE European case studies. Correspondingly, these case studies are not as in-depth as the European. However, they are also documented using the same CSLD template, for consistency and comparative purposes (see Chapter 1 of this deliverable). These four International case studies are located in countries with an approved national climate adaptation strategy. Rio de Janeiro case study assessed planned climate change adaptation with a focus on business organisations, while Cuba case study examined Cuban's exemplary disaster mitigation strategy, which assimilated both bottom-up and top-down collaborative learning from experience. U.S. East Coast explored the varying adaptive capacities of different cultural groups (e.g. ethnic minorities), while the Mekong case study analysed climate change adaptation pressures in the Mekong delta. These case studies focused on different sectors (Table 2.2), typologies (Table 2.3), drivers and funding sources (Table 2.4), as well as climate change adaptation methodologies (Table 2.5). To date, an article, a book chapter and a book have been published as a result of BASE International case study research, namely an article entitled "Commitment to Emissions Restrictions of Major Consumers of Electricity in Brazil" in the *Sustainability* journal by Casarejo et al. (2014), a book chapter entitled "The Cultural Context of Climate Change Adaptation: Cases from the U.S. East Coast and the German Baltic Sea Coast" in the book *Social Dimension of Climate Change Adaptation in Coastal Regions* by Martinez et al. (2014), and a book entitled "Permaculture and Climate Change Adaptation: Inspiring Ecological and Cultural Responses for Resilience and Transformation" by Henfrey and Penha-Lopes (2016).

Table 2-2 BASE International case study characterised by country, BASE partner and relevant sector(s) (cells marked with "x" indicates the sector involved) (source: CSLDs)

Country	Case Study	BASE Partner	Sector									
			Cities	Coasts	Agriculture	Water Resources	Biodiversity	Infrastructure	Tourism	Health	Education	Energy
Brazil	**Rio de Janeiro**	**FFCUL**						x				x
Cuba	**Cuba**	**FFCUL**		x	x							
Vietnam	**Mekong**	**Deltares**		x	x	x		x	x			
U.S.A.	**U.S. East Coast**	**EI**		x			x					

Table 2-3. BASE International case study typology and characterization: main goal(s), specific focus, objectives, category, territorial zones, scale, process direction and temporal definition (see Section 1.2.1 and Chapter 1 Section G of CSLD for full descriptions; source: CSLDs)

BASE Case Study		BASE Case Study Typology						
	Main Goal(s)	Specific Focus	Objectives	Category	Territorial Zones	Scale	Process Direction	Temporal Definition
Rio de Janeiro	Awareness raising among big companies on climate change and sustainability. Support the development of action plans.	Explore perceptions on climate change impacts and responses (mitigation/adaptation) led and implemented by major companies.	1, 7	C,D	Urban	Regional	Bottom-Up	Prospective
Cuba	Understand the top-down and bottom-up processes that allowed effective responses to natural hazard risks.	Disaster risk management (e.g., tornados and tropical storms) and urban food production.	2,3,7	D,E,G	Rural, Coastal	Local, National	Bottom-Up Top-Down	Retrospective
Mekong	Supports the development of a long-term strategic vision for a safe,	Identify no-regret short-term adaptation measures in light	2,3,7	A,B,C	Rural, Coastal	Local, National	Bottom-Up Top-Down	Retrospective

	sustainable and prosperous Mekong Delta with a combination of short and long-term adaptation options.	of a long-term vision. Prioritize measures to fit overall long-term objective for the MDP (agro-business strategy).						
U.S. East Coast	Assess the role of socio-cultural factors in climate change adaptation in a coastal environment on the U.S. East Coast.	Explore how local knowledge and values of major cultural groups, shape understandings and perceptions of climate change risks. Culture as factor for building resilience.	2, 6	A, J	Rural, Coastal	Local, Regional	Top-Down	Retrospective Prospective

Notes:

[1]Objectives: 1) Compile and analyse 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; and 7) Disseminate findings by sharing the results of the project with policy-makers, practitioners and other stakeholders. (…).

[2]Category: 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; and J) Informal groups, Movements.

(source: Chapter 1 Section G in CSLD)

Table 2-4. BASE International case study climate change adaptation strategy/plan/measure/initiative (Source: CSLDs)

BASE Case Study	**Climate Change (CC) & Adaptation**					
	Primary CC Impacts (BASE)	**Strategy/Plan/ Measure/Initiative that the case study is based on or contributes towards**	**Main Driver for the Strategy/Plan/Measure/Initiative**	**Funding of the Strategy/Plan/Measure/Initiative being studied at the time of the case study**	**Implemented/ Phase**	**Climate Adaptation Strategy/Plan/Measure /Initiative (Individual or bundle of measures)**
Rio de Janeiro	Extreme temperatures, Water scarcity, Flooding, Coastal Erosion, Droughts,	Climate change and corporate sustainability strategies for Brazil	LIGHT company: Understanding customers' needs and providing better value and service to customers PUC University:	LIGHT company & PUC University research funds	n/a	n/a

	Soil erosion, Vector borne diseases, Damages from extreme weather related events		Supporting corporate sustainability agenda			
Cuba	Extreme temperatures, Water scarcity, Flooding, Coastal Erosion, Droughts, Soil erosion, Vector borne diseases, Damages from extreme weather related events	Early Warning System: National Disaster Risk Management Plan Urban Permaculture: Local and regional strategy of improving the socio-economic and ecological wellbeing.	Decrease vulnerability to extreme events (wind, precipitation); reduce dependency on food and medicine imports; empowerment of local communities	Early Warning System: State Urban Permaculture: Private foundations and local community	Ongoing/ Implementation, Monitoring and Evaluation	Increase plant diversity; Integrate household planning; Increase seed sovereignty and safety; Coastal reforestation; Coastal protection with affordable & available resources; Food preserving; Increase social and community adaptive capacity; Reduce household heat absorption; Increase water availability and use efficiency; Look to opportunities in natural disasters
Mekong	Water Scarcity, Water quality, Flooding, Coastal erosion, Damages from extreme weather related events	Mekong Delta Plan	Socio-economic development, climate change, increased salinization, drought and flood risk	Some measures included in the plan are now being financed by the World bank.	Ongoing/ Assessment, Planning	Adaptation measures of agricultural production; Adaptation measures for coastal zone: dual zone
U.S. East Coast	Flooding, Storm surges, Coastal erosion, Damages from extreme weather related events	Coastal climate adaptation in U.S. East Coast: socio-cultural aspect	Loss in tax income from (potentially) submerged land and other private property issues; eutrophication	Federal (NOAA and EA) &Regional (NCCF)	Ongoing/ Assessment	Retention areas; Ecosystem based management; Wetlands; Dykes; Programs to foster increase in oyster population; New building codes in alliance with subsidized flood insurance policies

Table 2-5. BASE International case study climate change adaptation analysis, models and tools (Source: CSLDs)

BASE Case Study	Analysis, Models & Tools					
	CC-related Impacts	**Participatory Approaches & Social Learning**	**Economic Assessment**	**Evaluation/ Prioritization**	**Sensitivity Analysis**	**Adaptation Tipping Points & Dynamic Adaptation Pathways**
Brazil	n/a	Questionnaires	n/a	n/a	n/a	n/a
Cuba	n/a	Questionnaires and interviews	n/a	n/a	n/a	n/a

Mekong	Climate change scenarios: MONRE (Ministry of Natural Resources and Environment of Vietnam); IPCC RCP2.6 & RCP8.5	Stakeholder meetings, Expert meetings and workshops, Expert and stakeholder reviews	Impact assessment of the proposed long and short term adaptation options under different scenarios	Impact assessment of the proposed long and short term adaptation options under different scenarios	n/a	n/a
U.S. East Coast	n/a	Live polls, Stakeholder workshops & focus groups in the U.S. and Germany including stakeholder from the U.S. and Europe, Semi-structured interviews with coastal stakeholders (residents, political decision makers, enterprises), Ethnographic surveys	n/a	Coding via qualitative data software analysis	n/a	n/a

2.2.3 Lessons learnt & key messages from BASE International Case Studies

A) Rio de Janeiro

Rio de Janeiro case study examines how large companies perceive climate change and sustainability issues and initiates the assessment of their actions towards a more sustainable and climate proof business (infrastructures, value chain, clients and our planet). Even though some knowledge about the response of firms in advanced economies to climate change are described in the literature (see Casarejos et al, 2014), very little is known about organizations in developing and emerging economies that also have a huge and growing impact on the environment. To learn more about the impact of large companies in Rio de Janeiro, the case study included a survey to a representative sample of high-consuming customers (classified by economic sector) of a electricity power company in Rio de Janeiro (see results published in Casarejos et al., 2014). Results indicate that, with the exception of a few outliers, the degree of commitment for the participants to take action on climate change (in response to the guidelines established by the Brazilian Climate Change Policy) was ranked *Average*, which indicates that incipient GHG strategies are emerging (less than 7% of the participants fell within the *Excellent* category). There are very few firms who have done much. Further, the "Average" degree of engagement seems to be very low and most likely has little effect on the overall GHG emissions. Brazil has not enacted specific regulations to mitigate the GHG emissions associated with the generation of electricity; this finding is certainly a matter of concern due to the size and the regional influence of the country to global climate change. Therefore, the survey indicates the need for a proactive attitude towards mitigation and adaptation to climate change, in the context of sustainable development strategies. Specifically, the survey indicates the need for realignment with new methods that address the risks, threats, uncertainties and complexities of the undesired impacts of climate change. Rio de Janeiro's study recalls the need to learn more on the role of European firms in funding, monitoring or developing climate adaptation strategies. An overview of the current topics being addressed by European research projects (see introduction to Chapter 1) indicates the role of firms and large companies in Europe is still under studied in climate change adaptation research.

B) Cuba

This case study highlights that effective adaptation strategies and measures can both be applied to top-down and bottom-up. The coordinated early warning systems connect central government institutions with local neighbourhoods. Information and response seems to flow effectively both ways and Cuba manages to avoid death

rates and significant costs during strong hurricanes and tropical storms. On the other hand, Permaculture training and small to large scale food production (supported by a private Foundation), allowed urban and rural areas to increase their adaptive capacity to deal with the impacts and indirect consequences of climate change and meteorological extreme related events.

Early Warning System

Cuba has established, since October 1996, a highly sophisticated national disaster risk reduction framework through the creation of a comprehensive Civil Defence System that protects lives in the case of extreme climatic events and acts as an early warning system. This system involves a series of preparatory actions, annual large-scale simulations, and a broad network of logistical support centres across the country (Oxfam, 2011; UNDP, 2010). The Cuban Early Warning System (EWS) is among the best-practices all over the world, considered 'impressive', highly successful and acclaimed in the literature (Sims and Vogelmann, 2002) and International organizations such as the ISDR (International Strategy for Disaster Reduction, Issue 2004/2, December 2004). Cuba's formula for such an acclaimed success lies in the powerful combination of: public awareness of hazard risk; public policy commitment at the higher levels of power, and application of scientific knowledge. There is a wide range of legislation to support and give the appropriate framework for this level of institutional alignment[5]. The Institute of Meteorology of Cuba (IMC) has a coordination role in hurricane predictions and monitoring as a function of the Cuban State. The IMC has a network of more than 120 stations, 5 radars and operational access to satellite images. It is important to highlight that operational forecasts are supported by hurricane prediction methods. Over these bases, the IMC has developed its own advisory system, releasing one advisory every 12, 6, or 3 hours, depending on the level of threat. Cuba has a warning system that is activated by a national defense council. The system is structured in "defense zones" spread throughout the country. It allows the system to send information to the head of provinces and municipalities. The most important infrastructures under risk maintain direct phone lines to the centers of the Civil Defense.

Media - Broadcast radio and TV networks and newspapers - are public services fully controlled by the government which under a hurricane warning are subordinated to the national defense council to play a role in disseminating warning and instructions for the public. Cuban disaster management organization is not only focused on emergency response but also in risk reduction activities. Preparedness plans are designed to build capacities in local and rural areas under risk, to take measures. Although preparedness plans are established under military decision-making practices, military and civilian structures in the Cuban society practically overlap, ensuring a strong coordination between them. The internal Cuban economy remains highly centralized and government dependent; individual owners are practically reduced only to small business. Under these conditions, resources, infrastructures and transportation for evacuation and other protective measures come from only one source. BASE European cases studies, particularly those more vulnerable to storm surges (e.g. Ílhavo and Vagos; South Devon), could benefit from developing a similar type of warning system. However, for BASE it is important to stress that Cuba's experience is hard to be fully applied in a western-type society because it is supported by very different socio-political and economic bases, namely regarding governance/decision-making processes and the control and ownership over such critical elements such as the media. Cuba also has a beyond normal level of hurricane occurrence as well as a society that has been severely stressed by an economic embargo for many decades forcing it to be able to respond quicker and internally to external events and forces. Besides, under a strong ideological struggle against capitalism, the Cuban government considers itself under a permanent military aggression risk, developing a military doctrine which involves every stage of society creating quick reaction capacities for emergency response. However, there is a solid historical background of social awareness about hurricane risk and technical capabilities in hurricane warning that may be unique in the Americas.

Permaculture

[5] Law No. 75 of National Defense; Decree-law No. 170 on the Civil Defense system; Guideline No. 1 of the Vice President of the National Defense Council; Law No. 81 / 97 on the Environment; Resolution 106 /99 of the Ministry of Science, Technology and Environment; Ordinance Law No. 279 of 2007 "On General Principles, organization, Preparation and Provisions of the Hydrometeorological System of Cuba for Exceptional Situations.

Permaculture is a design system for sustainable human habitats, taking an ecological perspective and rooted in an explicit ethical framework. It was originally conceived in the 1970s by Australian field ecologists David Holmgren and Bill Mollison as a contraction of the term 'permanent agriculture'.[i] It later expanded its scope to encompass the full range of factors affecting the ecology of human settlement, economy and culture, and is now more commonly considered shorthand for 'permanent culture'. The basic philosophy is one of working with rather than against nature, designing human habitats and organizations in ways that deliberately seek to emulate features that contribute to resilience, sustainability and productivity in natural systems. Permaculture has become a key tool for efforts to reconnect human activities with their geographical resource base. It does this, in part by learning from peoples who never lost that connection. Cuba setting provided a good context to understand how Permaculture is building local resilient and why it was being chosen as the measure to support local food and medicine sovereignty. Living in sensitive habitats, directly dependent on the local ecology or foreign support, and often having historical experiences of both political pressure and change in weather patterns, local communities have often needed to be pioneers in adapting to these situations. The study illustrated how permaculture is being used to support adaptation to climate change related impacts. Initiatives and measures developed over the last ten years are described, providing portraits of hands-on experiences of conceiving and implementing practical responses to environmental change, with some current applications being relevant response to climate change impacts (such as sea level rise and increase intensity and frequency of extreme weather events). The Cuba case study provided the inspiration and worldwide examples for a book on Permaculture published by BASE researchers (Henfrey and Penha-Lopes, 2016). By offering an insight into permaculture experiences in Cuba, this case study highlights the need for Europe to learn more about its own autonomous adaptation experiences, at a grassroots level. There is still little knowledge on the number, on the characteristics and impacts of permaculture experiences and projects throughout Europe. For a multi-level and multi-scale climate change adaptation (Adger et al. 2013), it is relevant to evaluate this type of experiences in order to investigate their role in promoting alternative grassroots responses towards a more sustainable and adapted Europe. Such type of initiative may need to be further empowered by local and national governments, since grassroots communities can often fill out a gap in responding to societal needs when public services are unable to (see Seyfang and Smith, 2007).

C) Mekong

The Mekong case study shows that a more fundamental and comprehensive transformation of the economic support system is needed for successful adaptation. Similar transformations may be needed in Europe, for example in the increasingly arid and water-stressed Mediterranean region which still depends on water-intensive agricultural exports. The study is an excellent example of how a country has learned to be able to live with the floods and is able to make use of the opportunities it creates that enhance economic development. The same accounts for salinity intrusion with much more focus on aquaculture and saline resistant crops, and less focus on prevention and protection.

The Mekong Delta Plan sets out a long-term economic vision and strategy for the Vietnamese Mekong river delta to adapt to climate change, manage its water resources and prosper sustainably in the coming years. The integrated economic vision represents a sustainable land and water use strategy and includes 'no-regret', priority and long term adaptation measures. To deal with long term uncertainties, four future socio-economic scenarios were developed to assess the robustness of measures. The scenarios created insight in the most sustainable long term vision for the Mekong delta: Agro-business industrialization. Besides adaptive and sustainable water related measures, the plan includes recommendations on economics and finance, and should serve as a basis for further regional and sub-regional planning.

Outcome of the case study was that the major impact will be the socio-economic development in the area and the awareness that a sustainable economic development is completely dependent on how well the Mekong delta is able to make use of its natural system and its unique natural resources base. In other words: in the Mekong delta it is not so much about protecting against the natural hazards, but much more emphasis on how to make use of the opportunities of these natural hazards. A good example is the ‘controlled flooding’ measure: instead of having a triple rice policy, it is advised to switch to dual rice + seasonal flooding, as this has many advantages: a) post-flood rice crops tend to return higher yields due to soil fertility increases; b) active silt accumulation in the delta may offset subsidence; c) it

enables diversification (fish and vegetables), modernisation and sustainable agricultural production systems that return higher value products and meet changing food demands of an increasing middle-income urban population (in and outside the delta); and d) smart spatial and controlled flooding strategy can reduce the cost for rural flood protection in the future.

D) U.S. East Coast

U.S. East Coast case study highlighted that environmental justice considerations are highly relevant in adaptation to climate change. This could also be relevant in Europe, as groups of immigrants with limited language skills and social networks may not be reached by early warning systems. Despite the difficulty of addressing climate change and adaptation in the United States, a variety of measures have already been taken in order to adapt to the expected changes. In some cases, adaptation measures have been implemented at the local level without naming them as such. Research activities in the U.S. coastal case study were related to similar research foci in Europe, namely at the German coast. First, the collaboration began with different workshops that were held both in Germany and in the USA (more information: Obstacles to Adapting to Climate Change - a Discussion with Practitioners (http://www.ecologic-events.eu/climate-science-in-dialogue/about). In a second step, one event was organized each in the U.S. and Germany that combined scientists and local stakeholders (Information about the Event in Germany (http://www.climate-service-center.de/037947/index_0037947.html.de) and the U.S. (http://klimzug-radost.de/en/events/dialogue-mountain-coastal-2). Here in addition to coastal regions, actors from mountainous regions were invited, as they are also affected by climate change and gave valuable insights to the workshop. Thirdly, surveys were carried out at the German Baltic coast and the US East Coast (more information http://www.ecologic.eu/11735). The results were published in Martinez G., Orbach, M., Frick, F., Donargo, A., Ducklow, K., Morison, N.: The Cultural Context of Climate Change Adaptation: Cases from the U.S. East Coast and the German Baltic Sea Coast, In: Martinez, G.; Fröhle, P.; Meier, H.-J. (eds.):Social Dimension of Climate Change Adaptation in Coastal Regions, volume 5, München: oekom publishing, Pgs. 85-103.

In both the German and the U.S. case studies, local socio-economic development showed to affect local preferences for specific measures for coastal protection. In all case studies, local risk perceptions differed from those at higher levels of decision-making. Hence the community-based research indicates that it is crucial to understand local traditions, experiences, etc. before designing (let alone implementing) a coastal adaptation project, particularly if approaches are intended to be transferred to differing socio-economic contexts. Apart from this general finding, several points can be highlighted with regard to differences in the transatlantic comparison. To begin with, the issue of 'climate change' showed to be highly politicized in both countries, but with different outcomes. In Germany the general framing is that anthropogenic climate change is an 'issue to be solved' (i.e. reducing emissions) through politics, science, technology and 'environmentally friendly behavior'. Although there is no perception of acute danger at local level, measures for adaptation to coastal impacts from climate change are widely accepted and taken as reinsurance that the authorities are skillfully managing the risks. While some opposing positions exist, they are by far not as much as a dispute as in the U.S. where the scientific basis used to estimate sea level rise is an issue of political contestation. In summary, these findings suggest that framing a measure for preparing for rising sea levels as 'adaptation to climate change' can be beneficial to its acceptance in communities in Germany, but are more likely to hinder implementation in U.S.-communities. Secondly, the differences found in trust in public authorities and funding mechanisms indicate that the political culture in general has an influence on strategies preferred in adaptation to coastal change: German coastal dwellers generally expect to be able to rely on governmental institutions when it comes to protection from coastal hazards, whereas in the U.S., individualist measures are considered by private households, and NGOs contribute to the funding and design of adaptation measures, in addition to governmental action. In addition to these general observations, the Timmendorfer Strand case demonstrates the influential role of lobby groups, particularly in a setting of a singular dominating industry (here: tourism). These results indicate that both the institutional design and financing mechanisms of adaptation strategies require to be tailored to the relevant political, and economic and cultural context of a site. Thirdly, the preference for individualist measures in the U.S. case studies is likely to be linked to personal experiences of coastal hazards. While coastal adaptation measures considered in Germany are (so far) solely preventive measures, in the US local experience provides a more evident link between reactive and preventive measures. What is more, the German coastal Laender are willing and able to pay

for the largest share of adaptation measures along the Baltic Sea coast, whereas the U.S. state North Carolina is not at all while in Maryland the necessity of governmental activities at state level are acknowledged and initiatives such as the Coast Smart initiative are under way. However at the county level, in this case Dorchester county, the conservative attitude of the elected officials hinders an active public outreach of the state's coastal defense/ adaptation initiatives (Martinez at al., 2014). It is therefore likely that incentives for individual protection, including retreat strategies, which are not at all discussed in Germany but have been frequently mentioned in the U.S. cases, are much higher accepted by U.S. residents than for German coastal dwellers as a result of the individually perceived level of danger. In summary, the results suggest that measures for adaptation to coastal change face opposition for different reasons at the U.S.-mid-Atlantic and the German Baltic Sea coasts, and accordingly divergent strategies and arguments are more suitable for their implementation in the respective coastal communities.

2.3 Overview of BASE European case studies

BASE European case studies focus on a variety of sectors and types of climate adaptation processes (see Table 2-6). The comprehensive typology and characterisation of each case study can be found in details in Chapter 1-Section G of each CSLD. As explained in Section 1.2.1, some case studies are retrospective (post evaluation), prospective (forward-looking) or both; some are local, regional and/or national; some are urban, rural, river basin or coastal; while some are top-down, bottom-up or both. All case studies are located in countries that have a national climate adaptation strategy in place, with Italy and Czech Republic having theirs approved in 2015. However, having a national climate adaptation strategy does not imply actual implementation at the local scale (e.g. Cornwall, Donãna, Šumava, IJsselmeer, Kalajoki, Leeds, Madrid, South Devon, Ílhavo and Vagos, and Alentejo).

Table 2-6. BASE European case study typology and characterization: main goal(s), specific focus, objectives, category, territorial zones, scale, process direction and temporal definition (see Section 1.2.1 and Chapter 1 Section G of CSLD for full descriptions; source: CSLDs; D.5.2 and D.5.3)

BASE Case Study		BASE Case Study Typology						
	Main Goal(s)	Specific Focus	Objectives	Category	Territorial Zones	Scale	Process Direction	Temporal Definition
Alentejo	Explores climate adaptation perceptions, responses and innovations against drought in Alentejo (Portugal).	• Compares bottom-up and top down perspectives on strategies and policies for climate adaptation. • Studies innovative adaptation measures and projects in the region. • Prioritizes measures to be assessed through cost benefit analysis.	1,2,3,4,5,7	A,D,E,G, H,I	Rural	Local, Regional	Bottom-Up	Retrospective Prospective
Holstebro and Lolland	Examines agricultural climate change adaptation in two predominantly rural municipalities situated in different regions of Denmark.	• Analyses autonomous farmers' adaptations and perceptions on climate change. • Holstebro analyses "farmer as water manager" climate adaptation measure • Lolland assesses the hydrological model developed for the Rødby Fjord catchment area.	1,2,3,4,5,7	D	Holstebro: Rural, Urban, River basin Lolland: Rural	Local, Regional, National	Holstebro: Bottom-Up, Top Down Lolland: Top Down (with participatory elements)	Retrospective Prospective

Dartmoor	Characterizes and understands the current plans affecting climate change adaptation processes in Dartmoor national park (UK).	• Analyses climate change adaptation strategy for Dartmoor: how it was developed and who was involved. • Assesses potential risks not yet addressed, and who is and/or will be in charge for which adaptations.	1,3,4,7	A,C,D,G	Rural, River basin	Local, Regional	Top-Down Bottom-Up	Retrospective Prospective
Šumava	Takes stock of climate adaptation impacts on ecosystem services and biodiversity in the Central-European mountainous forested Šumava national park (Czech Republic).	• Analyses the potential impacts of climate change adaptation on biodiversity and ecosystem services sectors (together with tourism and forestry sectors). • Proposes integrated adaptation measures.	1,3,5,6,7	A	Rural	Local	Bottom-Up	Prospective
South Moravia	Investigates suitable and sustainable adaptation measures and strategies in the agricultural sector (particularly wine growing) and water management sector, while incorporating perceptions of local stakeholders in South Moravian region (Czech Republic).	• Studies feasible and sustainable climate adaptation measures for wine-growing areas and for dealing with drought issues. • Analyses local stakeholders' perceptions and preferences towards suitable adaptation measures and strategies.	1,3,5,7	D	Rural	Regional	Bottom-Up	Prospective
Donãna	Contributes to adaptation plans in the region, including the participation of informed stakeholders in Donãna (Spain).	• Understand climate change risk and evaluates potential adaptation options in the Doñana coastal wetlands.	1,3,4,5,6,7	A,B,C,D	Rural, River basin	Local	Bottom-Up	Prospective
Ústí	Investigates sustainable adaptation measures and strategies in the agricultural (particularly hop growing) and water management sectors, incorporates perceptions of local stakeholders in Ústí (Czech Republic).	• Evaluates feasible and sustainable climate adaptation for hop-growing areas (dealing with drought). • Analyses perceptions and preferences towards climate change impacts (in particular drought) and adaptation measures.	1,3,5,7	D	Rural	Regional	Bottom-Up	Prospective
Cascais	Revises the strategic plan for climate change adaptation of the municipality (PECAC) for Cascais (Portugal).	• Reviews the PECAC (2010) through a participatory process. • Analyses the implementation phase of the PECAC, re-prioritizes the Top 20 adaptation actions with new data, and develops an initial action Plan for top 13 actions.	1,2,4,6,7	A,E,G	Urban, Coastal	Local	Bottom-Up Top-Down	Retrospective Prospective
Copenhagen	Examines the urban adaptation strategy, storm surge and cloudburst adaptation plans for Copenhagen (Denmark).	• Determines Copenhagen's capacity to manage adaptation, with a specific focus on participation and strategic inclusion of climate	1,2,3,7	A	Urban	Local, Regional	Bottom-Up	Retrospective Prospective

		adaptation in public planning						
Ílhavo and Vagos	Develops a vision and strategy for climate change adaptation along the coastal stretch of Ílhavo and Vagos (Portugal).	• Facilitates a decision-making process, co-designing with local stakeholders adaptation pathways. •Assesses environmental, economic and social impacts of possible adaptation measures, costs and benefits.	1,2,3,4,5,6,7	A	Coastal	Local, Regional	Bottom-Up	Prospective
Jena	Reviews climate adaptation strategies/measures developed by the Department of Urban Development & City Planning and the Thuringian Institute for Sustainability and Climate Protection (ThINK) for Jena city (Germany).	• Analyses the development of the local adaptation strategy by considering, the role of leadership, types of knowledge used, the role of stakeholder participation. • Studies local climate change impacts using RCPs. • Economic evaluations for selected urban development projects. Heat stress levels (not the related health effects) are considered for the analysis.	1,2,4,6,7	A	Urban	Local	Top-Down (with participatory elements)	Retrospective Prospective
Kalundborg	Reviews the participatory approach used for drawing up climate adaptation strategy through the EU-Interreg project "BaltCICA", of which the Municipality of Kalundborg (Denmark) was a part of from 2009-2012.	• Carries out a retrospective analysis of participatory approaches: scenario workshop with relevant stakeholders followed by a citizen summit where ordinary citizens were consulted on the results of the scenario workshop.	1,2,3	A	Urban, Rural, Coastal	Local, Regional	Bottom-Up Top-Down	Retrospective
Leeds	Develops and evaluates adaptation strategies for managing urban flood risk in the city region and the wider Aire catchment area for Leeds (UK).	• Carries out cost-benefit analysis of three different approaches to adaptation, namely grey infrastructures, Sustainable Urban Drainage Systems (SuDS) for the city of Leeds and an ecosystem-based approach for the Aire catchment area.	1,3,7	B	Urban	Local, Regional	Top-Down	Prospective
Prague	Examines the current flood control system and concepts for integrative flood risk management under climate change (adaptive water management) for Prague (Czech Republic).	• Evaluates the city's adaptive capacity of the city (adaptation to flooding). • Analyses selected key sectors (flood risk management, infrastructure, spatial planning). • Examines heat stress	1,2,4,6,7	A	Urban	Local	Bottom-Up Top-Down	Retrospective Prospective

		adaptation pathway and flood control adaptation measures for Prague.						
Rotterdam	Reviews the flood risk management of the main river tributaries in the Rotterdam area (The Netherlands).	• Carries out a retrospective analysis of participation in the Rijnmond-Drechtsteden subprogramme of the Dutch Delta Programme. • Understands the functioning of adaptive planning while dealing with uncertainty.	1,4,7	B	Urban, Rural, River basin	Local, Regional, National	Top-Down (with participatory elements)	Retrospective
South Devon	Examines climate change adaptation in the South Devon Coast from Dawlish Warren to Teignmouth (UK).	• Understand and explain current discussions on climate change adaptation in the area. • Studies the South West of England's railway infrastructure (vulnerable to storm events): specific focus on the Dawlish Water and Dawlish railway line.	1,3,4,7	A,C,D,G	Coastal	Local, Regional, National	Bottom-Up Top-Down	Prospective
Timmendorfer Strand	Reviews the coastal protection strategy developed using a participatory process and implemented in Timmendorfer Strand (Germany) from 1998 to 2011.	• Determines the socio-cultural, ecological and economically drivers for the community to implement a particular measure. • Carries out a cost-benefit analysis of the already constructed coastal defense system. • Evaluates the participatory and implementation process.	1,4	A	Coastal	Local	Bottom-Up	Retrospective
Venice	Takes stock of private and public actors´ climate adaptation measures to rising sea levels in Venice (Italy).	• Analyses processes of spontaneous private adaptation, using data on costs and benefits of measures undertaken by private and public actors to adapt urban structures (pavement levels) and services (alert systems and emergency services).	1,4	A	Urban, Coastal	Local	Bottom-Up	Retrospective
Cornwall	Assesses climate change adaptation to health risks in Cornwall (UK).	• Reviews adaptation options for skin cancer, with cost-benefit analysis of public health campaigns.	1,2,4,7	D	Rural, Urban, Coastal	Local, Regional	Bottom-Up Top-Down	Retrospective Prospective
IJsselmeer	Examines governance of climate adaptation in the IJsselmeer lake region (The Netherlands).	• Examines the adaptation strategy established within the Delta Programme: envisioned governance arrangements, consisting of the set of stakeholders, actions, means, and instruments to guide and facilitate the adaptation strategy.	2,3	A	Rural, Urban	Local, Regional, National	Top-Down Bottom-Up	Retrospective

Kalajoki	Explores possibilities for "climate proof" flood risk management plans (FRMP) and river basin management plans (RBMP) according to Floods and Water Framework Directives for Kalajoki river basin (Finland).	• Integrates climate change adaptation measures in ongoing management plans. • Compares alternative management choices and their impacts in the Kalajoki river basin.	1,2,3,6	A	Rural, Urban, River basin	Local, Regional, National	Top-Down Bottom-Up	Prospective
England	Improved understanding of using cost-benefit analysis to assess mental health adaptation measures in England (UK).	• Develops methodological framework to assess costs and benefits of cross-sectoral adaptation strategies to reduce the impacts of climate change on mental health in England.	1,2,7	A	Rural, Urban, Coastal	National	Bottom-Up Top-Down	Prospective
Madrid	Assesses climate adaptation to water shortages and heat stress in the Madrid Tagus Water District (Spain).	• Analyses climate change impacts of heat waves and precipitations, and two adaptation measures for Madrid: heat warning systems and green roofs. • Evaluates risks and opportunities of implementing green infrastructure.	2,4,6	A,B,C,D	Rural, Urban, River basin	Local, Regional	Bottom-Up	Prospective

Notes:

[1]Objectives: 1) Compile and analyse 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; and 7) Disseminate findings by sharing the results of the project with policy-makers, practitioners and other stakeholders. (…).

[2]Category: 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; and J) Informal groups, Movements. (source: Chapter 1 Section G in CSLD)

2.3.1 Process Direction: Bottom-up and Top-down

As described in Chapter 1, in this deliverable "bottom-up" refers to an activity that progresses and informs upward processes, regardless of its starting point, while "top-down" refers to an activity that is directed downwards regardless of its starting point. Figure 2-1 illustrates the process direction of each case study, grouped according to its respective meta-groups. In BASE case study research, Lolland, Leeds, Jena and Rotterdam case studies focused mainly on top-down strategies, while Dartmoor, Kalajoki and IJsselmeer case studies started from top-down, and then followed a bottom-up direction. The strategy formulations for Lolland. Jena and Rotterdam case studies were largely top-down, but with participatory elements. Case studies, namely Holstebro, Cornwall, England, Kalundborg, South Devon, Prague and Cascais started from bottom-up initiatives followed by top-down strategies, while the rest (i.e. Šumava, Ústí, South Moravia, Donãna, Alentejo, Madrid, Copenhagen, Timmendorfer Strand, Venice, Ílhavo and Vagos, and Cascais) focussed on bottom-up initiatives (Figure 2-1). Some of the activities which were ignited through BASE case study research (e.g. implementation process) are either partially integrated (e.g. Cascais), or in the process of being integrated into local, regional or national plans (e.g. Ílhavo and Vagos). The integration process can be a dawdling process, therefore the actual realization of some of these activities goes beyond BASE time frame. Consequently, at

this point in time, it is not plausible to indicate with certainty the onwards process direction of every case study. For instance, case studies with only bottom-up initiatives may eventually be incorporated into top-down strategies.

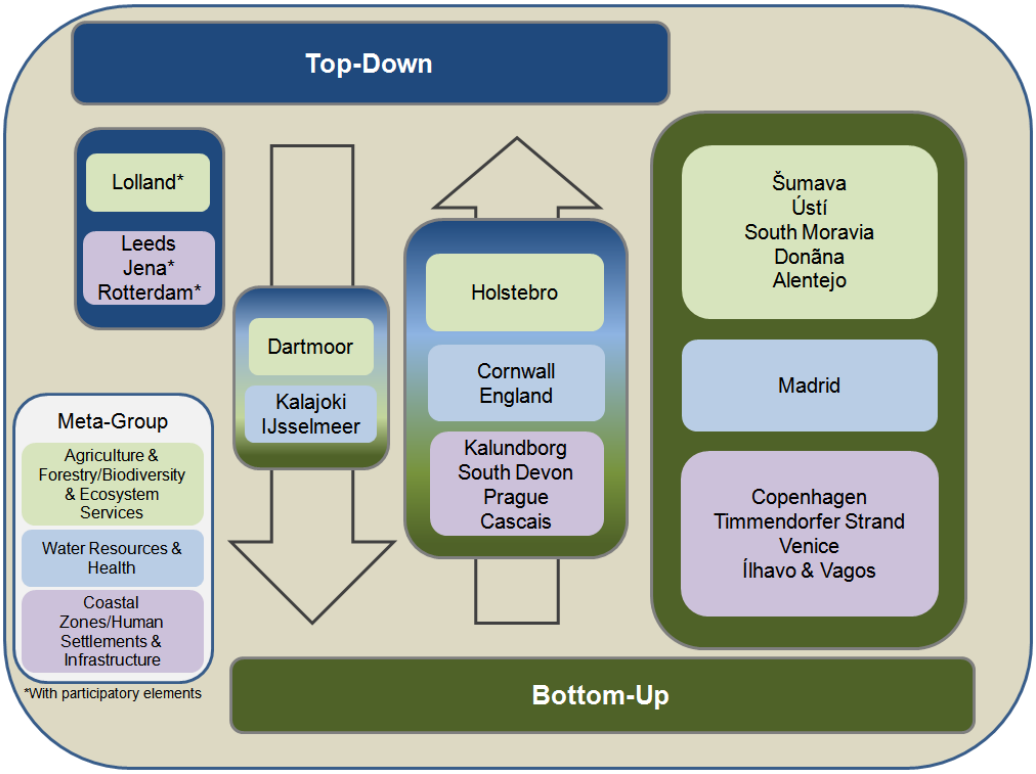


Figure 2-1. BASE European case studies adaptation process direction focus: top-down (no arrow), top-down followed by bottom-up (arrow pointing from top-down towards bottom-up), bottom-up followed by top-down (arrow pointing from bottom-up towards top-down) and bottom-up (no arrow) (Source CSLDs, D5.4)

BASE European case studies face different sets of climate-related risks and impacts, different drivers and funding, and different implementation phases. Climate-related risks and impacts range from flooding (pluvial, fluvial and coastal), coastal erosion, damage from extreme events, heat stress, water scarcity, water degradation, droughts and ecosystem degradation. Some of these case studies focus on direct climate adaptation measures (e.g. Copenhagen, Cascais), while others focus on indirect measures (e.g. Kalajoki, Timmendorfer Strand). Specific measures were determined for each case study and, in some cases, single measures were grouped into a bundle of measures. For instance, the context of adaptation to rising sea-levels and increased coastal erosion a number of grey and soft measures by be needed (e.g. Kalundborg; Ílhavo and Vagos). Single measures may also have an impact on one or more sectors, with either the same or different adaptation targets (e.g. urban green infrastructures, combined with green corridors could prevent flooding, but also be effective in reducing heat and protecting local biodiversity). Table 2-7 below offers the full set of strategies, plans and measures studied by European case studies. The table can be a useful synthesis for BASE WP 6 and 7 (particularly D7.1).

Table 2-7. BASE European case study climate change adaptation strategy/plan/measure/initiative (Source: CSLDs; D5.2)

BASE Case Study	Climate Change (CC) & Adaptation					
	Primary CC Impacts (BASE)	**Plan/Measure that the case study is based on or contributes towards**	**Main Driver**	**Funding of the Measure being studied at the time of the case study**	**Implemented/ Phase**	**Climate Adaptation Strategy/Plan/Measure/Initiative (Individual or bundle of measures)**
Alentejo	Heat stress, Water Scarcity, Droughts, Soil erosion	Identify and prioritize climate change adaptation measures to drought (to inform climate change policies for the region, such as the National Adaptation Strategy)	Social-ecological vulnerability: Land abandonment, increased soil degradation, droughts and risk of desertification	Regional (no funding), Tamera eco-villa (Private), *Centro de Convergencia* (Private)	Ongoing/ Assessment & Planning	• Adaptation measures for agriculture and forests • Water retention in the landscape: artificial landscape (Tamera). • Social innovation as an initiative against land abandonment and land degradation.
Holstebro and Lolland	Holstebro: Fluvial flooding, Pluvial flooding Lolland: Pluvial Flooding	Climate Adaptation Strategic Plan (2015): - Holstebro the 'farmer as water manager' measure. - Lolland Risk management plan; Climate adaptation plan in progress. Development of a hydrological model. Farmer autonomous climate adaptation analysed in both.	• EU flooding directive (Directive 2007/60/EC). Municipality identified by the Government as a flood risk prone area. • National requirement that Danish municipalities develop plans for how to adapt to climate changes.	Holstebro 'Farmers as water manager' would need national subsidies to initiate implementation . Lolland: No public funding	Holstebro: Ongoing/ Assessment, Planning, Implementation Lolland: No, decision to not implement due to regulatory framework and lack of financial resources	• The 'farmer as water manager' in conjunction with the construction of a dam to retain water upstream. • Farmers' autonomous climate adaptation is analysed in Holstebro, Lolland and nationally.
Dartmoor	Droughts, Pluvial flooding	Climate change adaptation strategy developed in 2011, Management Plan 2014-2019, Bog Restoration Project, Farming Futures Project	National policy programme for National Parks, Dartmoor National Park Authority, Bottom-Up Local Initiative, Bottom-Up Local Initiative	Dartmoor National Park Authority	Ongoing-No/ Planning, Implementation	• Changes to animal stocking to protect peat • Managing tourism, to reduce stress on ecosystems • Changes in land management • Measures related to managing wildfires • Measures related to managing pathogens • Measures related to managing flood risks • Longer term abandoning of peat measurement and reforestation of the upland area
Šumava	Ecosystem degradation	Since climate change adaptation has not been a mainstream issue in the Czech Republic, there has not been a pronounced adaptation process in the Šumava Mountains so far.	Damages from extreme weather related events	No extra public funding available for adaptation	No/ Assessment & Planning	• Sustainable forest management: choice of native tree species, diverse age classes, game regulation, selective thinning, etc. • Peat land and water course restoration: restoration actions to promote water retention in the landscape and increase carbon storage • Enhance ecosystem resilience: enlargement of core protection areas
South Moravia	Water Scarcity, Droughts,	Adaptation measures reflect potential activities related to	In case of agriculture, specifically wine	No extra public funding available for	No/Assessment & Planning	• Autonomous adaptation • Soft measures - Insurance policies

	Damages from extreme weather related events	drought and extreme weather events in the agricultural sector.	growing and non-existence of particular sectorial adaptation strategy, the adaptation actions are rather fragmented and autonomous.	adaptation		• Agricultural management practices - permanent set aside of arable land,changes in planted crop variety, no-tillage technologies, shift in the timing of agricultural activities. • Water saving measures - increase of water retention, change in irrigation practices
Donãna	Water Scarcity, Droughts	Flexible adaptation options to climate change in the Doñana wetlands	World heritage and biodiversity site. Iberian rice accounts for about one quarter of the total rice production of the European Union. Intensive water management required to produce rice stands at a crucial point since freshwater supply is deteriorating at an unprecedented rate.	Public funding included in the Rural Development Plans of Pillar II of CAP. Private funding included in the budget of the Irrigators Communities	Ongoing/ Assessment & Planning	• Construction of a pipeline connecting the reservoir with the rice fields • Purchase of 20% of rice fields
Ústí	Water Scarcity, Droughts, Damages from extreme weather related events	Local adaptation actions	National subsidy program of the Ministry of Environment "Support of restoration of natural landscape features" aims to design and implement adaptation measure in forest and non-forest sectors. Farmers already experience and adapt autonomously to climate change impacts related to extreme weather events.	No public funding	No/ Assessment & Planning	• Autonomous adaptation • Soft measures - Insurance policies • Agricultural management practices - permanent set aside of arable land, adaptation measures related to changes in planted crop variety, No-tillage technologies, shift in the timing of agricultural activities (e.g., time of planting, sowing, treatment) • Water saving measures - increase of water retention, change in irrigation practices
Cascais	Heat stress, Water scarcity, Pluvial flooding, Coastal erosion, Damages from extreme weather related events	Cascais Strategic Plan for Climate Change (Assessment & Implementation)	Cascais Municipality	Cascais municipality; Águas de Cascais; EMAC (Municipal Environmental Company)	Ongoing/ Assessment, Planning, Implementation, Monitoring, Evaluation	• Green Corridors of Cascais • Water savings in distribution • Training and raising awareness workshops and events

Copenhagen	Flooding (storm surge; urban heat islands) Coastal flooding, Coastal erosion, Damages from extreme weather related events Pluvial flooding	Copenhagen Adaptation Plan 2011 and Copenhagen Climate Plan 2012 CO2 Neutral by 202; Storm-surge adaptation planning; Cloudburst	Explore potential benefits and costs, and consequences of, adapting to increased risks of climate change induced flooding, for future work on a comprehensive climate strategy and a detailed climate adaptation plan.	City of Copenhagen, with additional state funding	Ongoing/ Implementation	• Local rainwater retention measures (green areas, permeable surfaces; ponds; green roofs, etc.) • separation of surface and ground water and establishment of network of water ways to channel cloudburst rains into e.g. the harbour or the lakes • Renovation of housing in regenerated areas. • Dike Sluices • Sewage system Backflow valve in basements
Ílhavo and Vagos	Coastal flooding, Coastal erosion, Damages from extreme weather related events	Participatory Exercise for Climate Action Plan for Adaptation for Ílhavo and Vagos Coasts	Winter storms & damages	No funding	Ongoing/ Assessment & Planning	• Artificial sand nourishment; • Sand dikes (and relocate farming fields); maintain existing structures (groynes); build a longitudinal adherent construction on the existing groyne South of Vagueira Beach (Vagos); • Re-align the direction of the Aveiro Harbour's Southern groined; • Build an artificial reef in front of either Barra or Vagueira beach (or both). • Re-vegetation of affected dune areas.
Jena	Heat stress, Pluvial flooding	Measures, which are economically assessed, are likely to be implemented on the basis of the local climate change adaptation strategy Jenaer KlimaAnpassungsStrategie - JenKAS	Urban adaptation strategy led by head of the Department for Urban Development and City Planning and local scientists. Financed through a research programme of the German Federal Ministry of Traffic, Construction and Urban Development and co-financed by local public funds	Additional planning costs borne by the municipal Department for Urban Development and City Planning; potential additional investment and maintenance costs to be borne by the City of Jena	Ongoing/ Assessment, Planning, Implementation	• Green structures (trees, bushes, façade greening, roof greening); • Reflective properties of surfaces (albedo); • Type and extent of soil sealing; Composition and properties (size, etc.) of building structures
Kalundborg	Coastal flooding	Kalundborg climate change adaptation strategy	General strategy Initiated by Municipality of Kalundborg (EU-Interreg project 'BaltCiCA' from 2009-2012), but in 2012 national legislation mandates climate change adaptation strategy by all Danish municipalities.	Kalundborg municipality	Ongoing/ Assessment, Planning, Implementation	• Visions identified by stakeholders: • Offshore dikes • Large dikes on the coast and land • Phasing out of vulnerable areas with human settlement during this century • Quicker conversion to natural areas (no temporary protection) On the basis of the 4 visions 24 concrete adaptation solutions were defined.

Leeds	Fluvial flooding	Flood risk adaptation. No adaptation strategy for Leeds, only a National Adaptation Strategy, and currently a Flood Alleviation Scheme is being constructed in the city centre. Thus, there is no coordinated or planned process for adaptation and specific (often isolated) activities are mentioned.	Flooding events & damages	Several sources, mainly central government and local city council	No/ Assessment	• Grey infrastructure • Sustainable Urban Drainage Systems (SuDS) • Ecosystem-based approach (EBA)
Prague	Fluvial flooding, Heat Stress	Czech National Adaptation Strategy is being developed. A common understanding of need for climate change adaptation is yet to be developed. Flood control system.	Increasing risk and occurrence of destructive flood events not only in Prague but also across the whole country.	No extra public funding available for adaptation	Flood risk: Yes/Implementation Heat stress: Ongoing/ Assessment & Planning	• Non-structural measures: disaster response management, risk transfer tools, monitoring and management • Structural: Improving flood defences (engineering)
Rotterdam	Coastal flooding, Fluvial flooding, Damages from extreme weather related events	Rijnmond-Drechtsteden subprogramme of the Dutch delta programme	Climate change, urbanisation, and population and economic growth.	Dutch Delta Programme	Ongoing/ Implementation	• Dike reinforcement • Water storage Grevelingen • Room for the River measures • Channel deepening • Full closure with dams and sluices
South Devon	Coastal flooding Coastal erosion Damages from extreme weather related events Fluvial flooding	Adaptation of the railway connection Shoreline Management Plan	No clear actor or policy drivers. Local & regional (Environment Agency and Teignbridge District Council) and semi-public (Network Rail)	No funding yet available for adaptation	No/ Assessment & Planning	• Business-as-usual: maintain existing sea defences and conduct repairs to damage to the rail infra-structure, cliffs and sea wall from storm events as and when they occur. or • Strengthen existing sea defences. This would involve strengthening and heightening the sea wall, stabilising the cliffs through wire netting and bolting, and measures to mitigate the erosion of beech material (e.g. improved groynes). • Reroute the railway inland away from the Dawlish coast. • The installation of domestic flood gates at 50 at risk properties Individual domestic flood gates to be fitted to all 50 properties. • The installation of sluice gates up stream to hold back flood water, thus protecting property in the two centre.
Timmendorfer Strand	Coastal flooding, Coastal erosion	Participatory integrated coastal zone management (ICZM): coastal defence planning	Regional ministry of the federal state. Former mayor of the town.	EU-funding via Cohesion policy / Federal Government / City	Yes/ Evaluation	Coastal protection measure in combination with a landscaping-project.

Venice	Coastal flooding	Autonomous adaptation, going on the background of a great infrastructure project which is being promoted since some time as potential adaptation measure.	The adaptation approach assessed only individual decisions made by single actors. Yet, financial resources from public subsidies for building renovation for private households have been used in the past, for implementing private flood proofing measures.	No public funding	Yes/ Implementation	Adaptation to privately owned residential and commercial buildings mitigating flood risks
Cornwall	UV radiation	Adaptation to climate change related health risks in Cornwall	Climate change may have significant adverse impacts on human health.	No public funding	Ongoing/ Assessment	• Cancer Research 'Sunsmart' • Met Office 'UV Index' prediction • Save Our Skins toolkit
IJsselmeer	Water Scarcity, Flooding, Droughts	Adaptation strategy developed within the Delta Programme	National policy program on climate adaptation: Delta Programme.	Dutch Delta Programme	Ongoing/ Planning	Creating more flexibility in the water levels of the lake and surrounding water systems
Kalajoki	Fluvial flooding, Water quality, Damages from extreme weather related events	Flood risk management planning River basin management planning	In National implementation of the Floods Directive and the Alavieska-Ylivieska region in Kalajoki, the river basin was nominated as a nationally significant flood risk site, based on the likelihood of flooding and the major negative consequences of extreme floods. Water Framework Directive	No extra public funding available for adaptation	Ongoing/ Planning	Combination of measures will be needed to achieve the objectives. Analysis focuses on the prioritisation: • Buffer zones (different slopes) • Small constructed wetlands (different % of fields) • Medium constructed wetlands (different % of fields) • Large constructed wetlands (different % of fields) • Winter time vegetation cover (different slopes) • Perennial grass (different slopes) • Controlled drainage • Optimal fertilization
England	Mental health	No specific mental health and climate change adaptation plan available to date. The case study examines costs of anti-depressant prescribing and how this may/may not increase in the future as a consequence of climate change (excluding effects of extreme events). Treatment is itself a form of adaptation. Autonomous adaptation assumed.	Climate change may have significant adverse impacts on human health. However, very few studies exists that examine the impact of climate change on mental health.	No funding yet available for adaptation	Ongoing/ Assessment	Anti-depressant prescribing

Madrid	Heat stress, Precipitations, Water Scarcity, Droughts, Damages from extreme weather related events	Climate adaptation to water shortages in the Tagus Water District of Spain, predominantly in urban municipalities: Heat warning plan and green roofs.	Multiple vulnerabilities due to: large size and population, its drought-prone climate; use of trans-boundary water. Vulnerability to heatwaves and change in precipitations.	No public funding	Ongoing for heat warning system/Assessment phase for green roofs	• Reuse of urban water • Water rights exchange programmes • Heat-health warning systems • Green infrastructures: trees in the street, parks, green roofs

2.3.2 **Methodologies and data sources**

BASE project's main objectives included developing new tools, methods and approaches (for impact assessments, for economic assessments and for participatory approaches), which in practice led to a wide span of methodologies used by case study owners. In this sub-section, Table 2-8 below presents the different analyses, models and tools used by each BASE European case study.

Regarding economic assessments, a detailed description of each case study can be found in D5.2. The general approach for the economic evaluation of climate change adaptation alternatives applied to these case studies followed five basic steps (methodology adapted from Gebhardt et al. (2013) and described in detail in D5.2): 1) Preliminary risk assessment; 2) Identification of adaptation options; 3) Selection of the evaluation method and the evaluation criteria; 4) Data collection; and 5) Evaluation and prioritization. In BASE, CBA was the most-employed economic assessment tool and is often applied in flood-risk assessments (fluvial, pluvial or coastal), in ecosystem services (InVEST model) and in the health decision-making context, across BASE European geographical distribution. However, model availability for generating monetary input data is a prerequisite for using this approach. Evaluation methods such as cost-effectiveness analysis (CEA), multi-criteria analysis (MCA), choice experiments (CE) and sector/measure-specific economic models are used either in place of or in addition to CBA. Another challenge demonstrated through BASE European case studies and in agreement with Meyer et al. (2013) is the accounting of intangible aspects which are rarely translated into monetary terms (e.g. Rotterdam and Prague). Tools for accounting monetisation of intangible effects (e.g. contingent valuation, choice modelling, travel cost approach and hedonic pricing) are available, however they are seldom employed in reality, likely due to the demanding efforts and resources required to carry out these analyses. Evaluation methods such as real option analysis (ROA) and robust decision-making (RDM) are valuable for explicitly addressing uncertainties, but they are highly complex and require a high computational effort. Therefore, they were not applied by BASE case studies which are relatively small and local (D5.2 p. 131). However, they are advisable for bigger and longer-term investment decision analysis studies in contexts with deep uncertainty. Four case studies applied the Dynamic Adaptation Pathways (DAP) approach and indicated the adaptation tipping points for changing paths (with the exception of IJsselmeer where no clear tipping point was identified), namely Prague, Rotterdam, Ílhavo and Vagos, and IJsselmeer.

A common challenge and struggle in case study research is finding good data sources. The reliability of any analytical result depends on the quality of the input data. In BASE, the main challenges felt concerned acquiring local climate data, socio-economic data, and cost and benefit data. This was specifically pointed out by the Prague and Kalajoki case studies. The cost-related data used in BASE European case studies came mostly from official sources such as guidelines, statistics, maps and plans, as well as scientific literature. Local stakeholders may be good channels, particularly for obtaining data that are not publicly available (e.g. Šumava Region, Cascais, Prague and Leeds). Additional data also came from International reports, research studies, scientific sources, private consultancies and experts. In cases where cost-data was not accessible or applicable, CE was applied to evaluate the cost data for compensation to farmers (e.g. Holstebro), and modelling results were used to estimate dike reinforcement costs (e.g. Rotterdam). Benefit-related data came mostly from impact assessment models, by estimating the benefits in terms of damage reduction (or avoided costs) through comparing impacts with and without the planned adaptation options. In

some instances, data was provided also by insurance companies (e.g. Ílhavo and Vagos); through household surveys (e.g. Kalajoki), by stakeholder workshops (e.g. Kalajoki and Copenhagen) and expert interviews (e.g. Jena, Rotterdam and Kalajoki). Impact assessment tools used in BASE case studies include the InVEST model for ecosystem services (e.g. Šumava Region and Alentejo), the Planning Kit DPRD for flood risk assessment and management (e.g. Rotterdam), the urban heat tool (UrbaHT) for heat stress (e.g. Jena and Prague), the WAAPA model for water availability (e.g. Doñana) and the VEMALA model for nutrient loading (e.g. Kalajoki). Details of the data source can be found in D5.2 and in the CSLDs.

Table 2-8. BASE European case study climate adaptation analysis, models and tools (Source: CSLDs; D5.2; D5.3)

Case Study	Analysis, Models & Tools					
	Climate Change-related Impacts	**Participatory Approaches & Social Learning**	**Economic Assessment**	**Evaluation/ Prioritization**	**Sensitivity Analysis**	**Adaptation Tipping Points & Dynamic Adaptation Pathways**
Alentejo	n/a	• Stakeholder meetings & workshops • Questionnaire & semi-structured interviews with farmers • Participatory Action-Research • PBCA • Participatory add-ons to MCDA • Systemisation of experiences (results published by Campos et al., 2015)	CBA (Use of the InVEST Model for the Ecosystems services)	MCA	n/a	n/a
Holstebro and Lolland	Based on existing scenarios (IPCC)	• National online survey for farmers´ CC perception • Local stakeholder interviews & survey	Holstebro: • Cost effectiveness analysis (CEA) (Choice Experiments (CE)) • Simple cost benefit analysis (CBA) Lolland: n/a	n/a	Holstebro: Applied different discount rates Lolland: n/a	Possible tipping point Holstebro: flood protection financial cost. No assessment of when that tipping point would be reached. Lolland: n/a Adaptation pathway: n/a
Dartmoor	n/a	• Stakeholder analysis • Semi-structured & structured interviews with key stakeholders	n/a	n/a	n/a	n/a

Šumava	• Ecosystem modelling	• Scenario workshops	CBA (InVEST Model)	n/a	Minimal, medium and maximal level of marginal values of ecosystem services; analysis for RCP4.5 and 8.5; discount rates 1% and 5%	n/a
South Moravia	n/a	• Questionnaire-based survey for wine growers • Semi-structured interview with relevant stakeholders • Stakeholders' perception assessment • Statistical analysis	n/a	n/a	n/a	n/a
Donãna	WAAPA model (Water Availability and Adaptation Policy Analysis)	• Semi-structured individual interviews to local actors • Participatory add-ons to MCDA • Expert panel	CBA	• Water Policy scenarios • MCA	n/a	n/a
Ústí	n/a	• Questionnaire-based survey for hop growers • Semi-structured interview with relevant stakeholders • Stakeholders' perception assessment • Statistical analysis	n/a	n/a	n/a	n/a
Cascais	n/a	• Stakeholder meetings & workshops • Training & raising awareness workshops • PBCA • Participatory add-ons to CBA • Participatory add-ons to MCDA	CEA	MCA	PRIMATE	n/a

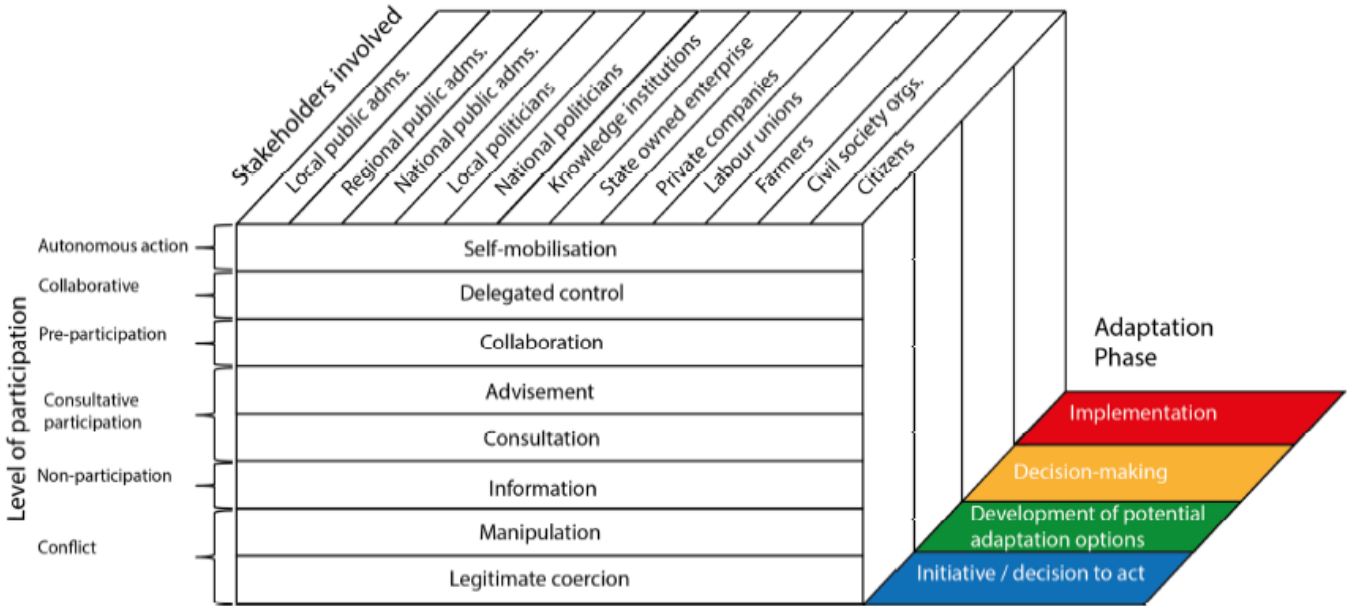
Copenhagen: **a) Urban Adaptation Policy** **b) Storm surge** **c) Cloudburst**	a-i) assessment of impacts and costs + possible actions to minimize risks and costs of these actions a-ii) risk map b-i) risk map b-ii) maximum propagation of high tide c) maximum propagation of flood	a-i) citizens reporting + participatory processes in local areas a-ii) appointment of experimental neighbourhood with wide testing of novel options and participation of local residents (living lab) b-i) Facilitating stakeholder involvement in legislative planning process b-ii) Stakeholder workshops b-iii) Participatory add-on to MCDA b-iv) Qualitative semi-structured interviews b-v) Participatory add-ons to Adaptation Pathways b-vi) Scenario workshops c) c) Qualitative semi-structured interviews with citizens, politicians, administrative bodies and other stakeholders	a) economic risk and impact assessment b-i) CBA b-ii) Economic risk assessment c) CBA	a-i) evaluation of individual projects a-ii) mid-term evaluation of Climate Plan/Eco-Metropolis which is the master strategy for the design of the Adaptation Plan b) MCA c) n/a	a) n/a b) Economic sensitivity analysis for sea level rise c) Economic sensitivity analysis for cloudbursts	n/a
Ílhavo and Vagos	n/a	• Scenario workshops • Participatory add-ons to Adaptation Pathways • SWAP	CBA	MCA	Sensitivity Analysis for different discount rates and different bundles of measures.	Tipping points: sea level rise; coastal erosion; Adaptation pathway: Scenario Workshop
Jena	Urban heat tool – UrbaHT	Stakeholder interviews; Participation in interdepartmental working group on local climate change adaptation; Regular presentations on progress and (intermediate) results to local stakeholders and decision-makers; Participatory add-ons to MCDA (elicitation of weights and determination of preference functions based on stakeholder consultations)	MCA, partial CBA	MCA (Stochastic PROMETHEE II); CBA	Monte Carlo simulations	n/a
Kalundborg	• 3 future scenarios • Flood mapping • Risk mapping	• Local stakeholder scenario workshops • Citizen summit (350 citizens representative of demographic distributions) where selected citizens were provided information, participated in discussion and voted.	• Comparison of cost & benefit, • Value cost mapping	n/a	n/a	n/a
Leeds: **a) Sustainable drainage** **b) Ecosystem-based adaptation** **c) Infrastructure**	Based on UK Climate Projections (UKCP09) central estimate of climate change for the Leeds area	• Consultations with key actors • Unstructured interviews with key stakeholders	a) CBA b) CBA c) CBA	n/a	Sensitivity Analysis	Tipping points: Increasing flood risk; population growth/urbanisation Adaptation pathway: n/a

Prague	n/a	Participatory Add-ons to adaptation pathways	CBA	n/a	discount rates of 1%, 3% and 5%	Tipping point: heat stress level Adaptation pathway: urban heat Island
Rotterdam	• 4 scenarios using "Steam" and "Rest" scenarios	• Interviews • Content Analysis	• CBA • Planning Kit DPRD • KOSWAT model for dike cost	MCA	n/a	Tipping point: cost option Adaptation pathway: most efficient
South Devon: **a) Railway management** **b) Flood risk management**	n/a	Interview with key actors	a) CBA b) CBA	n/a	a) Monte Carlo analysis b) Monte Carlo analysis	Tipping points: a) sea level rise and storm events b) extreme events Adaptation pathway: n/a
Timmendorfer Strand	2 extreme flooding scenarios	• Semi-structured in-depth interviews with relevant stakeholders • Random short interviews	CBA	n/a	n/a	Tipping point: dike height
Venice	damages to buildings (measured in terms of increased maintenance costs)	• Survey on ground floor units in the historic Centre • Interview with the Municipality	CBA	individual investment decisions	discount rates of 1%, 3% and 5%	Tipping point: physical condition of the buildings
Cornwall	• Process-based modelling • Welfare variation analysis under restrictions	Discussion with key stakeholders	CBA	n/a	Climate Risk Management Process	n/a
IJsselmeer	n/a	• Semi-structured in-depth interviews with insiders, • Focus groups with insiders & experts • Stakeholder workshops	n/a	n/a	n/a	Tipping point: n/a Adaptation pathway: 5 water resources management pathways: • Continuing with drainage and pumping • Flexible water levels of the lake • Flexible water levels of the surrounding water bodies • Water usage • Water safety

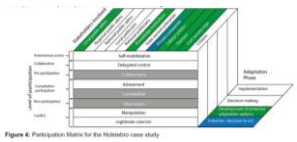
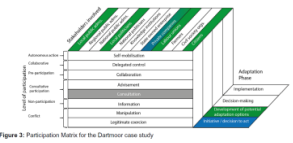
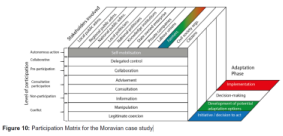
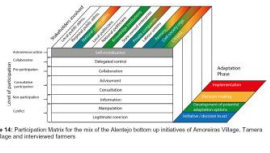
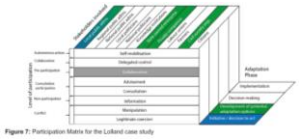
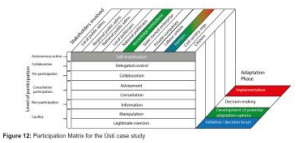
Kalajoki: a) flood risk management b) water quality management	a-i) MSFS hydrological modelling of the impacts of adaptation measures on climate change adaptation. a-ii) Delta change method a-iii) 20 different climate scenarios from both global and regional climate models using three SRES-emission scenarios a-iv) Flood risk map b-i) VEMALA hydrological and nutrient loading model. b-ii) 3 realistic climate scenarios	a-i) Contingent valuation (CV) postal questionnaire to 1320 local river basin residents about the flood risk perceptions and acceptability of measures. a-ii) Stakeholder workshops a-iii) Applied participatory multi-criteria decision analysis (MCDA) in flood risk planning b) n/a	a-i) Decision making not based on economic analysis due to uncertainties and insufficient data on costs and benefits. a-ii) Simple "cost-benefit analysis exercise" was carried out to see whether the measures seemed to be feasible or not from flood protection perspective. b-i) CEA using excel-based tool KUTOVA b-ii) Economic agricultural sector model DREMFIA	a) MCA b) n/a	a) n/a b) Monte Carlo simulations	Possible tipping points: a-i) objectives for flood risk management a-ii) increased seasonal variation in hydrological conditions. b) No clear tipping points Adaptation pathway: n/a
England	• Statistical analysis of the impact of background climate variation (excluding extreme events) conducted with the additional use of GIS analytical methods. • Process-based modelling • Welfare variation analysis under restrictions	Informal stakeholder engagement	Planned CBA but given the outcomes (positive) no CBA, considered wider economic benefits (savings) in predicted reduction in prescribing for mild-moderate depression	n/a	n/a	n/a
Madrid	• WAAPA model & climate change scenarios were used to present at stakeholders meetings. • Fuzzy cognitive mapping (FCM) • Epidemiological study Cost-benefit analysis	• Personal interviews with stakeholders following the FCM	CBA	n/a	Sensitivity analysis	n/a

Participatory approaches and social learning processes (see as example the description of the Systematization of Experiences of the Convergence Centre – a subcase of Alentejo - in Campos et al., 2015) are employed within varying levels and formats across sectors and geographic distribution. Figure 2-2 below depicts the participation matrices generated in D5.3 according to their meta-groups and designated European regions. The participation matrix illustrates the level of participation, the stakeholders involved and adaptation phase(s) for each relevant case study. As illustrated through Figure 2-2, stakeholder range and adaptation phases are more extensive in the Coastal Zones/ Human Settlements and Infrastructure meta-group across European regions. However, no clear common-based approach can be derived from the heterogeneous participation matrices, reiterating the obvious fact that public participation is largely dependent on local socio-cultural contexts and evaluation stage. Few et al. (2007) pointed out that tension between public participation principles and anticipatory climate policy and adaptation in decision-making process could arise as a result of including a wide range of stakeholders of varying powers. Their research suggests that a narrower approach to participation with explicit definition of scope and limits from the beginning of the process is more likely to succeed within this context. However, key messages and lessons learned from BASE case studies (given in the following section 2.4) advise on including a wide diversity of stakeholder groups, regardless of the difficulties in finding consensus, contending that methodological approaches, such as the Scenario Workshop and other participatory methods, can aid in reaching a higher level of agreement. Nevertheless, it remains central to consider when, why and how to integrate participation in climate change adaptation processes (Avgitidou, 2009). For

instance, the Kalundborg case study shows different results between a citizen summit and a local stakeholder scenario workshop. In Cascais, climate adaptation priorities changes when other stakeholder groups were included in the discussion, four years after the municipality adopted a climate change strategy.



Participation matrix template (Source: D 5.3)

Meta-Group	Northern Europe	Western Europe	Central-Eastern Europe	Southern Europe
Agriculture & Forestry/ Biodiversity & Ecosystems	Holstebro 	Dartmoor 	South Moravia 	Alentejo 
	Lolland 		Ústí 	

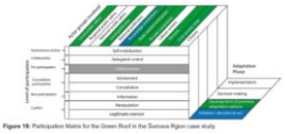
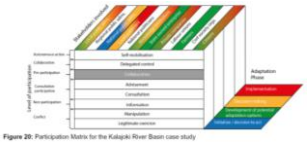
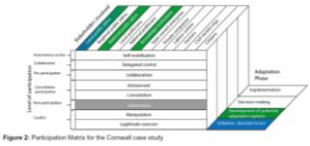
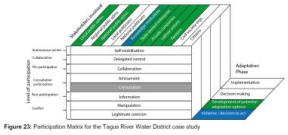
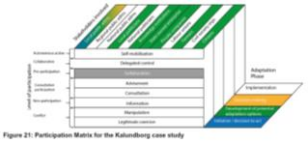
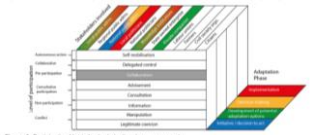
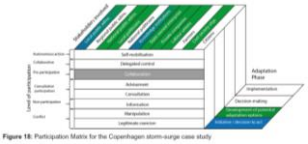
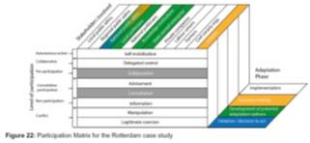
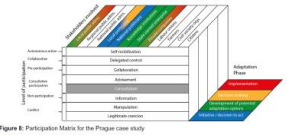
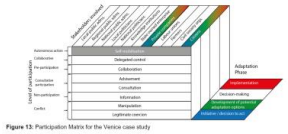
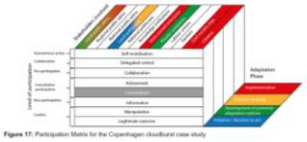
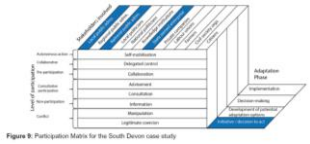
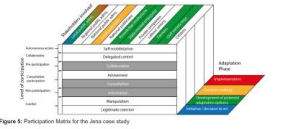
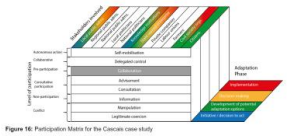
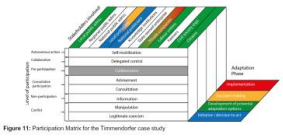
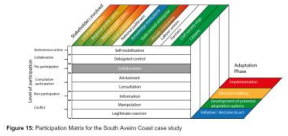
			Šumava 	
Water Resources & Health	Kalajoki 	Cornwall 		Madrid 
	Kalundborg 	IJsselmeer 		
Coastal Zones/ Human Settlements & Infrastructure	Copenhagen - StormSurge 	Rotterdam 	Prague 	Venice 
	Copenhagen - Cloudburst 	South Devon 	Jena 	Cascais 
			Timmendorfer Strand 	Ílhavo and Vagos 

Figure 2-2 BASE European case study participation matrix categorised by European regions and meta-groups (individual participation matrix retrieved from D5.3)

Evaluation tools combined with participatory approaches were applied in some case studies (Table 2-8). These approaches include participatory add-ons to CBA (P-CBA), participatory add-ons to multi-criteria decision analysis (P-MCDA), participatory add-ons to adaptation pathways (P-AP), and participatory benefit-cost analysis (P-BCA). Of these, P-BCA is a new tool developed through BASE case study research. It is a simple tool to implement, as it can be easily incorporated into an existing workshop (Alves, 2015). PBCA is complementary to CEA, CBA and MCA. For instance, MCA could help filter variables into a set of top 3 or 5 priorities, PBCA could then be applied to determine the most relevant impacts from selected priorities, and lastly CBA or CEA could be executed to quantify these impacts. Figure 2-3 illustrates the number of case studies that applied each of these approaches.

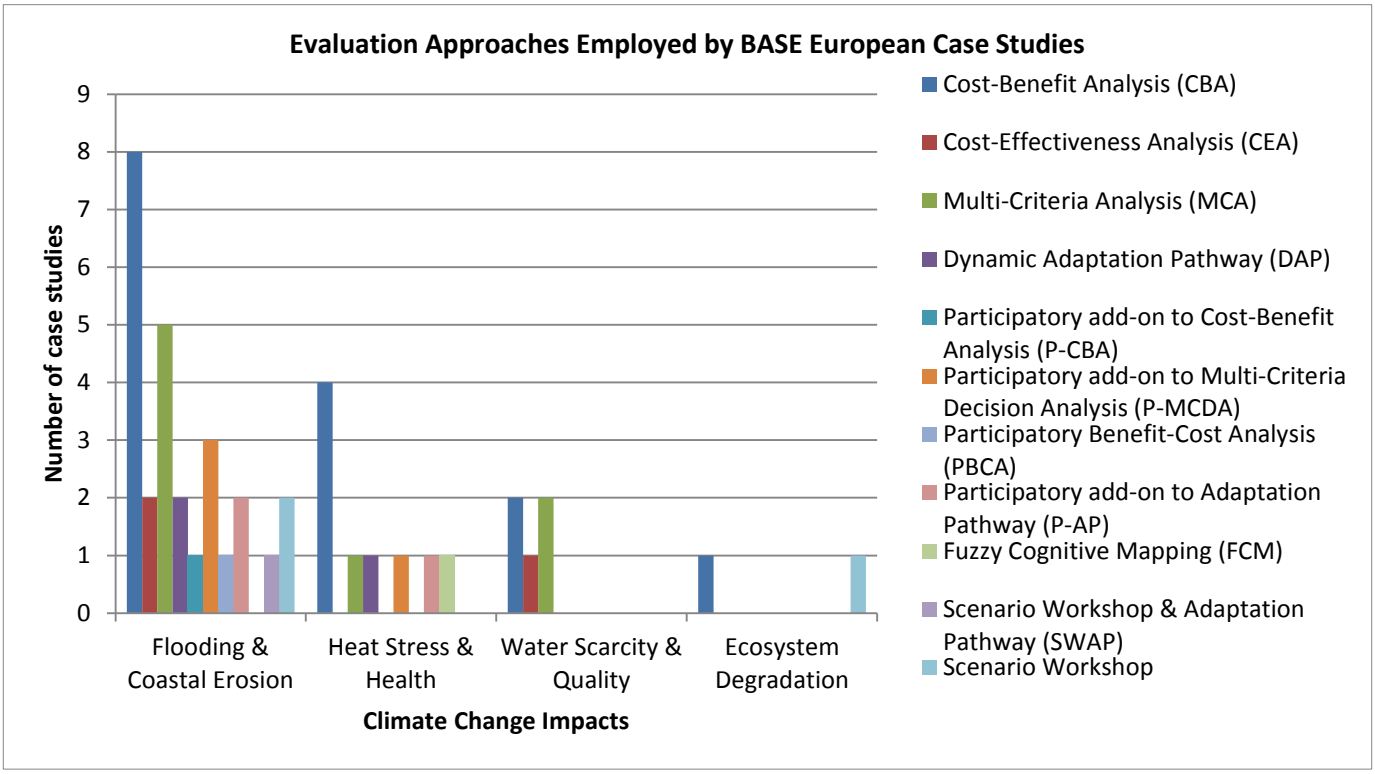
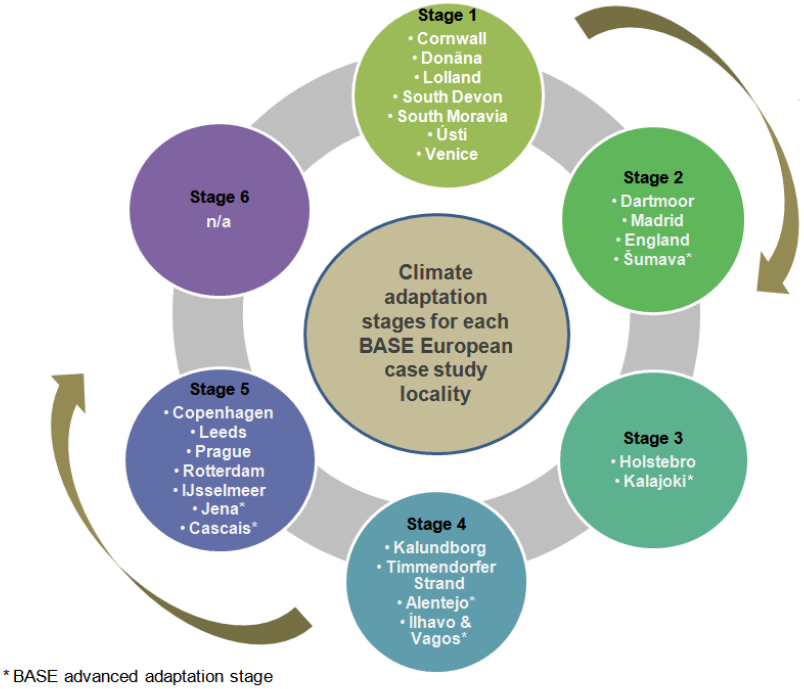


Figure 2-3 Evaluation approaches employed by BASE European case studies (source: CSLDs; D5.2; D5.3; Table 2-8)

The Urban Adaptation Support Tool available from the European climate adaptation platform (Climate-ADAPT, 2015) was adapted to demonstrate the temporal adaptation stage for each BASE European case study (see below Figure 2-4). This classification considers only BASE activities that have been officialised or incorporated by local authorities. Six case studies flagged with "*" in Figure 2-4 (i.e. Ílhavo and Vagos, Alentejo, Šumava, Jena, Kalajoki and Cascais) advanced in climate-related adaptation through BASE project. Except for Jena and Cascais, the other case studies did not have a local adaptation plan/strategy in place at the beginning of BASE research. A detailed description of the implementation analysis can be found in D5.4. Not surprisingly, case studies at Stages 5 are all developed European cities. Currently, none of the BASE European case studies are at Stage 6, however, some of the case studies at Stage 5 are moving towards Stage 6 (e.g. Rotterdam, Copenhagen, Cascais). Of interest, Ílhavo and Vagos and Alentejo case studies (Portugal) advanced local climate change adaptation as a result of BASE research and are at Stage 4, despite not even having a local adaptation strategy in place. This highlights how bottom-up efforts with strong guidance and participation can help fuel the adaptation process, which is also a finding analysed in Chapter 4 of this deliverable.



Stage 1: Preparing the ground for adaptation: key elements that are the basis for a successful adaptation process. These include: high level support, adequate coordination mechanisms, exploration of funding opportunities, development of climate change awareness and understanding.
Stage 2: Assessing risks and vulnerability to climate change: studies of how past weather events affected the area, assessing future threats and opportunities, addressing knowledge gaps and uncertainties; determine a strategic direction.
Stage 3: Identifying adaptation options: compiling detailed information of adaptation options, including the main concerns identified in stage two, and exploring good practices and the pros and cons of existing measures.
Stage 4: Assessing adaptation options: assess possible adaptation options (i.e. in terms of time, cost, benefits and efforts), and their trade-offs, prioritized options and preferences, and elaborated an (optional) adaptation strategic document.
Stage 5: Implementation: Elaborate an (optional) action plan, implementing actions, modified existing instruments or created new ones to mainstream adaptation, set up collaborations and agreements, roles and responsibilities, estimate resources needed.
Stage 6: Monitoring & Evaluation (M&E): monitoring and evaluating adaptation and (optional) performance indicators have been developed. Most advanced

Figure 2-4 Climate adaptation stages for all case studies based on adapted EU Adaptation Tool (Source: Climate-Adapt, 2015 and D5.4)

2.4 Lessons learnt and key messages from BASE European case studies

In this section, lessons learnt and key messages from BASE European case studies are synthesised and categorised according to meta-groups. Results equally illustrate key lessons learned within case studies that span over four European regions. Nevertheless, case studies are not representative of European regions, since such representativeness would require a quantitative based assessment and a large number of cases per region. The key messages and lessons learned reported here can be further explored in more in-depth future comparisons among European regions, and serve to inform BASE outputs expected from WP6 and WP7 (which is one of the key objectives of this deliverable). Therefore, this section's reporting of key messages and lessons learnt has been structured according to the meta-groups, and also in relation to European regions. Table 2.5 below offers a synthesis, across meta-groups, of lessons learnt and key messages, taking into account European regions.

Table 2-9. BASE European case study key messages by sector meta-group and European region (Source: CSLDs)

Meta-Group	European Region			
	Northern	**Western**	**Central-Eastern**	**Southern**
Agriculture & Forestry/Biodiversity & Ecosystems Services	Case studies: Hostebro & Lolland • Symbiotic rural-urban measure: flooding farmland to relieve flooding in city • Financial support is essential (e.g. national subsidies for "Farmer as water manager") In a survey to farmers from both locations, biggest barriers to implementation were: environmental and climate change regulations; farming policy regulations; economic losses in relation to changing practice; and economic losses from fewer/smaller subsidies. • Policy coherence between adaptation policies and rural development programs is fundamental.	Case studies: Dartmoor • Assigning National Park Authorities to develop a strategy is not enough for implementation. • In Land Use Management Plans there may be measures addressing climate change, although not under that heading. • Communication and deliberation are key factors, still not applied in practice. • Bottom-up initiatives can work quite well. But when they depend on national policy for funding, they may be threatened if policy changes.	Case studies: South Moravia; Usti; Šumava • Awareness-raising and knowledge sharing are required for successful implementation at all governance levels when, among the public and political representation, interest on the issue is low. • Communication strategies targeting local stakeholders and regional/national authorities, should draw attention to environmental and socio-economic issues, correlated to climate change (i.e. grounded on issues perceived as important before establishing a connection with climate change). • A need for broader political support to assist farmers with the implementation of suitable adaptation measures. • The agricultural sector is particularly exposed to climatic changes and vulnerability.	Case studies: Alentejo; Donãna •Regulatory framework should take into account the integration of potential innovative solutions. Innovation in adaptation should be rewarded/funded. • Private funded innovation should not be penalised, when it is adding value for research or to local development. • Innovative practices or techniques which are working well should be shared directly with farmers. • Farmers who that do not operate with tourism and/or education found less opportunities to obtain private funding for adaptation measures (in Alentejo). • When forestry and agricultural practices deploy water and soil resources in a manner that decreases local adaptive capacity, environmental assessments should be done. • Action-research is important. Research must become more practical and applied to the practitioners' needs. • Different groups are likely to have contradictory views and vested interests. Climate change is a complex problem, and consensus is difficult, but a compromise (that satisfies and motivates social actors) can be attained. • . Rice farming is a highly mechanized and organized agricultural system. Yet, rice farmers seem to have a short-term view of risks, which are not necessarily being linked to climate change.
Water Resources and Health	Case studies: Kalajoki • Participatory processes can improve implementation, but need to be contextualised and adapted to the local actors' perceptions and culture. • Implementation, in most cases, concerns the responsibility of public and private stakeholders. • Evaluation of potential benefits by a hydrological model helped rule out ineffective alternatives. • Multi-criteria methods can bring transparency to the evaluation of measures and are useful in providing a platform for a discussion on complex issues, and contribute to find a reasonable/acceptable level of uncertainty • In addition to economic	Case studies: England; Cornwall; IJsselmeer • in The Netherlands, the Ijsselmeer case study is an example that when flexibility is allowed regarding the water levels in the lake, water authorities are able to anticipate high river discharges and droughts by respectively reducing or increasing the water level. • Climate change and socioeconomic change may lead to a significant increase in the number of skin cancer cases in the future. Skin cancer's avoided costs are likely "no-regret" options. • Public health intervention campaigns may provide one	n/a	Case studies: Madrid • The high level of interconnection among urban elements makes planning a complex task. The cross-sectoral nature of climate change impacts results in the possibility that adaptation options lead to synergies and trade-offs between different sectors. • The implementation of green infrastructure strategies to adapt to climate change is a seducing strategy of adaptation, as it would present several co-benefits. • Proposing an uncertainty or probabilistic analysis would help to support and inform better decision making. In Madrid, for instance, green roofs are profitable in very few scenarios. However, including non-tangible benefits would complete the

	analysis, political and social domains have an impact on decision-making. • Policy integration is most effective if achieved at the level of legislation and regulations. Coherence is equally emphasized.	measure to adapt to the increased risk. The costs for public health intervention campaigns are not high, but evidence on their effectiveness is limited. • Barriers such as limited financing of public health and human resource losses in terms of staff turnover may restrict effective adaptation. • Results from England mental health case study suggest that overall mental health may be positively impacted by changes in mean conditions. But results are likely not transferable to different climatic zones – the variation in the dataset in terms of the temperature range considered is limited.		analysis.
Coastal Zones/Human Settlements & Infrastructure	Case studies: Copenhagen; Kalundborg • A key challenge for Copenhagen in implementing the city‘s adaptation plan is continued development and maintenance of expertise and knowledge, especially with regard to urban solutions at the community scale and coordinating across the involved policy areas. • Adaptation is framed within an overall urban narrative, outlining the future towards a sustainable, green and smart metropolitan area. This is motivating for decision-makers. • Understanding co-benefits, demonstrating the capacity to manage adaptation, and revealing the costs of non-adaptation pushed the allocation of resources, primarily financial, but also human resources. • Significant flooding events (or other extreme weather events) may lead to moving adaptation up higher on the urban policy agenda, and increase funding of adaptive measures and initiatives • A key challenge for Kalundborg is (the lack of) resources for implementation. Themes discussed showed that climate adaptation has to do with political choices and is not only a matter of finding the ¨right¨ technical solutions. • Land-use planning is critical. • A weakness in economic evaluation methods is that they tend to simplify complex planning issues.	Case studies: Rotterdam; Leeds; South Devon • The role of landscape is being underestimated: a landscape approach can strengthen the integration of different solutions and provide insights into social costs and benefits of (in) action • Adaptive capacity may depend on the institutional context. In a setting with privatised, decentralised and fragmented responsibilities and tasks, decision making and funding of adaptation may be very difficult (to nearly impossible). • Climate change adaptation requires a long-term collective perspective and a willingness to anticipate uncertainties. Yet, long-term planning is not mainstream in many administrative contexts (e.g. municipalities). • A combination of soft, grey and green measures (a holistic approach) is important. • There is still a research gap on economic analysis for green measures. • Most, if not all, flood adaptation actions were reactive and triggered by actual flood events. A more proactive focus is needed. • Adaptation efforts seem to be enhanced in Leeds, when several key stakeholders come together to work on an initiative, leading to a greater internalisation of concepts and goals in the stakeholders’ organisations.	Case studies: Prague; Jena; Timmendorfer Strand • Land use-related are relevant to limit heat stress in cities. • A greater emphasis on the involvement of stakeholders and on non-structural measures is needed for cities. • Involve key stakeholders from the very beginning, and understand and integrate their needs. • Financial support is fundamental. Results of damage cost analysis, and CBAs may be arguments for financing measures. • Solve potential conflicts of adaptation and mitigation efforts by searching for synergies at early stages of planning. • Exchanges between representatives of different administrative bodies and scientists on a regular basis to promote knowledge transfer (e.g. In-house trainings on data and tools for supporting adaptation). • The momentum created by adopting a local strategy can be maintained through projects that continuously update and expand the existing knowledge base. • External appreciation of local adaptation activities fosters ‘internal’ recognition by administrative and political decision-makers. This indicates disseminating climate change adaptation is a multidirectional process that includes relating to the ‘rest of the world’ what a region/locality is doing, as a way of empowering such action. • Any climate change related activity (e.g. a workshop, a social event) contributes to mainstreaming and to promote political commitment and collective action.	Case studies: Venice; Íhavo and Vagos; Cascais • In Venice, it was noted that the prevention of physical damage was not the only rationale used for investment decisions in households; psychological effect of being protected played a major role. The same can be inferred from interview results in the Íhavo and Vagos case. • Choosing who to involve in the participatory planning process is fundamental for implementation. In Íhavo and Vagos, for instance, different stakeholder groups were fundamental, but political actors were a must. • In a context where various institutions are involved in decision-making and participation has not been embedded in local culture and policymaking practices, it important to establish a platform for dialogue and action. • The more stakeholders are prepared for the discussions, the better are the chances to reach a shared future vision. • It is important to simplify complex decisions 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, which links to the already referred importance of action-research. • Going from a needs analysis to an Asset-based development enables creative processes with new approaches, and a shared sense of responsibility • Stable and real political support at all levels is a crucial factor for implementation

2.4.1 Key messages by meta-groups of case studies across European regions

From the table above a few key messages can be derived and are pertinent across case study meta-groups and the European regions represented. The importance of awareness-raising and knowledge transfer is continuously highlighted for a successful climate change adaptation process. Participatory processes and action-research were referred to be important at diverse stages of adaptation. While some case studies acknowledge the importance of involving stakeholders from the very beginning (e.g. Timmendorfer Strand and Jena), others stress the need to maintain participatory processes throughout the adaptation process, in a way that is appropriately contextualised and adapted to local perceptions and cultures (e.g. Cascais, Prague, Ílhavo and Vagos). Policy coherence and policy integration are frequently referred as fundamental (e.g. in relation to rural development or coastal management). Case studies highlight that policy coherence and integration can be best achieved at the legislative and regulatory levels. Overall, implementation is found to be of the responsibility of public and private stakeholders (thus the importance of dialogue, participation and knowledge exchange). Key messages point to important concerns such as land use planning and the availability of financial mechanisms when developing climate change adaptation processes. Finally, there is something to be said about narratives, while urban case studies outline the importance of a narrative around sustainable and resilient cities, in other meta-groups, framing climate change issues seem to benefit from establishing connections to other societal challenges that are already mainstream in political agendas.

Specifically as regards meta-groups, in Agriculture & Forestry/Biodiversity & Ecosystem Services, main lessons-learnt revolve around the need for a broader political support, including a more supportive regulatory framework, as well as a better financial and resource base, and effective communication strategies. Case studies in the Northern region, highlighted the essential need for a satisfactory compensation system for farmers, while those from Southern regions stressed the importance of public administrations not penalising innovative measures taken by private individuals/communities that contribute positively to climate change adaptation. As an example, in the Holstebro case study, a symbiotic linkage exists between farmland and city, i.e. allowing farmlands to act as flood plains could protect flood-risk areas in a nearby city (farmer as water manager). While in the Convergence Centre subcase (Alentejo), innovative practices to deter land degradation and land abandonment (see Campos et al., 2015) were implemented voluntarily by a grassroots community, with hardly any financial support from public funding. Similarly, in the Tamera sub-case (Alentejo) an innovative measure for water retention in the landscape was privately funded, and would be difficult to replicate in other localities without financial support.In the Water Resources & Health meta-group, policy integration and coherence were highlighted by case studies from the Northern region, while the importance of public participation was emphasised across case studies from this group. With regards to Coastal Zones/Human Settlements and Infrastructure meta-group, the lack of resources is a key challenge identified in case studies from the Northern region, although in the other meta-groups a lack of material and human resources of various types (knowledge, technical competences, financial) is frequently referred. A key message from a case study in the Western region is that a holistic approach (i.e. combination of soft, grey and green measures) is needed to achieve maximum flood risk reduction, and other benefits. .

The significance of integrating several governance levels and stakeholder groups was also pointed out, as well as the realistic need for relying on the support and political will of central governments (despite important local efforts) for regulations, funding and research, to name a few. For instance, the Czech Republic case study (i.e. Prague), in the Central-Eastern region, called attention to the need for a greater emphasis on non-structural adaptation measures, while Germany's case studies (i.e. Timmendorfer Strand and Jena) highlighted the importance of minimising potential conflict and mitigation efforts by explicitly addressing these issues at an early stage of the planning process (including relevant stakeholder representatives) and searching for synergistic solutions. Additionally, the need to institutionalise and promote knowledge transfers between administrative bodies and researchers was pointed out. Considering that research outcomes often tend to remain in the laboratory (Armitage et al., 2008; Laszlo, 2015), in-house trainings were found to be critical for passing on the knowledge gained, and for improving municipal or local organisation staffs' abilities to use and apply data and tools available for supporting climate adaptation. Case studies emphasised the vital need of public commitment from political decision-makers to support local adaptation activities. The Czech Republic

case study also pointed out that a city's ongoing adaptation process is more focused on grey infrastructures and does not yet consider alternative measures (such as ecosystem-based ones), while Germany, The Netherlands and Portugal case studies cautioned about the need to account for the long time-frame of climate change adaptation processes. As an example from the Southern region, Ílhavo andVagos highlighted the importance of promoting inter-institutional dialogue and decision-making through channels (such as forums), particularly when multiple institutions are involved in the decision-making process (a similar challenge was reported by the South Devon and Dartmoor case studies in the UK), and participation has not yet been embedded in local culture and policy-making practices.

2.4.2 Agriculture & Forestry/Biodiversity & Ecosystem Services

Northern Europe

For the northern region, key messages derive from two case studies in Denmark's - Holstebro and Lolland. In these case studies, 'the farmer as water manager' is a feasible adaptation measure with the potential of being replicated in other countries. It is a way of incorporating farmland with multiple functions and increasing the flexibility of the agricultural land. During extreme precipitation events, fields convert into flood plains, and in dryer seasons return to being farmland producing crops. However, certain conditions need to be met for this voluntary measure. Regulatory frameworks - vertically (EU, national, regional and local) and horizontally (across sectors) - must not put up obstacles for the measure. Financial resources are a prerequisite. If farmers do not receive satisfactory compensations, there will be no adaptation measure, since success is dependent on the ability and will of the farmers. Creating the right incentives (both financial as well as other types of incentives) is the be-all and end-all for this type of measure. Bottom-up initiatives like the 'farmer as water manager network' might prove important to influence the ability and will of farmers to participate. According to surveys done in Denmark, farmers in general are not very worried about climate change. Farmers report on quite a lot of different barriers for implementing adaptation measures. The surveys highlighted four main barriers (ranked from highest to lower score), namely: environmental and climate change regulations; farming policy regulations; economic losses in relation to changing practice; and economic losses from fewer/smaller subsidies.

Western Europe

Only one case study has been developed in Western Europe from this meta-group – Dartmoor National Park in the UK. The Dartmoor case study highlights that planning processes need to carefully swift through Land Use Management Plans, since there may be measures addressing climate change, although not under that heading. Communication and deliberation have been identified as key factors. Although they may seem obvious to many social scientist academics, one can see that they are (still) not obviously applied in practice. Local bottom-up initiatives can work quite well, as demonstrated by the Dartmoor Farming Futures project. However, they depend on national policy for funding, and the risk is that when the policy changes, the initiative may be threatened.

Central-Eastern Europe

Research in the Czech Republic offers some key messages from the Central-Eastern Europe region. In the Czech Republic, climate change adaptation is apparently an issue of low interest among public and political representatives. A national climate adaptation strategy was approved in 2015. In this context, a successful implementation of measures relies largely on awareness-raising and knowledge-sharing across all governance levels. Framing the climate change problem as being correlated to other issues (e.g. local conflicts linked to nature conservation, regional water management and flooding), was found to important when communicating with stakeholders and authorities.

For the CBA on ecosystem-based adaptation options, uncertainties were reduced by carrying out a sensitivity analysis. There was more success in reducing the uncertainty stemming from the economic evaluation than that from modelling. In general, there is a need for broader political support to assist farmers with the implementation of suitable adaptation measures. Agricultural practices are climate-dependent and yields vary over years depending on shorter-term weather

patterns, farmers are, in some extent, already used to these changes. Based on the current trends, adaptation measures against drought are of major importance. Measures for increasing water retention were identified as being the most important by 93% of the respondents to a survey (done in the South Moravia case study). In the case of integrated vine production, new agro-envi-climate measures (AEKO) are currently in place in South Moravia, but these measures focus on sustainable pest management and marginally on land-use management, rather than on the goal of increasing water retention in the landscape.

Southern Europe

BASE case studies from this region are the Alentejo (Portugal) and Donãna (Spain) studies. The importance of participation and stakeholder involvement was reiterated for Southern Europe. Both case studies find there are no perfect solutions and that the number of vested interests and societal needs at stake may be at times contradictory. In these two landscapes, climate change adaptation emerges as a complex decision-making process. The Donãna case study (Spain) allowed the identification of maladaptation options, as well as of the most acceptable options for stakeholders. Results from the consulting process showed how climate change is already affecting rice production and the natural ecosystem in the wetland. Water scarcity and the deterioration of water quality were perceived by informants as major risks for the good functioning of both rice farming and the natural ecosystem. Although rice farmers do not recognize higher temperatures as a risk for rice production, they are already changing the rice growing calendar and introducing new varieties which are more tolerant to heat stress. In this case study, farmers seem to have a short-term view of risks and they do not necessarily link them to climate change. Moreover, reductions of water availability together with the large water needed to irrigate rice fields and control the water salinity should lead to bigger conflict between water users from different economic activities and the natural ecosystem conservation. The lack of generational renewal by a decreasing number of young farmers and new environmental requirements from the Common Agricultural Policy can bring more pressure on local farmers' price support. On the other hand, environmentalists showed reluctance to those options which may result in higher economic costs and environmental impacts due to new infrastructures. Environmentalists and administration actors supported the reduction of rice cultivated area as an effective adaptation option. All actors and experts emphasized the important role of improved institutional governance and the need for encouraging the farmers' long-term views by climate change advisement and capacity building.

In the Alentejo case study (Portugal), results draw from interviews to farmers (21), participatory workshops (2), and from an analysis of autonomous adaptation processes which have been implemented. Farmers in Alentejo were concerned with the impacts of climate change in a region already witnessing significant land degradation and desertification. Farmers complained about the impacts that they suffered from forestry and agricultural practices, which deployed local water and soil resource, recommending that these practices would be accompanied by environmental impact assessments and even be made illegal. One example, is the extensive areas of eucalyptus monocultures that take up water from underground reserves. One of the main innovative practices studied was rainwater harvesting by farmers, through the creation of permanent lakes and small dams. These practices have been possible mainly due to private funding, and in some instances resulted from volunteer work by grassroots communities. Interview findings showed farmers' choices are very dependent on subsidies. In the context of subsidized agriculture (through the EU Common Agriculture Policy), conservation of soil subsidies does not oblige good practices, although in the case of farmers who adopted integrated farming payments some soil conservation practices were implemented. In forest plantations some soil conservation practices were mandatory. Nevertheless, the National Strategy for Public Irrigation reports a significant amount of applications from private farmers for irrigation infrastructures, and 696,2M€ in new projects were identified, yet there is no funding to support small irrigation projects led by farmers. At different levels of governance, this case study found that innovative solutions against land degradation and drought (such as Tamera eco-villa artificial lake) face obstacles when rural development programs are not flexible enough to incorporate practices at the bottom/grassroots level. I was noted that when farmers that do not operate with tourism and education (such as the Tamera eco-villa case), they do not have the opportunity to attain private funding and finance their adaptation measures and innovations. Farmers mentioned that innovations that proved to work should be disseminated among farmers and constitute an opportunity for learning and evaluating climate adaptation efforts.

Local traditional markets may play an important role as a support base for farmers with 'alternative' production practices. Yet, this increases the need for public compensation to farmers, when farmers (dependent on subsidies) cannot internalize the added cost of adapting in a certain region. Therefore, managing adaptation in the agriculture sector raises complex and intricate challenges that span from European to national and local level policies and strategies. Further, to accompany innovation and adaptation needs, a regulatory framework should create mechanisms for a regular update on environmental and societal needs and change.

2.4.3 Water Resources & Health

Northern Europe

In the water and health meta-group, there is only one case from the Northern region – Kalajoki (Finland). The case study highlights as a key message that policy integration is most effective if achieved at the level of legislation and regulations and that it appears as a key factor to successful implementation. The case also concludes that when the National Adaptation Strategies (NAS) tries to influence local activities directly, without a proper legal base, it is more likely to fail, because it lacks relevant implementation mechanisms. Policy coherence is referred as being equally important. "Strong" policies at the local level should not give contradictory signals with respect to adaptation to climate change (e.g. concerning responsibilities, risk taking, standards for protection). In many lakes in Finland, adaptation to climate change will require changes and more flexibility in regulation permits. In Kalajoki, the national action plans were in line with a set of possible measures considered in flood risk planning. Stakeholder participation was essential because implementation of adaptation measures in most cases was of the responsibility of both public and private stakeholders. It was found that participatory processes need to be contextualised in such a way that local actors can relate to the question in a meaningful way.

Multi-criteria approaches were found to be useful in providing a platform for discussion on multidimensional issues. MCDA tools can be context-tailored with criteria that will emphasise climate issues (i.e. in simple cases there is no need for using complicated computer-based calculations). Information about climate change, on mitigation measures and their impacts and costs was essential to the adaptive planning processes. Using limited time and resources for detailed information or performing comprehensive cost-benefit analysis was not always necessary for reaching an adaptive plan. In the Kalajoki case, climate change information and calculations helped to consider options. A detailed CBA was not needed because, after expert and stakeholder workshops, there were not competing options left. Hydrological simulations show that models were essential tools in assessing the benefits of those measures based on water retention and regulation. In addition, water level regulation was noted to be very dependent on weather forecasts. As climate change proceeds, the importance of forecasts (as well as decisions of organizations in charge of water level regulations) will increase. Another key conclusion from the Kalajoki case study analysis is that in dominantly rural areas, where population density is rather low and financial flood damages are moderate, often the most cost-efficient measure to protect existing infrastructures is to build embankments or use other permanent flood protection structures, because these options are effective in different conditions and benefits are not dependent on weather forecasts. In addition, land use planning and the adoption of lowest allowed building heights were found to be the most cost-effective measures to minimize future flood risk. Multi-criteria methods can bring transparency and an adequate structure to evaluating measures. Multi-criteria modelling tools may be helpful in cases where there are distinct alternatives, a need for making trade-offs and conflicting views among stakeholders. Even though some extent of uncertainty can be accepted in economic evaluation methods, the result is only as good as the data behind the models.

The Kalajoki case revealed that it is of a key importance to have a realistic assessment of the benefits of the measures, otherwise the results are not reliable. In this case, evaluation of the potential benefits by hydrological model helped to rule out alternatives that did not fulfil the objectives. Economic analysis is an often important issue in decision-making, but there are a number of other issues, political, social or legal, that have an impact on decision-making. For instance, the State has had a strong role in flood management and still may finance or partly finance projects of key importance, but a newly introduced act on compensation for flood damages has shifted the responsibility from State to

private insurance companies and increased private citizens' responsibility. In addition, municipalities and businesses are responsible for some measures.

Western Europe

Western Europe case studies from this meta-group are IJsselmmer (The Netherlands) and two health cases in the UK, England and Cornwall. The key result of the IJsselmeer case study is that flexibility is allowed regarding the water level in the lake, enabling water authorities to anticipate high river discharges and droughts by respectively reducing or increasing the water level. In the future this flexibility may be extended, although more research is needed to understand how flexible the system can be. A key message is that since the program had a participatory design from the onset, most parties were engaged and contributed to the development of the adaptation strategy. The Delta Program provided equally a platform for an inter-organisational communication, as people from various organisations gained a mutual understanding on the various perspectives and stakes.

Regarding the Health topic, the Cornwall case study concludes that climate change and socioeconomic change may lead to a significant increase in the number of skin cancer, and that the benefits of adaptation may significantly outweigh the costs. Public health intervention campaigns should be considered an important measure to adapt to this increased risk. The costs for public health intervention campaigns are not necessarily high, although evidence on their effectiveness is limited. Prevention campaigns may represent "no regrets", i.e. there may be significant net benefits from such actions even in the absence of climate change. Barriers such as limited financing of public health and human resource losses in terms of staff turnover may restrict effective adaptation. Considering autonomous adaptation in the mental health case study (England), the study concludes that overall mental health may be positively impacted by changes in mean conditions. This may enable the reallocation of resources to services targeted towards the mental health risks of extreme events (e.g. heatwaves or floods).

Southern Europe

In this region one case study was developed – Madrid (Spain). The results offer insights into the economics of adaptation to increased temperatures in Mediterranean cities (and subsequent effect on human health), because the sensitivity of results to climate data delivers geographically-specific final results, which can be transferable to similar climate and cities. The parameters of the model used for analysis were estimated based on the literature for Madrid and for Spain, except those of water retention services. Estimating the benefits of green roofs in physical terms (i.e. non-monetary) is a very challenging exercise given the little (but increasing) knowledge on green roofs at meso-scales. The most uncertain benefit concerns the potential of green roofs to reduce the urban heat island (UHI) effect. The UHI is well documented for Madrid, yet the specific contribution of green roofs (in a single estimation isolated from other adaptation measures) in reducing UHI is for the most part unknown. According to literature on UHI reduction, a higher temperature reduction can be expected when air conditioning is turn off. More generally UHI would be reduced in a more effective way by reducing the causes of UHI, such as air conditioning, than by engineering solutions like green roofs.

2.4.4 Coastal Zones/Human Settlements & Infrastructure

Northern Europe

In the Northern region case studies from the costal zones and human settlements/infrastructure meta-group are Copenhagen and Kalundborg, both in Denmark. The Copenhagen case study concludes that building adaptive capacity in this region has been fostered by: a long term amassing of expertise; by administrative as well as political leadership; by leaning heavily on co-benefits; tracking and developing 'adaptation solutions as good business' (linking to green growth); taking advantage of network governance (public policy makers, stakeholders, business, research, citizens); co-solutions with funding and business on developing grey measures, and by re-allocation ownership and responsibility to take adaptive actions to citizens/businesses. Moreover, fostering a learning organisation, appointing an Experimental Neighbourhood program and exploring novel planning approaches and socially innovative initiatives

in addressing adaptation challenges contributed to building adaptive capacity at the city level. A key challenge for Copenhagen in implementing the city's adaptation plan was the continued development and maintenance of expertise and innovative knowledge, especially with regards to urban solutions at the community scale and to policy coordination across scales and levels of governance. It was found that the coordination of adaptation objectives and actions and the integration of climate adaptation objectives needs to be intertwined with the integration of adaptation in an urban narrative for a future Copenhagen as a sustainable, blue, green, smart, and vibrant metropolitan area. Linking climate change to the urban narrative, to co-benefits and to green growth; and demonstrating the capacity to manage adaptation and revealing the costs of non-adaptation, pushed the allocation of resources to adaptation (primarily financial but also human resources). Significant flooding events (or other extreme weather events) may provide a mandate for the city's administration to move adaptation higher on the urban policy agenda, and increase funding of adaptive measures and initiatives (e.g. the cloudburst on 2 July 2011).

In the Kalundborg case study, a citizen summit allowed citizens to vote on the preferred adaptation possibilities which had resulted from the scenario workshop. Results from the stakeholder scenario workshop were used for the citizen summit, and those from the citizen summit were used in the preparation of the adaptation plan. The themes at the citizens' summit clearly show that climate adaptation has to do with political choices and is not only a matter of finding the ¨right¨ technical solutions. Two thirds of the citizens voted in favour of making a decision *now* that would allow the coastline to move further inland, and thereby eventually discontinue current activities in these areas, such as summer houses and farming. About one third of the participants wanted a collective solution based on dykes. These results differed significantly from the results of the scenario workshop, were local stakeholders were more supportive of various dyke solutions. It was concluded that the lack of resources is a key challenge with regards to implementing the local adaptation plan.

Interviews with officials and politicians confirmed that the participatory process gave the municipality a mandate to be more specific in addressing these kinds of issues. The participatory process did succeed in influencing the municipal adaptation plan (the process is explicitly described in the plan and its results are referred to regarding various issues). One example is the sensitive issue of prioritizing between protection of farmland and the development of wetland nature areas. One way to protect areas from flooding caused by cloud-burst or rivers is to allow water to flood farmland and hold up the water before it reaches inhabited areas. Hereby the municipality could create more wetland areas and thus improve the natural ecosystem. Such measures are mentioned in the plan and specific farmland areas are pointed out.

Western Europe

Three case studies are illustrative of the Western Europe region: Rotterdam in The Netherlands; South Devon and Leeds in the UK.

As illustrated by the Delta programme's activities in Rotterdam, landscape is an essential part of creating policy for climate change adaptation. A landscape approach can strengthen the integration of different solutions and provide insights in the larger social costs and benefits of (in) action.

The South Devon case study indicates adaptive capacity may hugely depended on the institutional context. In a setting with privatised, decentralised and fragmented responsibilities and tasks, decision-making and funding of adaptation may be very difficult (to nearly impossible). Climate change adaptation requires a long term collective perspective and a willingness to anticipate uncertainties. A few key challenges are taken from the application of CBA: first, the number of assumptions made may never materialise; second, how the boundaries of the analysis (in terms of what measures and costs and benefits to include and not include) may impact upon the final results; and three, how by looking at a localised case important information may be missed out from the bigger picture (e.g. the Dawlish coast is not the only part of the railway line that is vulnerable, other vulnerabilities may provide the tipping point for rerouting).

A key message from the Leeds case study research is that a combination of soft, grey and green measures (a holistic approach) is needed to achieve maximum flood risk reduction, as well as multiple other benefits. Efforts should not be limited to one approach. In addition, the ability to quantify the benefits of green adaptation measures has a substantial bearing on their cost effectiveness and thus its implementation by authorities. Key points for flood risk adaptation in Leeds include: a) most, if not all, flood adaptation actions (including community participation) generated from actual flood events, benefit from a proactive focus; b) although local efforts are vital, it is crucial to count on the support and political will of the central government for regulations, funding, and research; c) adaptation efforts in Leeds seem to be enhanced when several key stakeholders come together to work on an initiative, which also leads to a greater internalisation of concepts and goals in the stakeholders' organisations.

Regarding economic assessments made for the UK cases, there is a substantial amount of cost and benefit data available in government and consultancy work (grey literature; main source of data) which is quite disperse and at times hard to access (e.g. Defra and Environment Agency documents). The early involvement of key stakeholders in the economic evaluation process would have likely facilitated access to data. It is still not possible to capture all the direct and indirect benefits of the "green" adaptation measures, which may have a strong influence on the cost-effectiveness of measures. The application of cost-benefit analysis to three different adaptation measures for Leeds and the Aire catchment provides important insights into these areas that need further attention and research to assess the general feasibility of the measures. The exploration of different socioeconomic scenarios and the impacts of climate change highlight periods in time when tipping points might occur and how different adaptation measures might be combined and/ or staggered to distribute costs in time and provide the necessary standard of protection. This findings support the need to consider a bundle of adaptation measures beyond traditional approaches, and a wider catchment focus, in order to achieve a high standard of protection, as well as multiple benefits.

Central-Eastern Europe

In this European region, case study research on coastal zones/human settlements and infrastructures was developed in the Czech Republic and Germany.

As regards the Prague case study (Czech Republic), a key message is that there needs to be a greater emphasis on the involvement of stakeholders and on non-structural adaptation measures. The ongoing adaptation process is focused more on grey infrastructures and does not consider alternative measures (such as ecosystem based ones). Even though in Prague an implementation of grey infrastructures, including flood barriers, was essential in order to effectively protect the city, and was proved to be an effective investment. There is still a window of opportunity to adopt green measures which are usually cheaper and versatile. These could supplement the existing and forthcoming grey infrastructures and improve the overall resilience of the city, not only in terms of flood risk, but also other phenomena connected with climate change. Regarding the planning and decision making process, even though the city Mayor declares that different stakeholders were involved, the group participating in the adaptation process comprised mostly members of various city hall departments. Stakeholder groups with stakes on the protection measures were scantily represented. There is equally a wide array of possibilities to involve citizens in the adaptation process, especially as regards the adaptation of households and information dissemination. In general, the results (which are unique to this city's structure, geographic position and climate conditions) are not very transferable. It could, however, be assumed that Prague's adaptation system (not particular measures but rather the overall approach) may be suitable for a city affected in a similar way.

Regarding the Germany case studies, the retrospective analysis of an adaptation measure implemented in Timmendorfer Strand showed the following success factors: a) involve key stakeholders from the very beginning (e.g. the mayor of the town was a key person. With his support for the project, it was possible to get other stakeholders into the discussion); b), understand the needs of the stakeholders (understand the viewpoint of the different stakeholders and why they might not be willing to cooperate or not support the adaptation measure. In this case, the stakeholder had to be 'convinced' that a coastal defence measure is a reasonable investment); c) have financial support. In Timmendorfer, in order to implement the 'extra' measure (e.g. glazed retention wall and finishing and landscaping project) that ensured the support of the stakeholders, financial back-up from the municipality had to be guaranteed;

and d) use results of damage cost analysis, and CBAs as argument. Arguments based on costs and benefits helped to 'convince' stakeholders. In the case of Timmendorfer Strand the results of a risk assessment and damage analysis showed the material damages due to coastal flooding could be very high. This helped raise awareness and was an important factor for changes in the local stakeholders' attitude towards coastal protection.

The Timmendorfer case shows that planning and implementing adaptation is a medium to long-term process. The whole process took over 10 years from its start to the implementation. The long-term may become an obstacle when responsibilities change or the stakeholder and/or public lose interest in the topic. The results of the case study are only partially transferable. This can be explained by the local characteristic of the community, which is a frequented touristic community at the Baltic Sea. The values for land and property are quite high compared to neighbour and other towns on the German Baltic Sea. Furthermore, the results are based on the combined implementation of a coastal protection measure and a landscaping-project. Cost and benefits-analysis shows that the results are very much dependent on the expected climate impacts and uncertainties are incorporated at this stage. Discussions with local stakeholder and community members were helpful and essential to frame the case study. The knowledge and experiences of local stakeholders was not only relevant for gathering the data, but also for discussing possible effects and assumptions. The cost and benefit-analysis might have been a useful tool in the process of communicating the project to the local community.

The Jena (Germany) case indicates that potential conflicts of adaptation and mitigation efforts can be solved or at least mitigated by explicitly searching for synergic solutions at an early stage of the strategy and project development. Likewise, the exchange between representatives of different administrative bodies and scientists should be institutionalised and take place on a regular basis to promote knowledge transfer. The momentum created by the initial adoption of a local adaptation strategy can be maintained through projects that continuously update and expand the existing knowledge base. In-house trainings are essential to improve the ability of municipal staff to use data and tools available for supporting adaptation. Moreover, outreach activities do not only raise awareness but also ensure the support of the general public. Making information digitally available offers many advantages (e.g. more detailed explanation, options for customising or updating information), yet, the provision of information should be adapted to the existing routines. In the city of Jena the software for supporting the consideration of adaptation aspects in the planning process was primarily used by young professionals, whereas most planners preferred to use a hard copy handbook. The public commitment of political decision-makers to support local adaptation activities was found to be important.

Due to high initial costs, financial support was needed (in the two German case studies) to kick-off adaptation activities. It was also found that external appreciation of local adaptation activities fosters "internal" recognition by administrative and political decision-makers. Moreover, any climate change related activity seems to help making climate change mitigation and adaptation a mainstream topic, which in turn supports local climate change-related initiatives. Outreach activities do not only raise awareness, but also ensure the support of the general public. BASE results suggest that adaptation-related assessments at a later stage of the planning process are more likely to be considered, because at the early planning stages, the balancing of many other aspects (which are higher in the political agenda) dominates the exchange between planners and stakeholders.

The Jena case study illustrates that, despite a multitude of information and tools, climate change adaptation is (still) a subordinated matter in urban planning. MCA was found to be a useful decision support method for mainstreaming climate change adaptation into urban planning routines. PRIMATE tool helped dealing with data uncertainties probabilistically and allowed for simultaneous consideration of varying stakeholder preferences. The UrbaHT model results do not compare with those of sophisticated software packages for micro-climatic modelling, but the tool's comparatively low data requirements and immediate results enhance the probability of application and integration of heat stress-related considerations into established planning routines.

Southern Europe

Three case studies within this meta-group are from the Southern European region: Venice in Italy, Ílhavo and Vagos and Cascais in Portugal.

In Venice, the case study focussed the co-development of an existing strategy and private decisions for investments. The analysis of the economic performance of measures suggests that the prevention of physical damage is not the only rationale used for investment decisions in households; probably the psychological effect of being protected plays a major role that has not been quantified in this study. As a conclusion, private flood adaptation measures for buildings can considerably reduce damages, but will not be able to avoid them totally; especially with regards to non-monetary damages. Private adaptation comes under most of the options with a considerable level of investment cost, which may not be affordable for all households. The fact that some measures are employed despite a low cost-benefit rate, points to the fact that values not taken into consideration, especially the damages and losses in life quality and stress, play an important role in private decisions.

Although public investment is the main source of funding in the Íhavo and Vagos coast (Portugal), it was similarly found (although not quantified) that local stakeholders and residents were apprehensive and well aware of the vulnerability of their coast, not trusting political actors to develop an adequate action-plan for coastal protection (Campos et al., 2016). BASE research sought to overcome this pitfall by establishing a forum for dialogue, mutual understanding and decision-making, and by providing policymakers, planners and other local stakeholders and residents with needed knowledge on technical options, and economic costs and benefits for a long-term climate change adaptation plan. Ílhavo and Vagos offers an example of a socio-political context where various institutions need to be involved in decision-making and participation has not been embedded in local culture and policymaking practices. Political actors and all those with the responsibility for implementing the plan needed to be involved from the beginning, but also all those who can substantiate the plan, both by providing lay and expert knowledge. Choosing who to involve in the participatory planning process was fundamental for implementation. For instance in this case political actors were a must, given the need for public acceptance and funding. The case study could have gained from including experts on local and regional regulatory frameworks (this type of information was missing in the discussions). A participatory action-research approach was important to support a long-term collective action-plan for a more sustainable and adapted coast. The participatory experiences should be well-facilitated and a rewarding experience for those involved. In this case study it was equally important to create an action-group (see Campos et al., 2016) that would be able to lead the adaptation process to its next stages. A strong involvement of the different stakeholder groups was attained by carefully choosing methods and conveying, as much as possible, baseline information on impacts and measures, so that stakeholders are appropriately prepared (i.e. with enough information and a clear understanding of the problem) to take part in discussions. It is also important to simplify complex decisions 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. The action-research approach was also followed in the city of Cascais, where stakeholder engagement was equally crucial for adaptation. Cascais equally illustrated that stable and real political support at all levels is a crucial factor in implementation.

2.5 Discussion and Conclusion

BASE European case study research takes stock of the main findings from the International Case Study review presented in Section 2.2.1 and detailed in D4.2. Table 2-10 below shows how BASE European case study research assimilated or addressed each of the key messages from the International review.

Table 2-10. Advancement in Climate Change Adaptation through BASE: Lessons learnt from International Case Study Review and Addressing Knowledge Gaps

Key Messages from International Case Study Review (D4.2)	How did BASE assimilated lessons learnt and/or filled a knowledge gap in climate change adaptation?
a) Despite the significant number of databases focusing on climate change and climate adaptation, in many instances the databases vary in the amount of information provided and are often lacking information (e.g. on the decision-making process or assessment tools used), which makes it difficult to share and analyse success factors and constraints throughout the adaptation phases.	BASE European case studies detailed the climate adaptation process in the CSLDs. Further, details of economic evaluation methods for these case studies can be found in D5.2, participatory approaches can be found in D5.3, implementation analysis in D5.4, and comparative analysis of different approaches used by different case studies in this deliverable.
b) Through the case study assessments it is shown that participatory methods are often very fruitful and can be critical to the success of projects, providing added value for the implementation. These can be an innovative way to include knowledge from local stakeholders, research partners and clients in the design of adaptation actions and ensure future business activities.	BASE European cases study research included strong participatory approaches in some of the case studies. Similar conclusions have also been drawn with regards to the effectiveness and importance of participatory approaches in BASE European case studies. Participatory methodologies were combined with economic/non-economic evaluation tools, which proved to be very useful and easy to apply, and could be used in other places in the world.
c) Very little information in regard to economic methods and their application is available.	See response to a).
d) Corresponding to the literature, a mix of measures seems to be for many circumstances implemented and advantageous, such as the combination of grey infrastructure measures and green infrastructure for flood protection.	BASE European case study research also reached similar conclusion.
e) In most instances adaptation projects rely on a mix of funding sources (e.g. government, private companies, etc.). This helps funders spread and minimize the individual risk of investments and to ensure that opinions and decisions are not linked to one funding source. But it equally increases the effort for the applicant or the institution which connects the different funders.	In Europe, most of the funding sources came from EU-funded projects or national sources. Lack of funding has been raised as an obstacle to climate adaptation in Europe. Future research could study alternative funding mechanisms such as businesses, insurance companies, international organisations and private organisations and associations.
f) To disseminate lessons learnt of the selection and implementation of adaptation measures, the methods used to select, design and ultimately implement adaptation measures should provide a clearer description of the reasons why a specific measure was selected.	See response to a). BASE research strives to provide as much information in a coherent and consistent manner across all case studies. This allows climate adaptation practitioners to have a broad view of adaptation processes and tools used across different sectors/climate impacts/drivers (D5.2, D5.3, D5.4, this deliverable), as well as details for each case study (CSLDs), each tool or adaptation phase (D5.2, D5.3 and D5.4)

The meta-analysis of the case studies contributes to bridging top-down and bottom-up strategies. Taking into consideration the main dimensions of BASE case study research – i.e. economic analysis, testing and developing participatory approaches and methodologies, and implementation analysis – key messages show the intricate interdependencies between these three dimensions in climate change adaptation processes. In what follows, these dimensions are discussed. Yet, it is useful to bear in mind their interconnections. Conclusions on economic assessments cannot be pinpointed without considering relevant aspects regarding participatory processes and implementation. The same can be said as regards the importance of these key messages for both upscaling the results of bottom-up case study research throughout Europe and for the purposes of a policy analysis.

Concerning the economic dimension, the extent of adaptation evaluation is largely dependent on data availability and quality, but also on time, resources (human, material, and financial) and budget constraints. The type of economic assessment tools to use largely depends equally on the adaptation phase. For instance, CBA is a very useful tool and has been employed by most flood-risk case studies. However, both detailed CBA and CEA were considered non-appropriate for a pre-feasibility study of potential measures (e.g. Kalajoki) or for multi-objective adaptation options as they could end up limiting important criteria such as political, social and environmental aspects. Results from economic analysis such as CBA may also vary greatly depending on the scope and dimension of measures, costs and benefits to be included in the evaluation. As shown through some of the case studies, CBA could be complementary to MCA, with the former focusing on tangible/monetary parameters and the latter examining intangible/non-monetary parameters. They could also be complementary in an iterative form, where the former could be employed to answer a broader question and the latter then examines the various options based on the CBA results, or vice versa. The use of CEA is suggested when comparing adaptation alternatives with a similar non-monetary target effect. The Kalajoki water quality case study demonstrated the use of various tools that took into consideration both current conditions and future climate and socio-economic change. Novel approaches carried out in these case studies include linking CEA with the D-AP approach (e.g. Rotterdam case study) and using CE approach to determine the cost of flood retention on agricultural land (e.g. Holstebro).

However, participatory experiences such as those developed in Kalundborg, Cascais, and Ílhavo and Vagos case studies, clearly show that climate change adaptation has to do with political choices and is not only a matter of finding the ¨right¨ technical solutions. These case studies also indicate that the more stakeholders are prepared for the discussions, the better are the chances to reach a shared future vision. Thus, the importance of embedding, within the research methodology, social learning processes (e.g. discussions to prepare stakeholders for the Scenario Workshop in Ílhavo and Vagos). Bottom-up participatory approaches and social learning (i.e. survey by post or email, face-to-face stakeholder interviews, focus groups, scenario workshops, scenario workshop & adaptation pathway (SWAP), PBCA and participatory add-ons to CBA and MCA) have shown to provide valuable local/traditional knowledge to case studies. Amongst these methods, PBCA and SWAP are new participatory tools developed through BASE case study research. The participatory approaches resonate with Lowe's (2002) proposition of stepping beyond the modern science syndrome of "islands of understanding in oceans of ignorance" and moving towards an effective collaboration between scientists and practitioners to develop "trustworthy knowledge that combines scientific excellence with social relevance". Figure 2-5 below offers a synthesis of BASE novel methodologies.

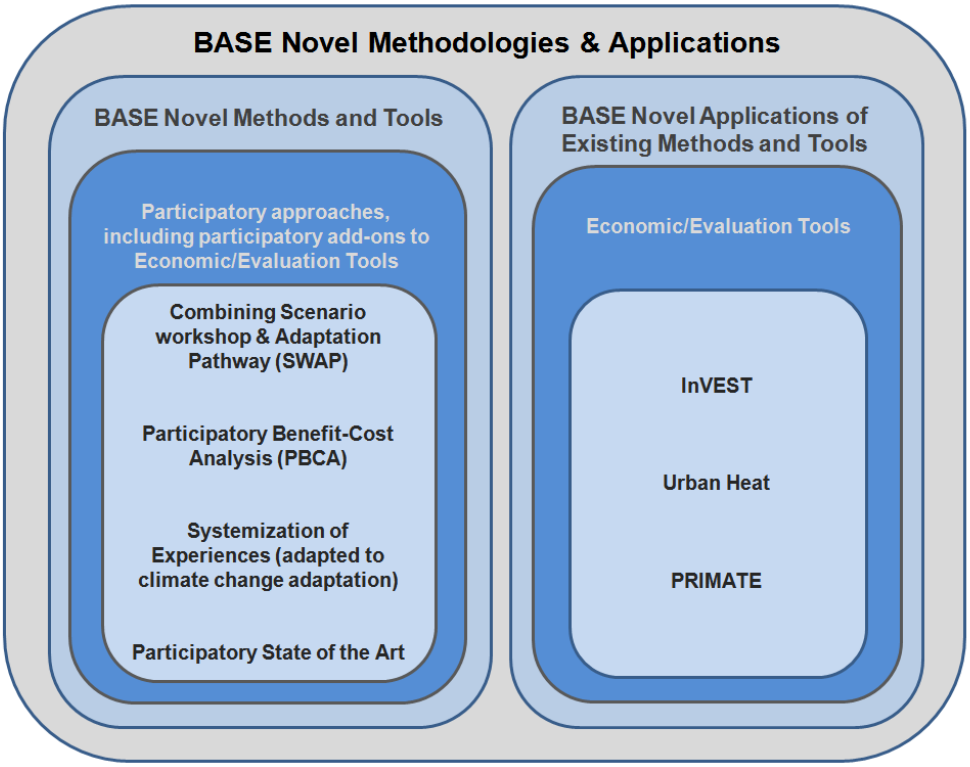
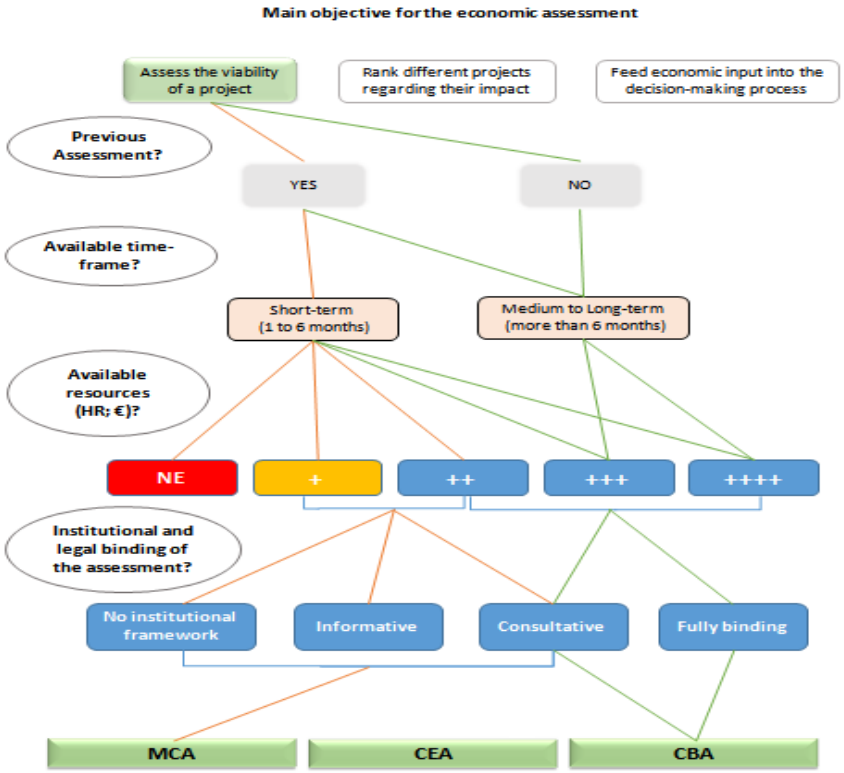


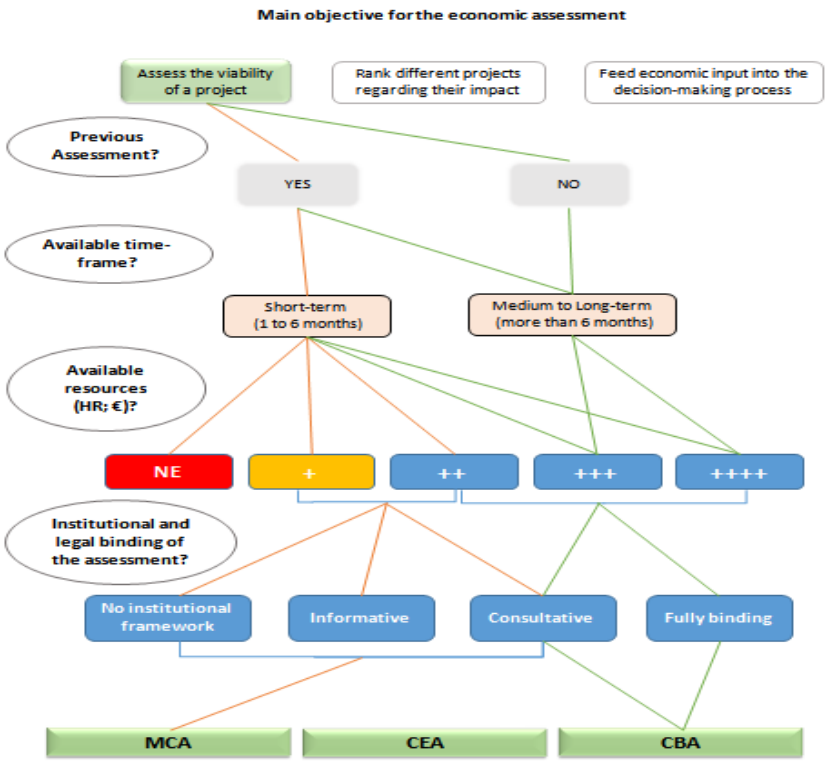
Figure 2-5 Novel approaches & applications of existing tools developed through BASE: Novel methods and tools for participatory approaches, including participatory add-ons to economic/evaluation; and BASE novel applications of existing methods and tools for economic/evaluation.

Concerning the choice and use of appropriate economic evaluation tools and methodologies at the local level for climate adaptation, this case study research has shown that economic evaluations of climate change adaptation processes depend on multiple considerations and constraints, namely i) What is the main objective of the economic evaluation?; ii) Has any assessment of evaluation been carried out?; iii) what is the available time-frame for conducting the assessment?; What is the available time-frame for conducting the assessment?; iv) What are the available resources?; and v) What is the legal and institutional binding nature of the evaluation? Based on these variables and taking stock of the experiences in different case studies, a tree-choice model has been drafted and proposed as a guideline for political decision-makers (Figure 2-6). The bottom-line of this decision-tree is that if time and available resources are limited and restricted, it seems useful to opt for an MCA, unless prior assessments already exist and there is a legal binding regarding the results of the assessment, in which case using CEA or CBA should be the norm. In order to bring robustness and credibility to the MCA, participatory methodologies can be used as an add-on either to choose and validate assumptions, criteria, weights, etc., or to conduct the MCA itself with little marginal costs for the methodology. In this respect, an MCA (or a P-MCA) can be applied as a baseline option for any economic evaluation. Depending on the considerations and constraints described above, this baseline approach could subsequently be complemented and deepened by a CEA or a CBA, according to the specified needs, requirements and aspirations. The experiences and outcomes of the economic and evaluation analyses carried out in BASE European case study research depict the importance of exploring and trying new methodologies that promote coherence, consistency and a bridge between existing proven tools (i.e. MCA, CEA and CBA) and the use of participatory methodologies.

a)


Main objective for the economic assessment
Assess the viability of a project
Rank different projects regarding their impact
Feed economic input into the decision-making process
Previous Assessment?
YES
NO
Available time-frame?
Short-term (1 to 6 months)
Medium to Long-term (more than 6 months)
Available resources (HR; €)?
NE
+
++
+++
++++
Institutional and legal binding of the assessment?
No institutional framework
Informative
Consultative
Fully binding
MCA
CEA
CBA

b)


Main objective for the economic assessment
Assess the viability of a project
Rank different projects regarding their impact
Feed economic input into the decision-making process
Previous Assessment?
YES
NO
Available time-frame?
Short-term (1 to 6 months)
Medium to Long-term (more than 6 months)
Available resources (HR; €)?
NE
+
++
+++
++++
Institutional and legal binding of the assessment?
No institutional framework
Informative
Consultative
Fully binding
MCA
CEA
CBA

c)

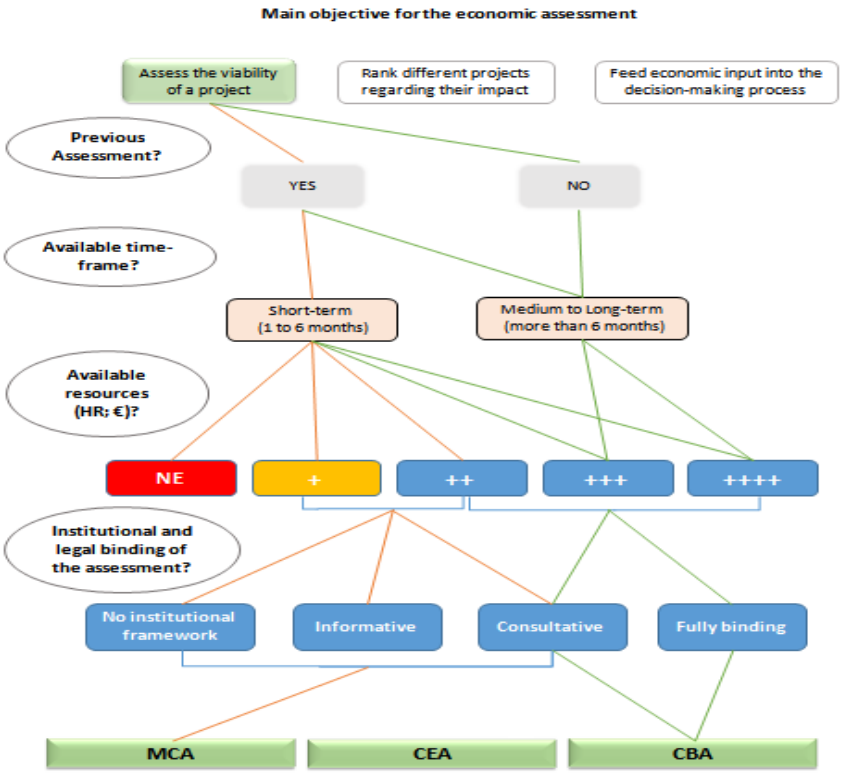


Figure 2-6 Economic Assessment Decision Tree: a) Viability assessment, b) Ranking projects and c) Input into decision-making process

The wide variation in analytical results for similar adaptation measures in different areas, emphasized the fact that adaptation measures are context-specific and cannot be directly transferred to another location without carrying out economic, feasibility and public perception analyses. For example, green roof assessments in Cascais, Madrid and Jena yielded significant cost disparities, likely due to the different levels of advancement in the adaptation technology market across Europe and local expertise availability.

Bottom-up initiatives such as the "farmer as water manager network" with compensative incentives could be an effective measure that can be replicated in other locations. Similarly, in the Kalundborg case study, one option resulting from the participatory process and considered by the following municipal adaptation plan was to use farmlands as flood plains to protect the city. In Ílhavo and Vagos, the Scenario Workshop discussion raised the possibility of using an area occupied by farmland for building a sand dike to prevent the formation of a new inlet between the ocean and a river Lagoon (which would cause flooding in urban areas). These three cases have in common the exploration of synergies between rural and urban spaces for flood protection, but also the political and economic issues raised by these solutions, since they demand both the expropriation or relocation of farmers, and a need for compensation plans. These case studies reveal a need to reconcile EU policies such as the Common Agriculture Policy (CAP) and directives with the current state of farmlands which will be dealing with climate change impacts, particularly for rural agricultural areas, and taking into consideration rural/urban synergies. Currently, the EU Flood Directive (Directive 2007/60/EC, (11)) states that "Flood risks in certain areas within the Community could be considered not to be significant, for example in thinly populated or unpopulated areas or in areas with limited

economic assets or ecological value". Consequently, the authorities are very focused on cities (higher economic assets) when making climate adaptation and risk management plans, but not as much in rural/farmland areas (lower economic assets).

Key messages for Agriculture & Forestry/Biodiversity & Ecosystem Services meta-group are rather uniform across BASE European geographic distribution (Table 2-9). They indicated a lack of or non-supportive (or at times contradictory) regulatory framework applicable at a local level, and called for resources and financial aid from EU, as well as national and local authorities. In some case studies, autonomous adaptation measures are implemented by local farmers on a voluntary basis (e.g. Holstebro) and innovative measures have been developed by private entities with financial capacity (e.g. Alentejo). A satisfactory compensation system will need to be in place to promote farmers' ability and willingness to contribute to the collective climate adaptation movement. The role and value of farmlands and natural parks in climate change adaptation should be studied in more detail, in order to formulate a fair compensation system. The outcomes of the case study research indicate that the enforceability and willingness to cooperate at a local scale, particularly in rural areas, relies largely on voluntary bottom-up initiatives (e.g. Holstebro, Lolland and Alentejo), and on their responsibility, since they benefit from good adaptation, but also on symbiotic top-down strategies and incentives which have been found to be lacking in the above-mentioned cases.

When comparing local perceptions between European regions and meta-groups, differences can be noted between Northern and Southern European cases. In the Agriculture and Forestry/Biodiversity and Ecosystem Services meta-group, stakeholders in the South seem to be more aware and concerned with climate change impacts (e.g. Alentejo) than in the North (e.g. Holstebro). Conversely, in the Coastal Zones and Human Settlements & Infrastructures meta-group, stakeholders appear to be equally concerned with climate change impacts. Except for the latter, in the other meta-groups and in every European Region, but particularly in Northern and Central-Eastern regions, promoting local climate change policies often required an alternative framing or narrative (e.g. protection from flooding; better health; protection against storm surges). This conclusion points to the importance of dissemination and awareness raising and a genuine stakeholder engagement, which were continuously stated by case study owners as crucial for progressing along the stages of adaptation processes. The importance of dissemination is not a new finding, however, it has equally been noted that the dissemination/engagement process needs to be multidirectional, not only within the scale of the case study and its diverse stakeholder groups, but also in a larger scale, promoting to the 'rest of the world' what a particular locality, region or country is doing, and consequently empowering such action. Finally, regarding the governance of climate change adaptation, the importance of institutions and capacity building processes (Folke et al, 2005; Smit and Wandel, 2006) was repeatedly stated across meta-groups. Yet, the novelty brought in by BASE is that one way to promote instituitonal capacity is to overcome defragmentation and support inter-instituitonal dialogue by integrating multiple stakeholder groups at distinct levels and scales of governance, through deliberative governance processes (Dryzek, 2010). Narratives, framings and storlyines that accompany climate change adaptation strategies are important triggers for allocating resources (Denton et al., 2014). In most cities analysed (e.g. Copenhagen, Cascais, Jena, Roterdam) the urban narrative (of climate change integrated in a wider transition towards sustainable, green and smart metropolises) promoted additional studies (such as economic analysis of measures) and pushed the allocation of resources for developing the adaptation process (primarily financial, but also human resources).This chapter has sought to synthesize how BASE European case studies inform Europe on participatory approaches, and economic and evaluation tools. Detailed information can be found in each CSLD (BASE CASE STUDY LIVING DOCUMENTS), as well as in D5.2, D5.3 and D5.4. These case studies are either top-down, bottom-up followed by top-down, top-down followed by bottom-up or only bottom-up. Regardless of the starting point, a critical understanding distilled from the variation of case studies' process directions is the importance of keeping the process going. In other words, the goal is to attain a regenerative and fluid cyclical channel between bottom-up initiatives and top-down strategies (Figure 2-7). It is of utmost importance not to stifle or strangle bottom-up initiatives via top-down strategies. For instance, bottom-up climate adaptation initiatives in rural agricultural areas or grassroots individuals/communities often arise as a result of a need to accommodate climate-related change. Almost half of BASE European case studies have some form of ongoing autonomous adaptation (Alentejo; Ílhavo and Vagos; Cascais; Copenhagen; Dartmoor; Donãna; Holstebro and Lolland; IJsselmeer; Jena; Kalundborg; Leeds; Madrid; Prague; Rotterdam; South Moravia; Venice; and Ústi). Most of these measures are implemented by individuals/small communities in rural and urban areas. However, the regulatory framework generally does not encourage non-conformity and more often impedes "thinking-out-of-the-box" innovative initiatives taken by individuals. In a modern society which advocates and

incentivises creativity and innovation in advancing technological field, it is curious that the same does not apply to innovations developed to satisfy basic human needs in face of climate-related changes (Cash et al., 2006; Seyfang and Smith, 2007). The former propels humanity towards undefined limits, while the latter roots humanity down towards the known essentials. There is no conflict, they are symbiotic alike the relationship between bottom-up initiatives and top-down strategies. EU and national policies, research findings and action-research could act as "lubricant" that allows information and ideas to flow without resistance. Again, using acknowledged feasible bottom-up initiatives as a starting point, top-down strategies should provide enough support to bottom-up communities for keeping the initiatives alive. Clearly, it varies from case to case, but in general they should play the supporting role and not take control over the initiatives. Ownership of one's basic needs is an essential step towards willingness in adapting to climate change (Adger et al., 2013).

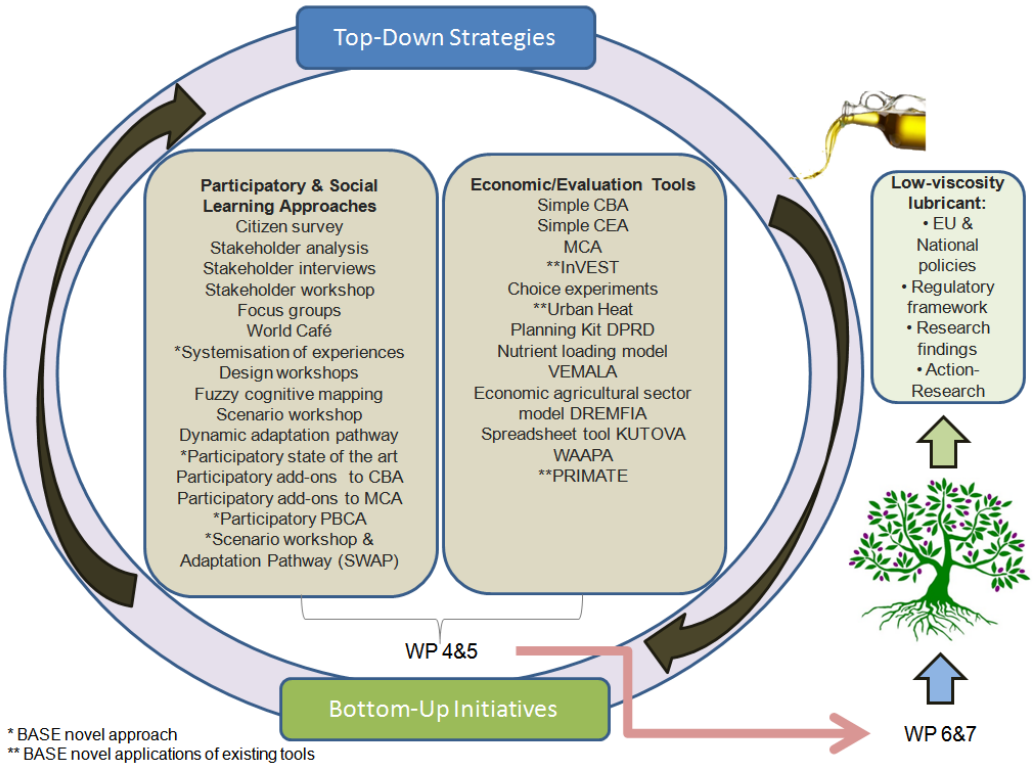


Figure 2-7. BASE European case study synthesis: A regenerative cycle of bottom-up initiatives and top-down strategies

3 Meta-analysis of Participatory experiences in BASE case studies

By Andreas Hastrup Clemmensen, Inês Campos and Kiat Ng

3.1 Introduction

The empirical basis for this chapter's analysis will be the 22 case studies utilised in deliverable 5.3 (See table 3.1 below). The other chapters in this deliverable are addressing the 23 European case studies, plus the 4 national cases. However, since this chapter will be built on the analysis of participation presented in D.5.3, this does not include Leeds, since it applies an analytical top-down approach and did not include a participatory angle in its scope. D.5.3 also did not include the international cases, since these had a different purpose in the scope of BASE case study research (as was explained in Chapter 1 of this document). The objective of this chapter is to further explore the data and analysis presented in BASE deliverable 5.3. This will be done by cross-examining the data already been presented there in new contexts and patterns. However, the 22 cases include both a number of cases that have actively undertaken participatory methods and others that have not. For an analysis of the participatory cases, please see Deliverable 5.3, chapter 2.

Table 3-1 Case studies analysed in deliverable 5.3

Case Study context (cluster)	Case Studies	BASE partner	Climate related impacts and risks
Agriculture and forestry	Alentejo	FFCUL	Water availability (drought)
	Holstebro and Lolland	AU	Flooding (fluvial and pluvial)
	South Moravia	CzechGlobe	Water availability (drought)
	Ústí	CzechGlobe	Water availability (drought)
Biodiversity and ecosystems	Dartmoor	UniExeter	Drought and flooding (pluvial)
	Šumava	CzechGlobe	Ecosystem degradation
Cities and infrastructure	Cascais	FFCUL	Heat stress
	Copenhagen	DBT	Flooding (coastal and pluvial)
	Jena	UFZ	Heat stress and flooding (pluvial)
	Prague	CzechGlobe	Heat stress and flooding (pluvial)
	Rotterdam	Deltares	Flooding (fluvial and coastal)
	Venice	CMCC	Flooding (coastal)
Coastal zone	Íhavo and Vagos	FFCUL	Flooding (coastal)
	Kalundborg	DBT	Flooding (coastal and pluvial)
	South Devon	UniExeter	Flooding (fluvial and pluvial)
	Timmendorfer Strand	EI	Flooding (coastal)
	Cornwall	UniExeter	Heat stress

Human health	England	UniExeter	Heat stress, vector borne diseases
Water resources	Kalajoki	SYKE	Flooding (fluvial)
	Ijsselmeer	Deltares	Water availability (drought and flooding)
	Madrid	UPM, BC3	Heat stress

3.1 Methodology

The point of departure for the cross-comparison are the stakeholder groups of all cases and their influence in the adaptation processes described in Deliverable 5.3. The meta-analysis is build up around the data that was reported through the case study living document (CSLD) for the 22 cases used in D5.3, and involves three forms of data and subsequent analysis, which will be utilised here. In order to provide cross-comparisons, the data will be rearranged and looked at across cases and adaptation phases[6], with a particular focus on the stakeholder groups and their involvement in driving and influencing the adaptation processes. The comparison analyses adaptation phases across Europe in reference to decision-makers and civil society stakeholders. These were the stakeholder groupings that were reported back on and which have been more relevant in the context of the participatory methods applied, as one of the primary targets of participation is to involve stakeholders from a wide array of positions in society, albeit with a stake in adaptation (Smit and Wandel, 2006; Sayce et al., 2013). This often challenges the classic decision-process, which might neglect conflicting views or interests as extraneous (Füssel, 2007).

The three dimensions of data and analysis include:[7]

a) Level of Participation
b) Stakeholders involved in the participation process
c) Adaptation phases

3.2 Results

3.2.1 Stakeholders in adaptation decision-making

The stakeholder groups presented in figure 1 below are next analysed in the context of uncovering the participation of decision makers and civil society actors, in the process of developing and determining adaptation measures and strategies. The patterns uncovered are then examined in framework of 'level of participation'.

[6] See description of adaptation phases in D5.3, p.13

[7] For an explanation of the different categories of data and analysis, see pp. 9-14 in D5.3

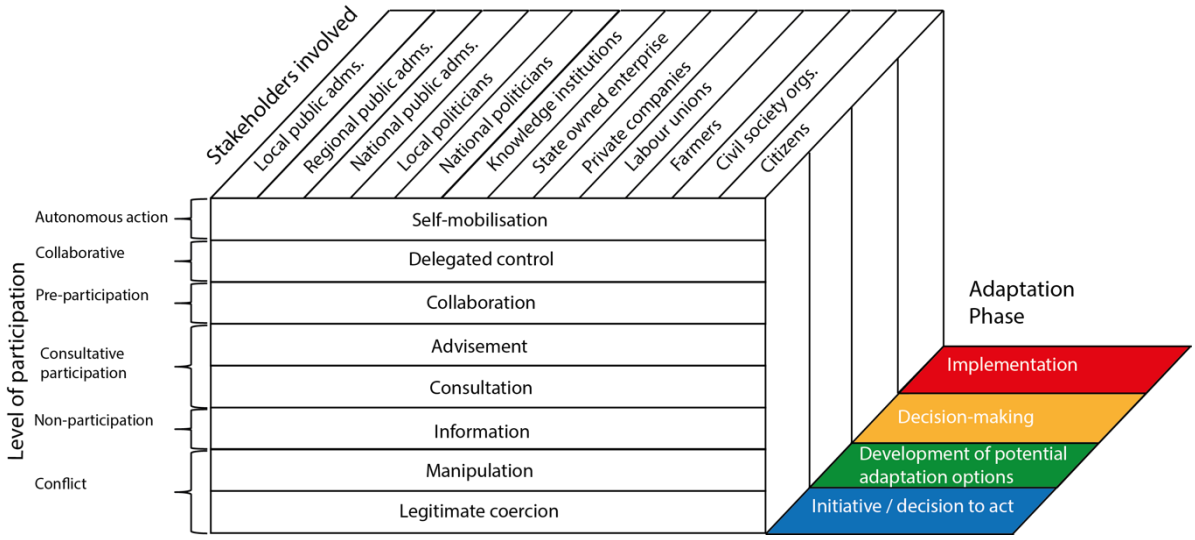


Figure 3-1 Participation Matrix

Civil society stakeholders

(Farmers, civil society organisations, citizens, private companies, labour unions, knowledge institutions)

By cataloguing the civil society stakeholders reported in BASE, we can see their distribution over the different phases of adaptation development. For this rather diverse group of stakeholders, a number of observation jump out, which are related in what follows.

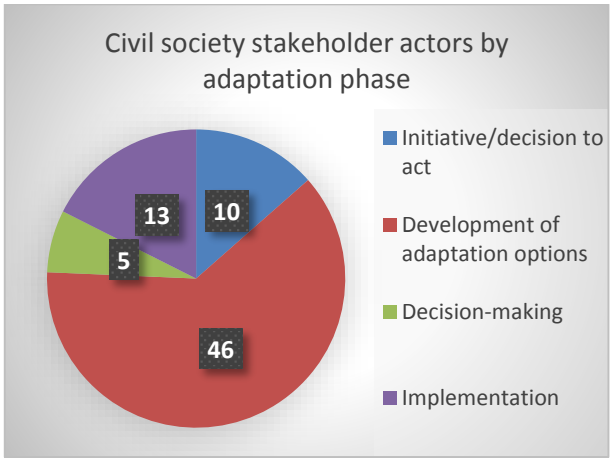


Figure 3-2 Civil society stakeholder groups by adaptation phase

- Civil society actors are in the BASE cases mostly involved in the development of potential adaptation options, and less so when it comes to initiatives or decisions have to be made, as visible from the numbers above. Examining the crude numbers, only one case (Venice) has citizens as involved in the instigating 'Initiative/decision to act' phase. Civil society organisations are, likewise, only represented in one case (Alentejo). Both examples are bound together by the perceived level of participation for the stakeholder groups, Self-mobilisation. In Venice, citizens and private companies, whom are property owners, are involved in "*processes of spontaneous private adaptation measures to adapt their premises and urban structures (pavement levels) and services (alert systems and emergency services) to increasing sea levels*" (D5.3: 43) In Alentejo, self-mobilisation comes in the form of

smaller societies in the form of villages, acting together against an evident danger to their livelihood. The Tamera ecovillage fought desertification and used Permaculture to create water retention landscapes and peace biotopes. Their adaptation measure was implemented and the process resulted from self-mobilisation with the collaboration and consulting of other stakeholders.

- The autonomous adaptation actions in Venice and Alentejo are the result of initiatives, independent of external institutional arrangements or formalised processes, quite the contrary to planned participatory initiatives. Although hard to conclude from the sparse evidence, self-mobilisation seems to have worked with relative success in the context of Alentejo, where grass-root movements also formalised the adaptation process eventually and involved other relevant stakeholders. In Venice, although effective, the property owner 'principle' seems to be diffuse and lack the organisation and involvement across different stakeholder groups and interests, which a participatory approach could have assisted.
- The only stakeholder group under the civil society umbrella that has been involved in formalised participatory processes (collaboration) is 'knowledge institutions'. The role of civil society organisations, citizens and farmers are only categorised as 'self-mobilisation'. This division also illustrates the case studies where BASE researchers have taken an active part in adaptation initiatives and carried through a formal process of participation (Green Roof (Šumava Region), Cascais, Copenhagen, Aveiro Coast).
- Out of the 61 tracked stakeholder groups that took part of the 'development of potential adaptation options' in case studies, a clear majority (40) are evaluated as being collaborators, indicating that civil society stakeholders are often considered as playing a key role in this phase of the adaptation process. There is quite an even distribution across the cases that actively utilised participatory methods (20 stakeholder groups) and those that did not (21 stakeholder groups). There are examples from BASE cases across Europe, where civil society groups have been involved in spite of not doing it through a formalised participatory method. The involvement has mostly, though, been instigated by BASE researchers and, as such, not been a 'natural' part of an administrations or civil society's development of adaptation measures. Examples of this are processes in Alentejo (civil society organisations, farmers and knowledge institutions) and Kalajoki (citizens, farmers, knowledge institutions and private companies). In all of these cases, the involvement of civil society stakeholders was facilitated by BASE researchers and cannot be said to have been executed with participatory methods.
- Timmendorfer Strand is an case that stands out in this context, as a retrospective case, where the local authorities applied a top-down approach as they made use of one-way communication in order to push through a storm-surge adaptation measure in the local community: "*the initiative to this process came from the authorities (top-down approach)…because of their fears regarding the attractiveness for tourists (tourism is the most important economic sector in the municipality), they had to be convinced, that coastal protection is necessary.*"(D5.3: 37)
- Civil society stakeholder groupings are not widely making their mark when it comes to decision-making within adaptation and taking an actively part in the implementation of measures. Only in three of the cases (Alentejo, Rotterdam and Kalajoki) did citizens and knowledge institutions take part in the decision-making. The latter two cases it operated through collaboration and consultation efforts, while citizens and farmers in Alentejo relied on self-mobilisation. Of the 11 cases where civil society stakeholders played a part in the implementation of adaptation (policies, hard/soft measures, etc.), 4 of the cases were the product of self-mobilisation (Alentejo, South Moravian Region, Ústí Region and Venice). Of these four cases only the Alentejo case made use of active participatory methods, so this cannot necessarily be seen as a prerequisite of civil society stakeholder involvement in the BASE case studies. However, the remaining cases encompassed stakeholder groups that had a high degree of participation. Private companies, knowledge institutions, citizens and CSOs were all involved in the implementing phase, as decision-making was shared through the principles of collaboration, understanding that participants are partnering together to find good solutions.
- In Kalajoki, significant flood risk sites were identified with the help of stakeholder consultation workshops. The final outcome of this process was a revision of the Flood Risk Management Plan, where involvement was ensured in this ultimate implementation phase by expressively stating where stakeholders had an influence on the plan. A similar way of ensuring a basic level of involvement from civil society stakeholders was used in the case of Kalundborg. Local authorities drafted the adaptation policy plan with a dedicated section to the citizen summit, and highlighted decisions made by citizens. The reason for these two examples and processes in other cases not being categorised as *delegated control*, is the lack of delegated control and decision-making to the participatory

actors. The decision maker should be willing to accept the results of the participatory collaboration, which they themselves should be an active part of.

Decision makers

(Local public administration, regional public administration, national public administration, local and national politicians, state-owned enterprises)

This pooling of stakeholder groups involves actors that formally bestowed power and, as such, are normally central to the adaptation phases. The delegation of power and influence is something that all case studies reported back on, which makes the role of decision-makers interesting to examine across all the cases

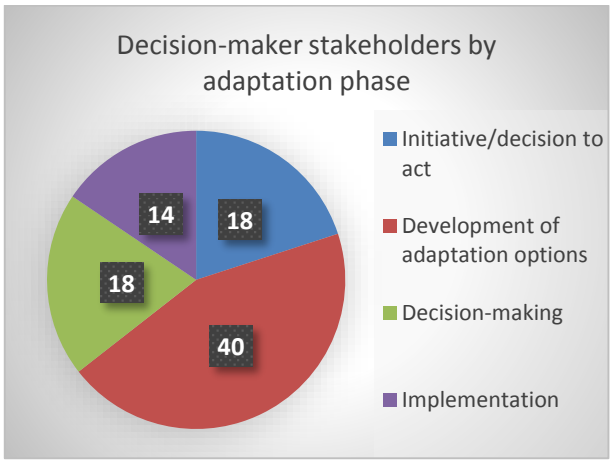


Figure 3-3 Decision-maker stakeholder groups, by adaptation phase

- In the early phases of adaptation there is a tendency towards local decision-makers as the instigators. In 9 out of the 13 observed cases, local politicians or public administration took the initiative and decision to act on a perceived climate change threat towards adaptation. In Copenhagen, the municipality started working on an overall policy framework and its implementation, both for previously known climatic threats (pluvial and fluvial flooding) and future anticipated (flooding caused by storm-surge/sea level rise). This was the product of a clear locally anchored political pressure. It also took pressure, albeit from another stakeholder group, in the Lolland case, for the municipality to take action on flooding hazards experienced in the region. In 2012, Lolland Municipality took the initiate to start the project for the Rødby Fjord catchment area due to pressure from farmer representatives, who were unsatisfied with the municipality's asserted inactiveness after the 2011 flooding. In Jena, the climate policy and planning efforts was the product of pressure from a single individual, namely the head of the Department of Urban Development and City Planning. An even more fragmented approach to adaptation challenges can be observed in South Devon, where the District Council took action after a plea from local businesses. In spite of the multiple affected stakeholders in the area, no process of involvement has been carried out. A top-down approach was also applied in the case of Timmendorfer Strand, where authorities undertook a campaign to convince citizens of the necessity of raised dikes. This process took approximately 12 years (1999-2011) to finalise and could potentially have gained, both in terms of cost-benefit and procedural, from an organised bottom-up procedure at the onset.
- The experiences with participation (be it through formalised methods or otherwise) from Kalajoki and Kalundborg shows the fruitfulness of combining a top-down with bottom-up approaches, as this let the local authorities and decision-makers sustain a local anchoring from the beginning of the, in these cases, policy process. The two respective policy plans from Kalajoki and Kalundborg both contain clear footprints of citizens and other relevant stakeholders, which have been taken into consideration by decision-makers.

- Across the cases we can see that stakeholders, particularly locally anchored, have difficulties with planning for future perceived climatic threats or events from an ex-ante approach. The question becomes interesting in relation to the use of participatory methods as a tool for future planning. Political realities of short terms and budgetary constraints often limit the focus on future planning, in spite of the disaster risk reduction community's well documented cost-benefit ratio of acting today on the climate threats of tomorrow. Participatory processes can help instigate such processes and make sure that the legislature is held accountable to decisions, and improve transparency.
- When comparing the 17 cases that have reported on activities from decision-makers in the development phase of adaptation, a number of observations stand out. In the cases that have been analysed as being of a collaborative nature, 28 of the total 39 stakeholders are represented (6 local politicians, 16 Local public administrations, 6 national public administrations, 11 state owned enterprises). It is no surprise that the more you involve; ultimately more stakeholders will be take part of an adaptation process. In this range of cases the diversity of decision-maker groups, still, is by far the largest in cases that have utilised participatory methods. Aveiro Coast engaged 4 administrative layers as well as the local politicians (applying a scenario workshop, adaptation pathways and MCA), as did the Copenhagen case (MCA and stakeholder workshops) while the Green Roof case (scenario workshop) engaged the public companies, local politicians and administration. This mixture of political engagement with the administrative bodies in the adaptation measure development is quite unique to the cases where participation has been thought of in a formalised methodological way.
- Making decisions and taking part of the implementation in adaptation processes is often delegated out to administrative bodies (be it local or national). Two-thirds of the identified decision-makers that took part of, or were observed in, the BASE case studies in the more advanced adaptation phases belong to the administrative/government category. This trend is similar in the different clusters and in relation to responses to diverse climate risks. When BASE researchers were active in engaging local stakeholders, there is an inclination towards politicians being more implicated in the decision-making and implementation phases. Apart from the retrospective Timmendorfer case, in all instances, when politicians played a role, there was also the active involvement of BASE researchers. In some cases politicians established partnerships with BASE researchers to co-develop the adaptation processes (e.g. Cascais; Ílhavo and Vagos; Copenhagen). The experience from those cases that did use participatory methods involving politicians (Kalundborg, Cascais, Copenhagen & Ílhavo and Vagos), shows that there is a tendency towards engaging the political system deeper particular at the implementation phase. In Kalundborg, politicians engaged in directly dialogues with citizens through a citizen summit and the Cascais case saw similar experiences through structured workshops. The Ijsselmeer case stands out in this context, because of The Netherlands' relationship with water and therefore sees a high degree of political involvement in spite of the lack of participatory methods applied.

3.3 Conclusion

As presented in the conclusions of D5.3, the arguments for applying participatory methods are often associated with promises of better outcomes, conflict resolution and cost-effectiveness. In this regard, the delegation of control, interaction and connectivity between decision-makers and civil society stakeholders is interesting to examine, in the context of adaptation processes and participatory methods. When cross-examining the European BASE cases, a number of observations point towards a less fragmented and diffuse decision-process when adaptation measures are being developed, decided upon and implemented with the use of participatory methods, and when involving a wide range of stakeholders. Participatory methods can help by organising processes and engage capacities that otherwise would not be concerned with adaptation, but are not a natural safeguard for transparent and inclusive processes. It all depends on local circumstances. As the Šumava case experienced with their use of scenario workshops, it took a while for stakeholders to acknowledge the process and thereby each other, when the method was applied for the first time in the local setting. The stakeholder analysis of BASE cases studies also shows that in cases with a higher degree of diversity of stakeholders, adaptation is not only viewed upon exclusively as a technical or administrative issue, but also as a political issue (Kalundborg, Cascais, Alentejo, Šumava & Copenhagen). Government and administrative bodies, along with knowledge institutions play an important role in shaping adaptation (development of adaptation options and decision-making). However, when planning for solutions that might have long-term implications, such as adaptation measures, decisions made on a basis of well-informed consensus tend to be more sustainable and stand the

test of time. It is not something that can be derived out of the empirical basis of BASE case studies, but the points above show tendencies that point to the importance and prospect of treating the development of adaptation processes as more than a technocratic process.

4 BASE European case studies: stakeholder perspectives

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4.1 Introduction

Involving stakeholders has become a stepping stone for European projects. Although academic excellence is a central criterion for evaluating research and grant proposals, mounting attention is given to innovative approaches, such as the co-design of proposals that are based on a transdisciplinary framework and aim at achieving the highest possible societal impact (CIVITAS, 2006; Durham et al., 2014). In Sustainability Science and Climate Change research, ongoing FP7 projects are integrating some form of stakeholder engagement and participation at the core of their methodological frameworks. CLIMSAVE[8] has been developing an interactive web-based tool to allow stakeholders to understand impacts and vulnerabilities, and explore local climate change adaptation strategies. MEDIATION[9] was concerned with gathering robust scientific data on climate impacts, vulnerabilities and adaptation options, as well as developing an easily accessible framework to convey relevant information to policy-makers and adaptation practitioners.

Both CLIMSAVE and MEDIATION targeted their stakeholder involvement processes to higher levels of governance, mainly focusing on top-down processes. BASE offered and alternative outlook by aiming at bridging top-down/bottom-up gaps in the scope of climate change adaptation processes. Another ongoing project, which started after BASE, ECONADAPT[10] focusses on economic analysis of adaptation process throughout Europe and may benefit from BASE case study experiences with participatory approaches in the context of economic assessments (e.g. P-CBA).

Given the relevance of stakeholder engagement as a stepping stone for climate change adaptation research, this chapter provides an analysis of climate change adaptation processes from the point of view of the stakeholders involved in BASE case study research. Over the past three years, BASE case study research has resulted in a total of 94 workshops and participatory events held until month 36 (i.e. September, 2015). Altogether BASE researchers participated in 89 conferences with presentations or posters that resulted from the case studies developed. Additionally, 45 publications have resulted from the case studies. Since the social impact of the case study research has been central concern since the beginning of BASE, the focus of the chapter is on providing a stakeholders' appraisal of the observable consequences of the research process developed over the past two years, regarding the main barriers, opportunities and research gaps that can be identified. The chapter draws from the results of a participatory workshop - The European Local Stakeholder Workshop on Climate Change Adaptation (henceforth referred as Stakeholder Workshop) - organised in the Bella Centre, Copenhagen, Denmark, on Monday 11th of May 2015. The workshop included group discussions, world café sessions, and a questionnaire to case study stakeholders. Results of this workshop were intended to inform this deliverable report on the perspectives of those involved in BASE. The chapter relates and synthesizes the results in order to draw on some key directions for future research in the conclusion.

4.2 Methodology

The question leading to this chapter was to understand how BASE case study owners and stakeholders assess the adaptation processes they have been involved in. Specifically, the chapter relates how BASE transdisciplinary groups perceived the barriers, obstacles, and opportunities of the adaptation processes. Additionally, it is important to identify relevant gaps for future research and policy. The methodology applied was a participatory workshop, with the

[8] http://www.climsave.eu/climsave/index.html
[9] http://www.mediation-project.eu/
[10] http://econadapt.eu/partners.html

objective of providing a retrospective assessment of BASE case study experiences from the point of view of those who were involved in the process.

The stakeholder's workshop provided a platform for stakeholders and researchers to exchange experiences on adaptation and to review the research carried out in each of the case studies. The workshop was organized by the University of Leeds, FFCUL and the Ecologic Institute with the support of all BASE case study partners, and brought together 23 case study owners and 16 stakeholders from across the project's 23 case studies.

The workshop provided a participatory assessment of the adaptation experiences, based on the perspectives of researchers and stakeholders. This assessment was made through group discussions sessions between case study owners and stakeholders, and through three world café sessions. The results of the morning discussions are framed within the new BASE meta-groups, which evolved beyond their original cluster structure (reported in D. 4.1), as explained in chapter 1, section 1.2.1 of this deliverable. The groups are:

- Agriculture and Forestry/Biodiversity and Ecosystems Services
- Water Resources/Health
- Coastal Zones/ Human Settlements and Infrastructure

In each discussion group a stakeholder and a case study owner were present. The aim of the discussions was to provide a comparative assessment of BASE case study results, taking the perspective of the meta-groups. The discussions provided insights guided by a set of questions made to the participants. The questions aimed at collecting a synthesis evaluation of the adaptation success stories and challenges, taking stock of BASE European experiences. Two main questions were addressed:

a) What have been the main success stories of working in climate change?
b) What were the main challenges?

The World Café is a method for facilitating debate on a large-scale (Brown, 2010), where participants are grouped in thematic tables with topics for discussion. The topics for discussion of the 'world café' tables were the Barriers; Opportunities and Participation in climate change adaptation processes (figure 4-1 below shows the structure of the workshop).

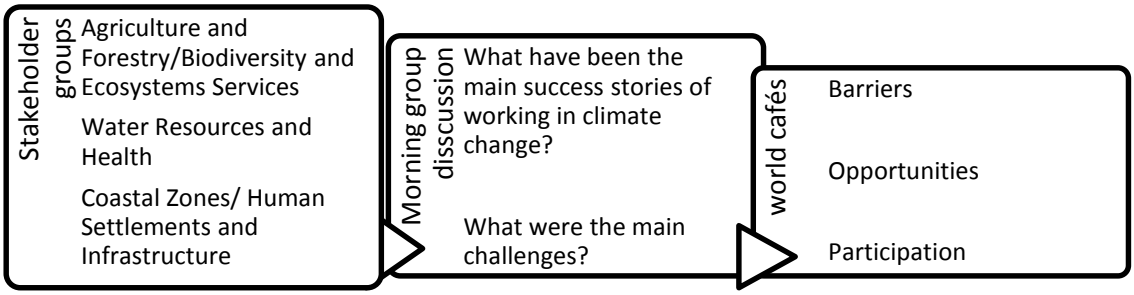

Figure 4-1: Structure of the participatory workshop for a stakeholder's appraisal of BASE research

Following the workshops, the stakeholders were asked to respond to a short feedback questionnaire form to assess their views on the case study experiences and the BASE project as a whole. Baseline information on stakeholders and their case study was also collected. This baseline information included the expertise of stakeholders and the themes found to be most relevant for their case studies (see Appendixes 3 and 4 for a sample of the agenda of the day and of the questionnaire used).

4.3 Results

4.3.1 Group discussions

The following Table 4-1 provides a synthesis of the results of the discussion groups on the challenges and success stories of the adaptation processes experienced.

Table 4-1 Synthesis of Discussion groups results on the success stories and challenges of adaptation processes developed or analysed through BASE case studies

Discussion groups results	Agriculture and Forestry/Biodiversity and Ecosystems Services	Water Resources/ Health	Coastal Zones/ Human Settlements and Infrastructure
On Success Stories	→ Establishing new collaborations among stakeholders (of different sectors) with a shared strategy, aimed at finding – flexible – solutions, and with a shared commitment. (e.g. Holstebro and Lolland) → Reaching a holistic approach, harmonizing local players and ensuring an intermediate strategic level worked in several case studies (e.g. Alentejo, Dartmoor; Šumava) → Stakeholders found that the focus on climate change adaptation has the potential to increase interaction/collaboration between different sectors; stakeholders are able to work together when facing a specific question and/or a specific practical solution. → The use of models (e.g. InVEST; PRIMATE) contributed to improve discussions with stakeholders. → Participatory moments, such as events, workshops, offered a forum for an open dialogue between different groups who were previously disengaged (e.g. the Participatory State of the Art workshop in the Alentejo case study) → By bringing in new stakeholders into the decision making processes, and the meeting of new knowledge domains, competences and resources provided a new momentum for adaptation and supported political	→ Public Health in England studied the various effects of environmental change, e.g. Urban Heat Island, ground level air pollution, allergens (pollen), floods, etc., on public physical and mental health. → The UK MET Office calculated how many hospital beds will be needed in respect to different temperatures. They also calculated the time to a destination based on temperature (i.e. the higher the temperature the longer to destination). → There is an annual heat wave plan and winter fuel plan in the UK. → Small blocks for shading are in a planning stage in Venice. → There are plans to build cold-producing areas and connect these with residential areas and green corridors. There is a cold-air modelling system for Jena (Germany) based on the direction of the wind. → Increasing local knowledge and awareness of potential climate change impacts through surveys has helped (e.g. Kalajoki).	→ Cascais is among the richer municipalities in Portugal and uses climate scenarios. They share experience with others, these are usually more creative due to a lack of funding. → In the UK there are maps showing where flood risk is, where it is not appropriate to build. → It was found that Venetians are willing to invest more than is expected in terms of damages, because of psychological reasons (relief of not having to worry). These factors should be taken into account in future research. → In the coast of Íhavo and Vagos (Portugal), despite the challenge of financing adaptation, an inter-municipal long-term adaptation plan has been done, as a result of BASE research. → The creation of a common knowledge basis and an atmosphere of equality facilitates discussions, local stakeholder felt more confidence and trust as they were engaged in co-developing the process with researchers. → The use of scenario workshops is an important adaptation tool, encouraging thinking out of the box (e.g. Šumava ; Kalundborg). → People are more willing to implement and defend a plan that they perceive as their own (i.e. local ownership), not introduced by an external force (e.g. Ílhavo and Vagos). → In Portugal, traditional flood charts and model flooded areas helped identify areas where not to build, along the Atlantic coast.

	interest and commitment (e.g. Alentejo; Šumava)		
On Challenges	→ Stakeholders from this meta-group's case studies agreed that there are problems of scale, a gap between adaptation strategies different governance levels (e.g. national and country regions). Local solutions present an important perspective, large scale strategies tend to be too general, so the intermediate level is needed to ensure a holistic perspective. → Stakeholders referred to the non-collaboration of sectors in local or national government (with differing views and priorities), lack of communication and discussions across sectors. → There is a lack of information about climate change at the local level. → Stakeholders found that in some places climate change is not pronounced enough to alarm local stakeholders and the public. If stakeholders and the public are not alarmed, neither are politicians. → It was also stated that the public doesn't understand scientific language. → Stakeholders found it hard to draw the line between public and private involvement and responsibility. The group argued that the public sector (e.g. national rural development plans) should create incentives to make the private react, and that this may be particularly difficult in the agriculture and forestry sectors. → It was also argued that in some countries, there is no legal room for local governments to find local solutions, due to an emphasis on central governance of sectors and different targets for different sectors. Therefore it is not possible to find win-win solutions. → The previous challenge is interrelated to the emergence of new grassroots movements and initiatives, such as the Transition Towns, or the Convergence Centre (a sub-case of the Alentejo case study). These initiatives seek to respond to societal needs at the local level, when governments are not able to act. → Stakeholders referred the issue of securing funding from national to local level. Who will pay for the measures?	→ The effects on human health of green infrastructures in cities (both physical and mental) need to be carefully considered in the planning process. For instance, wetlands and green areas are popular measures but their creation may bring adverse effects such as waterborne diseases (ticks, invasive mosquitos) → The wetland paradox was mentioned: native wetlands were dried/destroyed in the past due to problems with mosquitoes, now wetlands are being promoted but not accounting for past problems. → Planting trees in cities can worsen allergies due to pollen (Public Health England). → All stakeholders mentioned the problem of how to inform people at the local level; there is a need for a more personal approach. Legislation does not include this kind of approach. Information is referred as crucial especially to protect peoples' health during heat waves and cold waves. → There is a lack of problem ownership at the local level, thus different stakeholders need to be integrated actively in the adaptation process. → There are issues on how to prioritize actions and what is needed to make better decisions. → The appropriate design of green infrastructure. Even though green infrastructure can provide many benefits it needs to be evaluated within a wider context. → There are issues with a lack of political will at different scales and with responsibilities from the municipality to the national level.	→ The main issue for coastal adaptation is securing funding, there aren't enough financial resources; it is also important to know how to make the best use of available funding. → Not every measure is suitable for every case and it is very important to take into account the unique character of each city. For example, in Cascais it is impossible to implement a green belt around city, as it would disrupt the natural fresh air flow to the city. → Despite the existent flood risk maps in the UK, the pressure to build is stronger and there are plans for new developments in risky areas. This causes problems with insurance companies. → In The Netherlands there is no flood insurance and flood maps are based on current situation. → In Germany they back-cast and adapt as a response to past events. There is a general perception that adaptations under uncertainty are mal-adaptations. → There is a lack of clarity of financial responsibilities, how should costs be distributed among stakeholders. Who is going to pay for measures? What funding mechanisms are needed? Example: Copenhagen has a collective tax based on water use. A tax on soil-sealing was suggested: if you can handle the cloud-burst water on your own ground you get a 'pay-back-fee'; but there is a limit of how much you can cover your ground with stones. There could be a decreasing tax depending on the distance to the sea, but it is a long process to develop such a differentiated tax system, and the time frame for politicians is different. Portugal already has a higher tax for coastal areas. In Kalundborg there is a problem in getting insurance for houses at risk. → How do we convince local residents to contribute financially? It does not seem realistic to ask tourists to pay. Example: Vagos municipality expects to be unable to convince local residents to pay to protect their coast, because the government let them build there in the first place. → There is a problem with limited human resources, especially in small municipalities, and the impermanence of knowledge when staff leave. → Regarding implementation, there are gaps in what needs to be done once a plan is adopted. Example: The adaptation strategy in Kalundborg was approved last year and the recommendations are good and detailed but nothing is happening. It is more about individual solutions than about government action.

4.3.2 World Café

The subsequent results show the main conclusions of the world café tables, which explored the themes: barriers to adaptation, opportunities and participation. The first world café discussions focussed on the barriers to adaptation, and were guided by a set of questions posed by the facilitators, these were:

1. Who (and what) hinders the adoption and implementation of adaptation measures/ strategies/policies?
2. What is needed to overcome the barriers/obstacles to the adoption and implementation of adaptation measures/strategies/policies?
3. If any obstacles were overcome, how was this achieved?

Guided by these questions, the results of the world café's discussion tables are systematized in three topics: Resources, Awareness and knowledge and Institutions. Table 4-2 below provides this synthesis.

Table 4-2 Barriers to adaptation identified by stakeholders, concerning the topics *resources, awareness and knowledge, and institutions*

Resources	Awareness and Knowledge	Institutions
Lack of financial resources and lack of human resources	Traditional knowledge/beliefs can foster scepticism; culture can influence perceptions of risk; uncertainty hinders governance	Competing with existent resources
Long timeframe of adaptation – difficulty in establishing policy priorities	Professional attitudes: science versus engineering	Lack of dialogue, unclear attribution of responsibilities.
Unequal distribution of benefits of adaptation	Complexity-based holistic approaches may hinder action (rather than focus on narrow, yet tangible issues)	Need for broader participation in decision-making/lack of platforms and institutional frameworks to support participation
Governmental subsidies may constraint adaptation options (e.g. agriculture subsidies)	Tourism preferences constraint adaptation choices (e.g. concern with aesthesis/landscape preservation)	Adaptation as a long-term issue, not compatible with short-term horizons in policy-making

The world café participants equally provides reflections on the perceived triggers to local adaptation (see Table 4-3 below). Discussions on the triggers and drivers for overcoming barriers to adaptation were informed by the following questions posed by facilitators:

1. Who/what drives climate change adaptation?
2. How can we build on opportunities?
3. What are the prospects for adaptation in the future?

Table 4-3 Overcome barriers to local adaptation: perceived triggers and drivers for adaptation, according to the results of the world café discussions

Triggers	Drivers for adaptation
Local experiences with extreme events	Floods
Knowledge exchange	Key decision-makers (state authorities, mayors)
Experiences in other places (e.g. Delta program/Katrina hurricane); Learning from the past	EU regulation, directives
Co-benefits of adaptation measures (social, environmental)	EU funding mechanisms

Communication and awareness raising	Media

Experiences with extreme events, communication and awareness raising are pointed out as central triggers for local action, which is congruent with literature (Dannevig et al., 2012; Baker et al. 2012). Other triggers emerge and are less commonly referred, namely the co-benefits of adaptation measures, the role of EU regulation and directives; as well as of transdisciplinary approaches and knowledge transfers between locations. Finally, regarding future prospects, stakeholders and researchers highlighted the following areas for future research:

Table 4-4 Future prospects for climate change research, policy and action highlighted by workshop participants

Future prospects for climate change research, policy and action
Innovation; exploring urban-rural links; ecosystem services for compensating farmers for changes in land use
Revise relevant legislation
New technologies; urban green infrastructures; sustainable urban drainages systems
Education programs on climate change
Participation, local involvement, local perceptions and cultural dimensions of participation.

Lastly, regarding participation, participants questioned and suggested the following:

Table 4-5 Notes from workshop participants on participatory processes: questions and reflections

Notes form participants on participatory processes: questions and reflections	
Questions	**Reflections**
How to engage the private Sector in participatory processes?	Same actor-groups tend to participate in the adaptation process, there is a need to integrate a wide diversity of beneficiaries and stakeholders.
At what point, during the adaptation process should participatory approaches and methods be integrated?	Traditionally, the culture of climate change adaptation decision-making has not been bottom-up; institutions tend to dismiss the importance of participation, research could focus on capacitating policymakers on introducing participatory approaches in 'traditional' planning processes
Is participation more or less expensive?	The existence of conflicts among potential participants shouldn't be an argument against participatory processes, but actually an argument for.

4.3.3 Evaluation from BASE case study stakeholders

At the end of the workshop, the stakeholders present were asked to fill out a feedback questionnaire. The results are given below.

Stakeholders' profile

Stakeholders had relevant expertise to the workshop and the BASE project. When asked about their expertise, stakeholders provided the following answers, among others:

'economy, CBA information (relevance), participatory process'; 'economics of flood management, adaptation pathways'; 'economics'; 'flood risk management'; 'participated and facilitated a citizen summit'; 'desertification, land degradation, drought, biodiversity, forests'; 'city planner at a municipality, work with climate adaptation plans'; 'working with the local working group for the climate change adaptation strategy. I'm expert in working with local authority in planning processes, analysis of governance and policies, technical issues related to climate change (e.g. flood risk)'; 'economical instruments of sustaining smart cities; opportunities of clean technologies'; 'cities and climate adaptation: heat, flood, health risk, storm, drought'.

Themes relevant for case studies

The stakeholders were asked to choose which themes were most relevant to their case study. The themes chosen provided a good spread of case study themes (see Figure 4-2). The most frequently mentioned were city flooding, coastal, agriculture and water resources. These themes reflect the amplitude of sectors and climate change impacts covered by case studies researched in the BASE project.

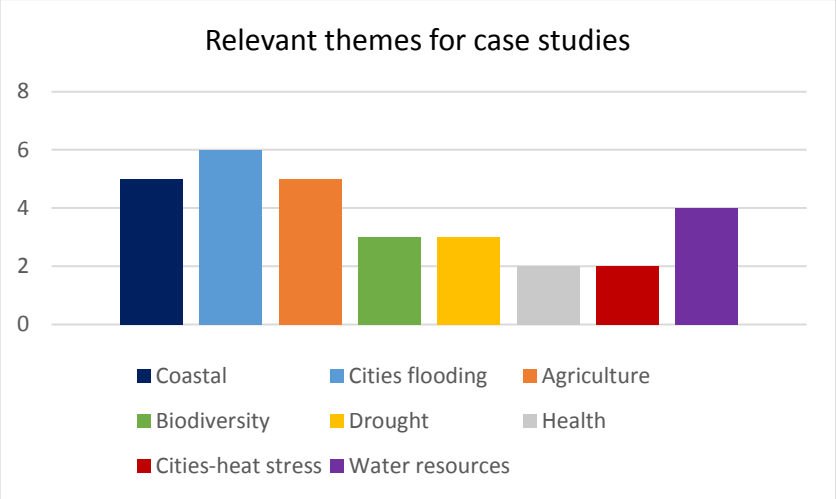

Figure 4-2 Relevant themes for case studies

Regarding the stages of adaptation, stakeholders perceived that the BASE case studies focused their research mostly in the planning stage (67%), followed by assessment, implementation and evaluation (Figure 4-3).

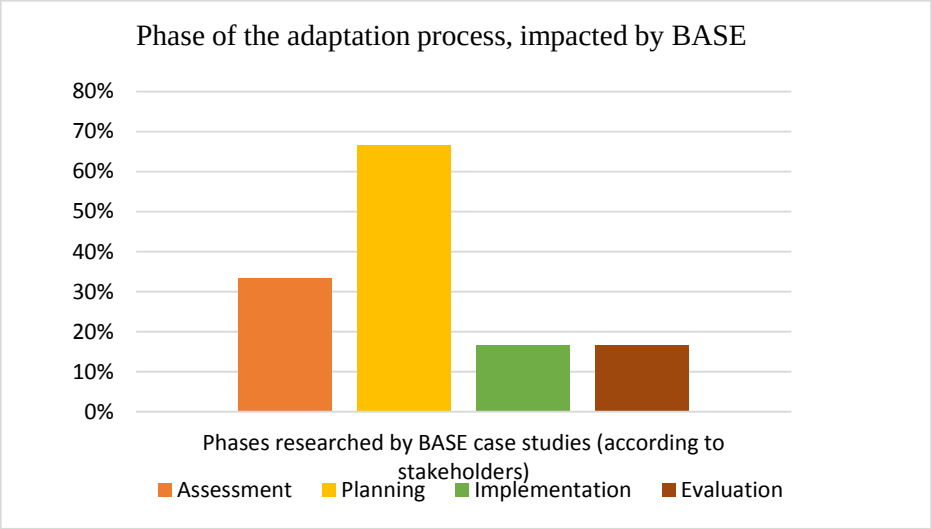

Figure 4-3 Phase of the adaptation planning process impacted by BASE research

Case study involvement

Of the stakeholders present, 83% had taken part in an aspect of the BASE case study at their locality (Figure 4-4). These stakeholders were mainly involved in providing their expert opinion (58%), contributing to data collection (50%) and supporting the establishment of links between the BASE team and other stakeholders (50%). All other types of involvement were mentioned by less than 30% of stakeholders.

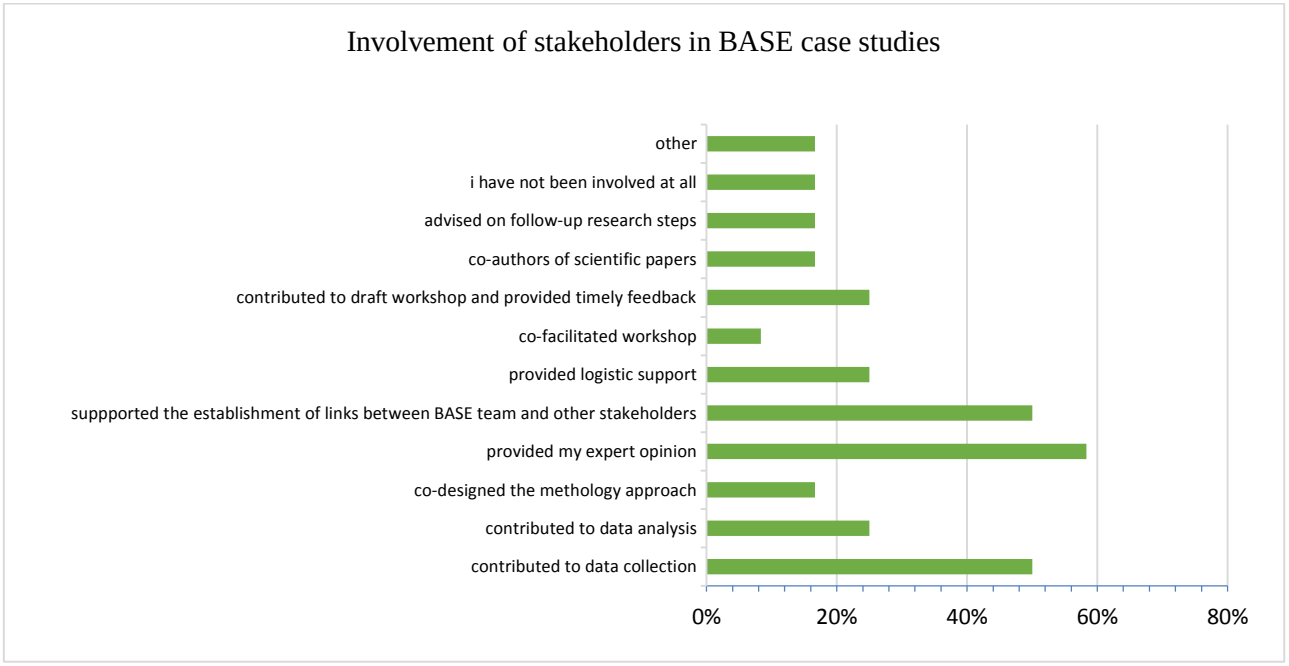

Figure 4-4 Involvement of stakeholders in BASE case studies

Stakeholders were asked to evaluate how BASE case study research was relevant to them. Where 1 is low and 5 is very high, stakeholders gave their case studies an overall high performance (Figure 4-5). This means that stakeholders felt: i) well informed about the research process and results in their case study (3.9); ii) the level of their involvement in the case study was highly satisfactory (4); iii) the quality of the research produced by the BASE case study was high

(4.2); iv) the research was highly relevant for adaptation issues at their case study (3.9); and the results of the case studies were communicated well (3.7).

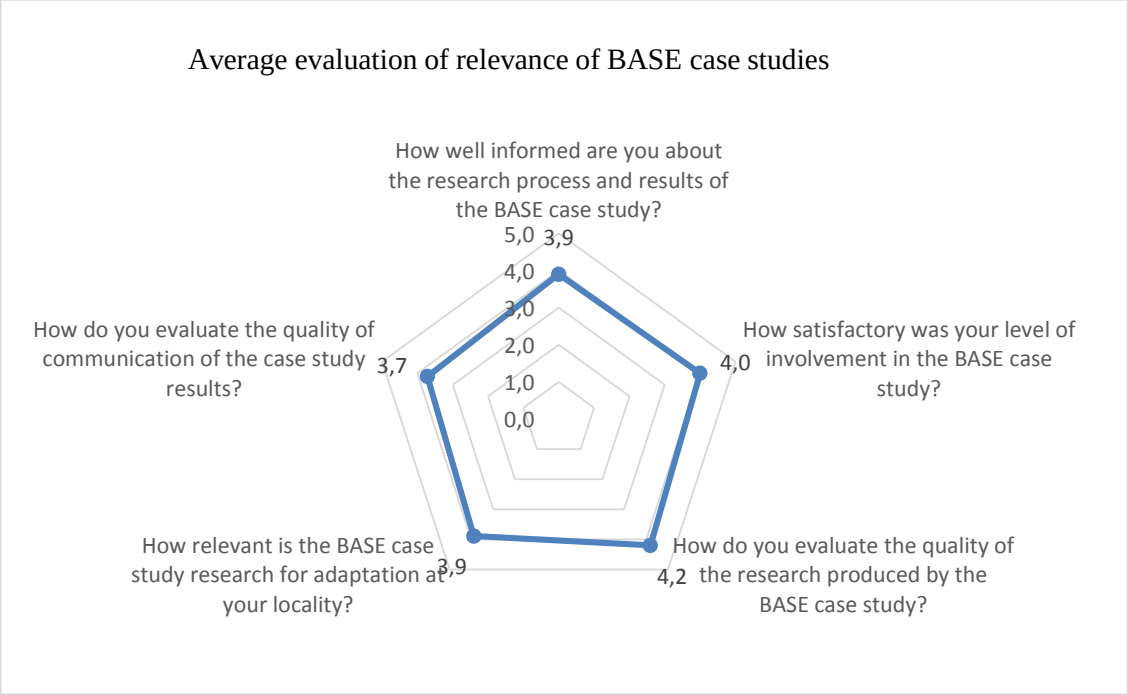

Figure 4-5 Average Evaluation of the relevance of BASE case studies

Regarding the contribution to the process of adaptation and mitigation in the case studies' localities, half of stakeholders perceived that the case study research contributed positively to their locality (50%), some considered it was neutral (20%) and others considered it was not applicable or it was retrospective (30%). The BASE results were considered useful to all stakeholders and their organisations; the following comments provide more insight into stakeholders' views:

> '*not applicable yet but I think it will be very important to support political decisions and explain to the government what the stakeholders think*', '*yes, very much, the information will allow us to relate previous work on climate change and better it, or even reorient it for better results*', '*yes, I should apply the results on the programme that I'm implementing at national level*'; and '*we can use the results in the city planning so can the outside partners do*'.

Assess experiences with BASE

The stakeholders were also asked to assess BASE case studies, based on their experience with the project so far, including the workshop on the same day of the review. The research of BASE case studies as a whole was evaluated as being of high performance (3.8). Stakeholders felt that: i) the quality of the research produced by the BASE case studies is high (3.8); ii) the results of the case studies are clear and understandable (3.1); and iii) the results were useful to them and their organisation (3.4; Figure 4-6).

When referring to the clarity of BASE results, stakeholders said:

> '*information was well explained and written reports were very well written*', '*due to the technical demands, the report is not easy to understand by all stakeholders*', '*sometimes [it] is difficult to*

understand English because I don't work in English', and '*the example fits the problems we all have together on the way forwards to resilient cities and countries*'.

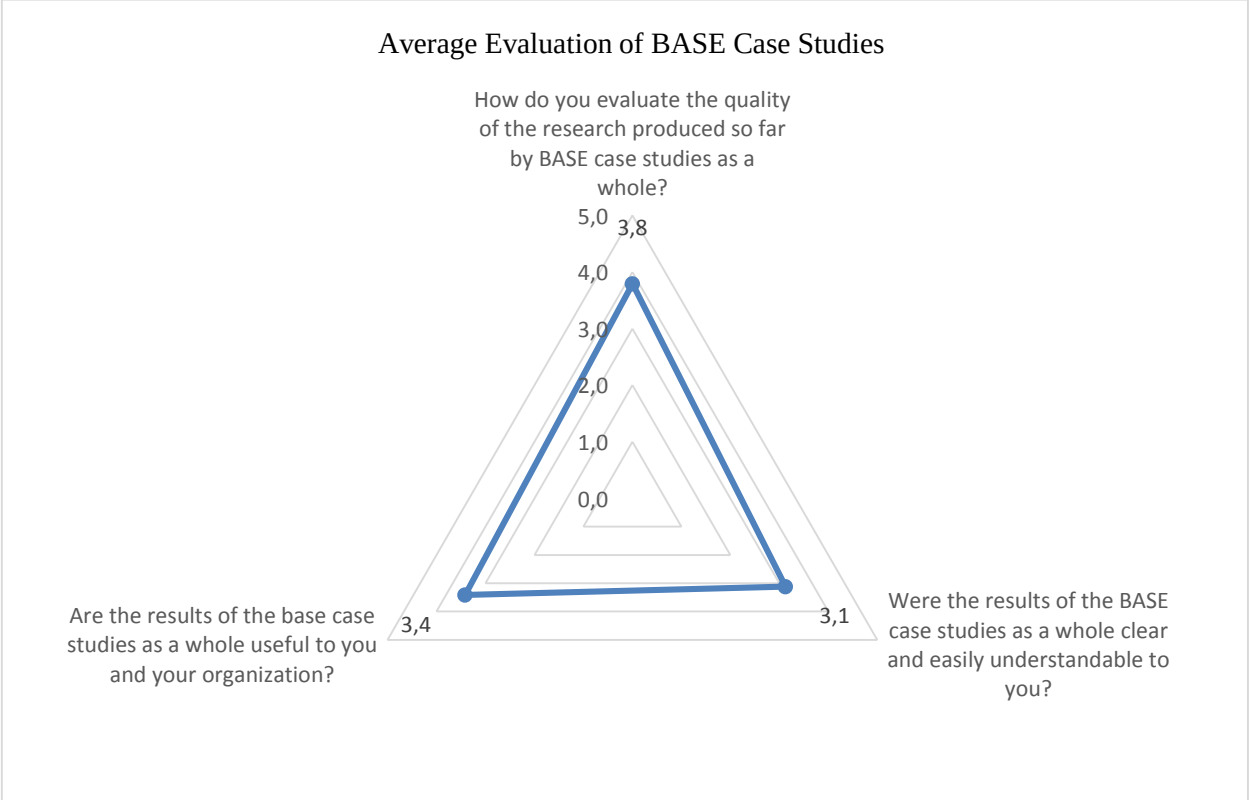

Figure 4-6 Evaluation of Base case studies from stakeholders involved

When stakeholders were asked 'why the results of the base case studies as a whole were useful or not' they gave examples on how the results are helpful to them and their organisation, or their locality. They responded that the BASE case studies were useful because the results, guidance, knowledge and examples can be used in their local, regional or national strategies of adaptation:

> *'We will use it heavily in our revised adaptation plan.', 'to apply at national and regional and local level of my work'; 'useful to all the research applied to cities in the field of climate change'.*

The results are also considered useful to improve the quality of the work of adaptation and provide information of good practices that can then be applied to inspire and evaluate adaptation options and measures:

> *'Because we can apply some good practices with the knowledge that we took from BASE projects', 'improving quality'.*

Finally, the results confirm the approaches used by the stakeholders which supports their work and their communication with other stakeholders:

> *'it's a confirmation of our approaches', 'some of the same problems', 'they are useful for communication with politicians, for example'.*

Comments and questions

In the end of the questionnaire, stakeholders were asked if they had research questions regarding adaptation. One person asked:

> '*How can we have/reach a better commitment/acceptance to adaptation if some results will be expensive/not free of other circumstances, like green and blue infrastructures and mosquitos?*'

Another suggested it is important to evaluate the green washing effect related to adaptation to climate change and another asked for knowledge on '*how to deal with climate change scenario uncertainties'*. Regarding final comments, stakeholders mentioned:

> '*It was good to know the effects of the construction of a submersible seawall (submerged breakwater)*', '*Much better than expected! The team fulfilled all demands and went beyond it by far*'

4.4 Discussion: stakeholders perspectives on BASE research

Based on the opinions of case study owners and stakeholders, workshop discussions touch on a variety of challenges, successes, and barriers of adaptation experiences. A synthesis of these results is provided in tables 4-6 to 4-11 (following this text). Several issues have been identified by workshop participants and in most cases these issues match the current topics of attention in climate change adaptation research.

Problems of scale and multi-level dynamics in environmental policies are well-documented in literature (Cash et al., 2006). These problems have been mainly referred by the agriculture and forestry/biodiversity and ecosystem services' groups. Interactions between different scales and levels of governance are complex (Tompkins et al., 2010) and can benefit from adaptive governance (Olsson et al., 2006; Cash et al., 2006). Adaptive governance or 'co-management' builds on participatory approaches that allow for an effective mediation, co-production and negotiation across scales (Cash et al., 2006). It is a transdisciplinary approach (Hadorn, 2006; Lang et al., 2012) and can contribute to respond to climate change at multi-level and multi-scales of governance (Olsson et al., 2006; Tompkins et al. 2010). As an example, in the UK, climate change adaptation has been dominated by top down initiatives that gradually spurred responses at the bottom level (Tompkins et al., 2010). Although BASE case study research was not framed as an adaptive governance study, in some instances, such as Ílhavo and Vagos, or the Cascais and the Súmava case studies, researchers and stakeholders, at different levels and scales of governance, worked together to advance the adaptation process. Therefore, from the point of view of the stakeholders involved, the research developed was a transdisciplinary effort and a co-management experience. Other case studies were less proactive in co-developing adaptation processes with local stakeholders (such as the Rotterdam or the Leeds case studies).Nevertheless, the case study experiences throughout the project can be a key stepping stone to develop a broad governance framework and social learning process in climate change adaptation. To this effect the experiences of stakeholders need to be better coordinated across casework.

Funding was a recurrent topic in the discussion groups and world cafés. Participants found that BASE helped clarify funding needs by producing economic analyses. However, *how* and *when* to fund are key concerns for the stakeholders involved, which arise beyond the scope of BASE research. These concerns are therefore an important topic to address in future research. In current literature, increasing attention is given to developing a range of mechanisms for funding adaptation. Research projects have been investigating the role of the private sector and alternative forms of funding (OCED, 2015). A key issue for funding is the long timeframe of climate change adaptation, and the challenges it poses for identifying what constitutes adaptation, as well as in keeping track of progress on adaptation processes (Fussel, 2007; Ford et al., 2013). Related to funding is the issue of monitoring adaptation processes. The challenges reported by BASE stakeholders indicate further research on alternative modes of financing adaptation processes is needed, as well as developing robust monitoring and assessment tools. While the effectiveness of mitigation has a high degree of certainty, the effectiveness of adaptation does not, and monitoring is more difficult (Fussel, 2007). Funding can be constrained by the uncertainty regarding what an adaptation measure is (Ford et al., 2013), this may lead to adaptation processes being framed as something else in the political context. For instance, a study of local level policies in the UK found that climate change adaptation progresses faster when framed as 'resilience to extreme weather events'

(Porter et al., 2015). Finally, the question of monitoring progress on adaptation is a challenge for policymakers and other stakeholders, and of vital importance to secure adequate funding mechanisms (Ford et al., 2013). Future research should develop robust mechanisms, indicators and methodological approaches to assess and monitor progress on adaptation processes. Furthermore, assessment procedures need to extend beyond economic criteria, equity considerations (e.g. on the lossers and winners) should be added, as well as the distribution of capacity building and vulnerbility awareness, and the scope for redefining political power relationships.

In order to deal with complexity and uncertainty (of climate impacts and of the effectiveness of adaptation policies and actions), adaptation requires well-developed methodological approaches and tools, including participatory and capacity building approaches, to provide efficient and effective means of supporting decision-making and collective action (Wise et al., 2014). BASE case studies illustrate methodological approaches developed or applied in participatory contexts. These approaches offer a wide and inclusive role for stakeholders who have been able to lead the processes – such as in the Ílhavo and Vagos, or the Súmava case studies. Participatory scenario tools and the use of models were particularly highlighted by workshop participants as successes, due to their ability to promote thinking 'out of the box' and create a wider involvement of relevant stakeholders. For instance, more empathetic and long term processes of interviewing and recording (including video and aural diaries) could be helpful (see Table 4.1 on pages 107-8, and Table 4.2 on page 109).

BASE research provided an alternative picture to managerial and top-down led adaptation initiatives, by looking into bottom-up processes (Smit and Wandel, 2006). Although participation has been mostly associated with bottom-up initiatives (Amaru & Chhetri, 2013), workshop participants agreed that it can benefit diverse levels and scales of governance. The stakeholders' comments point to issues of vertical and horizontal policy integration, as well as gaps between local level and national policies (Urwin & Jordan, 2008; Juhola, & Westerhoff, 2011). Although case studies research tapped into these issues and attempted to spur new dynamics from bottom-up processes to top-down initiatives (i.e. 50% of stakeholders found that BASE research contributed positively to their locality), stakeholders also felt the research confirmed the need for continuing promoting policy integration.

Another key issue concerns mediating the different perceptions and perspectives on climate change, among the technical bodies involved (e.g. engineers) and scientists. Different actors will be more concerned with finding solutions or with preventing climate change. While scientists my attempt to develop complex and holistic approaches or integrated assessments, guided by a broader conceptualization of adaptation (Wise et al., 2014), local actors may prefer a more action-oriented and simplistic focus. There is an important role for researchers in bridging these gaps by constantly meditating and co-developing a wide range of processes, such as implementing a particular measure (Súmava), or developing integrated and cross-sectorial measures (e.g. Cascais, Jena).

Cultural issues were also pointed out by participants. Recent literature explored the cultural dimensions of climate change adaptation (Adger et al., 2013; Wise et al., 2014). Likewise, BASE provides examples, across diverse geographic and socio-demographic contexts, of the need to account for the diverse cultural contexts, beliefs, values and worldviews that influence adaptation policies and actions.

Participants noted that there is still considerable scepticism on climate change and that a direct/personal approach should be at the centre of a communication strategy directed towards local stakeholders. Scepticism was mostly referred in the coastal zones/human settlements group, although in coastal zones the main challenge is to finance expensive climate adaptation measures, such as dikes and breakwaters. This may

indicate cultural differences and experiences, which could be further researched, while developing new communication strategies and stakeholder engagement processes that integrate the different perceptions on climate change. The field of communicating science has grown over the previous decades, and 'framing'– or the interpretative storylines that guide action – has been considered important for public engagement (Nisbet, 2009). Yet, a transdisciplinary approach is needed to both co-produce and convey scientific data in a comprehensible and accessible manner, making use of carefully designed participatory methods and communicating science techniques (O'Neill & Hulme, 2009; Pidgeon & Fischhoff, 2011).

Finally, particularly regarding the coastal zones and human settlements group, BASE stakeholders commented on a knowledge-action gap in urban developments, since risk areas are still not being appropriately integrated in urban plans. This issue should be developed in further research on communicating climate change science, and by establishing platforms for dialogue among researchers and policymakers that insert multiple communication links and highlight research needs (Sayce et al., 2013).

Table 4-6. Synthesis on the successes and challenges of climate change adaptation in BASE case studies, from the perspectives of case study owners (drawing from the workshop discussions and world café results)

Stakeholders perspectives: Synthesis of Successes and Challenges	Successes	Challenges
Agriculture and Forestry/ **Biodiversity and Ecosystems Services**	→ Scenario workshop: thinking out of the box; → Use of models (e.g. InVEST) and tools (e.g. participatory methods) can improve discussions and provide important methodological strategies for local action. → Focus on climate change adaptation links different actors working in collaboration towards a solution. Participation creates a sense of ownership, as stakeholders are involved in co-creating an adaptation plan.	→ Problems of scale, non-collaboration between local-national governmental bodies and institutions. → Strategies that link national to local scale solutions are needed → Lack of information at the local level, public does not understand scientific language → No incentives for private sectors, not possible to find win-win solutions, securing funding from national to local level. Need for alternative funding mechanisms.
Water Resources/ Health	→ Various effects of environmental change were studied‘ and solutions were proposed and developed, such as: → An annual heat wave plan and winter fuel plan in the UK’; ‘cold-air modelling in Jena’; flood charts and model flooded areas in Portugal to identify areas where not to build. → Creativity in local solutions → Integrated adaptation options	→ Appropriate design of green infrastructures → Integrated assessments of green infrastructures, need for more research on secondary effects. → Information to local stakeholders: need for a more personal approach → Scepticism regarding climate change. → Climate change issues are not appropriately integrated in urban plans, including urban developments in risk areas (problem with insurance companies)
Coastal Zones/ Human Settlements and Infrastructure	→ Various effects of environmental change were studied‘ → Annual heat wave plan and winter fuel plan in the UK’ ‘cold-air modelling in Jena’; traditional flood charts and model flooded areas in Portugal help identify areas where not to build. → Creativity in local solutions → Integrated adaptation options	→ Securing funding, and adequate funding mechanisms → Limited human resources → Lack of problem ownership → Need for participation and capacitation programs at the local and national levels. → Lack of political will → How to prioritize actions and best support decision-making. → Need for Capacity-building and training programs on approaches and tools

4.5 Conclusion

The main issues identified by workshop participants relate to: i) multi-scale and multi-level governance; ii) funding climate change adaptation; iii) a top-down culture in managing climate change adaptation versus a need for more inclusive and genuine participatory processes; and iv) a need for robust methodological approaches to support decision-making and collective action, as well as the difficulties in monitoring and assessing adaptation processes. While some of these topics were at the core of BASE research (e.g. participation; methodologies to support decision-making), some are derived from advancements made through BASE and are highlighted as new research needs. Of particular importance to stakeholders seems to be the issue of monitoring and assessing climate change adaptation processes, as well as the importance of monitoring for funding procedures and mechanisms. Future research could focus on processes that support decision-making and funding mechanisms, without being constraint by various types of uncertainty, for instance regarding the effectiveness of adaptation; the effectiveness of the measures; and foreseen climate change impacts. The Dynamic Adaptation Pathways approach (Hassnoot et al., 2013) is already a step in that direction, yet more research is needed to address the challenges posed by uncertainty. Studies could equally build on the approaches developed by BASE, (such as the economic assessment tools), in order to devise frameworks for keeping track on adaptation processes, and inform decision-making and adaptation subsidy mechanisms.

General conclusion

By Inês Campos, Kiat Ng and Gil Penha-Lopes

BASE case study research illustrates that relationships between bottom-up initiatives and top-down strategies are potentially symbiotic and can form a vibrant and co-evolving ecosystem for collective action towards climate change adaptation. Together, bottom-up and top-down processes emerge as a regenerative cycle. This broad understanding of multidirectional synergies derives from a number of general conclusions that can be extracted from this deliverable's four chapters. One broad overall conclusion of BASE case study research is the need to ensure a link between top and bottom action domains, since neither can offer a fair assessment of climate change adaptation on its own.

Specifically concerning this deliverable, the four chapters sought to address four key objectives described in the General Introduction. These objectives are strongly interrelated. For instance, by compiling and comparing case studies (objective II), this work led to an assessment of methodological approaches and tools (objective 1), provided a synthesis of key messages (objective III), and gathered information for the following BASE WP6 and WP7 (objective IV). Therefore, although the focus of each chapter may be mainly on one of the objectives, all chapters address in some capacity the four objectives.

Regarding objective I, the analysis of the CSLD as a working tool developed in Chapter 1 showed the CSLD provided a blueprint for setting up collaborative structures among future researchers. The chapter's conclusion points equally to the importance of robust frameworks for coordinating case study research approaches that make use of computational and web-based tools. Such tools and platforms can do more than disseminating case study results, but actually be an integral component of the process of building adaptive capacity as those with a stake in the issue can be active coordinators/managers of the adaptation process. Using IT tools can contribute equally to bring to the foreground issues such as equity, vulnerability awareness, and further embedding the case evidence in the theoretical and institutional framework. Chapter 2 highlighted new methodological approaches co-developed by BASE interdisciplinary and transdisciplinary teams, such as the PBCA and the SWAP. These approaches can potentially be applied to a wide range of climate change adaptation contexts. Case studies have equally set the stage for novel applications of well-known methods and models (e.g. InVEST, PRIMATE). Chapters 2, 3 and 4, it can be concluded that action-research and a target oriented-research are important to support climate change adaptation in Europe and elsewhere.

To build on this conclusion and contribute to a broader assessment of climate change adaptation processes, future research could experiment with more ethnographic based long-term processes of interviewing and recording (including video and aural diaries), and build on a portfolio of social learning processes particularly in the context of institutional design and stakeholder perspectives.

Regarding objectives II and III, Chapters 2, 3 and 4 provide most of the inputs. Of significance, BASE European case study research provides information on methodologies detailed in each CSLD (i.e. participatory, economic and non-economic evaluation and implementation tools), and presents a broad overview and comparison of methodologies (i.e. participatory, economic, and implementation), used by different case studies of varying socio-political-ecological-economic settings, in different sectors and across Europe. This information will be disseminated to the general public through publications, and selected case studies with detailed methodologies, and climate change adaptation process will be presented in Climate-ADAPT platform. In agreement with findings from the International case study review, participatory approaches have also shown to be of utmost importance in many BASE European case studies, and even more so when combined with strong guidance or as add-ons to economic/non-economic evaluation tools. Similarly to the International case study findings, a mix of measures (i.e. grey, green and soft) is common and seems advantageous amongst BASE International and European case studies. Funding is a key issue for climate change adaptation in Europe and elsewhere. In International experiences, adaptation processes tend to rely on a mix of funding sources (i.e. minimizing risks for investors but also posing more challenges for those seeking funding who have to rely on multiple sources). Conversely, most European adaptation processes rely on public funding and alternative mechanism should be developed.

It can be concluded that national policies and strategies should support bottom-up initiatives. Particularly bottom-up initiatives in rural areas appear to be more isolated within the landscape of climate change adaptation experiences studied, and will benefit from a coherent financial and regulatory support structure that allows the incubation, maturation and a safe operating space for new initiatives. It is central to understand how policies or strategies may promote these autonomous adaptations processes, so that innovative initiatives by individuals/communities are not penalized. Urban-rural links and synergies, at diverse levels (i.e. from local authorities to national governments) and scales of governance (i.e. from a number of municipal actors to cover a wide range of European regions), should be taken into account by policy makers, practitioners and researchers. Stakeholder engagement has a key role and should continue to be at the heart of climate change adaptation research projects. In particular, the inputs from stakeholders indicate the relevance of keeping track of adaptation processes, in order to inform decision-making and adaptation subsidy mechanisms. The role of disseminating and communicating science is particularly important to frame climate change adaptation. Framing climate change as part of a broader sustainability challenge could contribute to support the development of long-term action-plans, capable of responding to existent and future climate change related vulnerabilities, and to account for the resilience and adaptability of both present and future generations. Through its bottom-up analysis, BASE can be a key stepping stone in developing a fuller theory of climate change adaptation that covers the scientific requirements of climate change responses within a broad governance framework and social learning process. Further research will need to take stock of a more holistic approach, capable of intertwining equity considerations, and the distribution of capacity building and vulnerability awareness, as well as the scope of redefining political power relationships. While these considerations were important for BASE case study research, the goal of providing a bottom-up assessment, supported by new knowledge on economic assessments of adaptation experiences, as well as to develop and apply participatory assessments, brought to the background institutional frameworks and social learning process that still need to be further integrated in a (top/bottom) holistic theory of climate change adaptation across scales and levels of governance.

Finally, concerning objective IV, responses can be found at various moments throughout the document. Particularly, for WP6, Chapter 2 offers some key insights into differences between European regions (which are also the basic framework used to develop WP6 storylines). Chapter 2 shows a number of key messages for WP7 (particularly Sections 2.4 and 2.5). Chapter 3's analysis of how different stakeholder groups were involved throughout the various adaptation phases, supports the conclusion that it is important to integrate a diversity of stakeholder groups in policy making processes. From Chapters' 3 and 4, it can be concluded that more than quantity, having a representative and a diverse group of participants seems to be key for a holistic approach to climate change adaptation, by engaging society at diverse levels of governance (from bottom-up initiatives to policy makers and planners), while taking into account local socio-political and institutional contexts within a governance learning framework. Specifically, Sections 4.4 and 4.5 offer useful insights for WP7, such as reinforcing the importance of monitoring for developing adequate funding mechanisms and promote political commitment. Lastly, drawing from this deliverable report and the final revised CSLDs, a representative number of case studies, across sectors and European regions will be described in a template and uploaded onto the Climate-ADAPT platform.

Reference list

Adger, V. N. (2003) Social Capital, Collective Action, and Adaptation to Climate Change. *Economic Geography*, *79* (4), 387-404 doi: 10.1007/978-3-531-92258-4_19

Adger, W. N. (2006) Vulnerability. *Global Environmental Change*, *16 (*3), 268–281. DOI:10.1016/j.gloenvcha.2006.02.006

Adger, W. N., Barnett, J., Brown, K., Marshall, N., and O'Brien, K. (2013) Cultural dimensions of climate change impacts and adaptation. *Nature Climate Change*, *3* (2), 112–117. doi:10.1038/nclimate1666

Agarwal, A., Perrin, N., Chatre, A., Benson, C. S., & Kononen, M. (2012). Climate policy processes, local institutions, and adaptation actions: mechanisms of translation and influence. *Wiley Interdisciplinary Reviews: Climate Change*, *3*(6), 565–579. doi:10.1002/wcc.193

Alves, Filipe Miguel (2015), *Cost-benefit Analysis in Climate Change Adaptation - The use of participatory methodologies*. Master thesis, ISCTE-IUL

Amaru, S., & Chhetri, N. B. (2013). Climate adaptation: Institutional response to environmental constraints, and the need for increased flexibility, participation, and integration of approaches. *Applied Geography*, 39, 128-139. doi:10.1016/j.apgeog.2012.12.006

André, K., Simonsson, L., Swartling, Å. G., & Linnér, B. (2012). Method Development for Identifying and Analysing Stakeholders in Climate Change Adaptation Processes. *Journal of Environmental Policy & Planning*, *14*(3), 243–261. doi:10.1080/1523908X.2012.702562

Armitage, D., Marschke, M., and Plummer, R. (2008) Adaptive co-management and the paradox of learning. *Global environmental change*, *18*(1), 86-98.

Avgitidou, S. (2009). Participation, roles and processes in a collaborative action research project: A reflexive account of the facilitator. *Educational Action Research*, *17*(4), 585-600. doi: 10.1080/09650790903309441

Baker, I., Peterson, A., Brown, G., & McAlpine, C. (2012). Local government response to the impacts of climate change: An evaluation of local climate adaptation plans. *Landscape and urban planning*, *107*(2), 127-136. doi:10.1016/j.landurbplan.2012.05.009

Brown, J. (2010) *The world café: Shaping our futures through conversations that matter*. ReadHowYouWant. com.

Campos, I; Vizinho, A; Truninger M; and Penha-Lopes, G. (2015). Converging for land abandonment – a Systematization of Experiences of a rural grassroots innovation. *Community Development Journal*. DOI: 10.1093/cdj/bsv051

Campos,I.S., Alves, F.M; Dinis; J.; Truninger; M. Vizinho,A, and Penha-Lopes, G. (2016) Climate adaptation, transtions and socially innovative action-research approaches. *Ecology and Society*, 21 (1), 13 [online] URL: http://www.ecologyandsociety.org/vol21/iss1/art13/

Casarejos F, Frota M N, Penha-Lopes G, Silva V V, Particelli F (2014): Commitment to Emissions Restrictions of Major Consumers of Electricity in Brazil. *Sustainablity* 6, 6377-6399.

Cash, D. W., Adger, W. N., Berkes, F., Garden, P., Lebel, L., Olsson, P., ... & Young, O. (2006). Scale and cross-scale dynamics: governance and information in a multilevel world. *Ecology and society*, *11*(2), 8. [online] URL: http://www.ecologyandsociety.org/vol11/iss2/art8/

CIVITAS (2006) *Involving Stakeholders: toolkit on organizing successful consultations.* Retrived from: http://www.civitas.eu/sites/default/files/Results%20and%20Publications/Brochure_STAKEHOLDER_CONSULTATION_web.pdf

Climate-Adapt (2015): European Climate Adaptation Platform, http://climate-adapt.eea.europa.eu/adaptation-support-tool. (Accessed on 11th December 2015)

Crane, T. A. (2010). Of models and meanings: cultural resilience in social-ecological systems. *Ecology and Society*, *15*(4), 19. [online] URL: http://www.ecologyandsociety.org/vol15/iss4/art19

Dannevig, H., Rauken, T., & Hovelsrud, G. (2012). Implementing adaptation to climate change at the local level. *Local Environment*, *17*(6-7), 597-611. doi: 10.1080/13549839.2012.678317

Denton, F., T.J. Wilbanks, A.C. Abeysinghe, I. Burton, Q. Gao, M.C. Lemos, T. Masui, K.L. O'Brien, & K. Warner (2014). Climate-resilient pathways: adaptation, mitigation, and sustainable development. In: Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (Eds.). *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.* Cambridge and New York: Cambridge University Press.

Directive 2007/60/EC (2007): Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks. *Official Journal of the European Union* L288/27

Dryzek, J. S. (2010). *Foundations and frontiers of deliberative governance*. Cambridge University Press: Cambridge

Durham E., Baker H., Smith M., Moore E. & Morgan V. (2014). *The BiodivERsA Stakeholder Engagement Handbook.* BiodivERsA, Paris.

EEA (2012): Map of biogegraphic regions in Europe. European Environment Agency.

EEA [European Environmental Agency] (2013). *Adaptation in Europe Addressing risks and opportunities from climate change in the context of socio-economic developments* (Report No 3/2013). Retrieved from: http://www.eea.europa.eu/publications/adaptation-in-europe

EEA [European Environmental Agency] (2014). National adaptation policy processes in European countries. Report No 4/2014. Retrieved from: http://www.eea.europa.eu/publications/national-adaptation-policy-processes

Engle, N. L. (2011) Adaptive capacity and its assessment. *Global Environmental Change*, *21* (2), 647-656. doi:10.1016/j.gloenvcha.2011.01.019

Engle, N. L., and Lemos, M. C. (2010) Unpacking governance: building adaptive capacity to climate change of river basins in Brazil. *Global Environmental Change*, *20*(1), 4-13. doi:10.1016/j.gloenvcha.2009.07.001

Fabricius, C., Koch, E., Turner, S., and Magome, H. (2013) *Rights resources and rural development: Community-based natural resource management in Southern Africa*. Routledge, London

Few R, Brown K, Tompkins E L (2007): Public participation and climate change adaptation: avoiding the illusion of inclusion. *Climate Policy* 7(1): 46-59

Ford, J. D., Berrang-Ford, L., & Paterson, J. (2011). A systematic review of observed climate change adaptation in developed nations. *Climatic change*,*106*(2), 327-336. doi:10.1007/s10584-011-0045-5

Ford, J. D., Berrang-ford, L., Lesnikowski, A., Barrera, M., & Heymann, S. J. (2013). How to Track Adaptation to Climate Change : A Typology of Approaches for National-Level Application. *Ecology and Society*, *18*(3), 40. http://dx.doi.org/10.5751/ES-05732-180340

Füssel, H. M. (2007). Adaptation planning for climate change: concepts, assessment approaches, and key lessons. *Sustainability science*, *2*(2), 265-275. Doi: 10.1007/s11625-007-0032-y

Gebhardt O, Meyer V, Brenck M, Melch S, Hansjürgens B (2013): Bewertung und Priorisierung von Klimaanpassungsmaßnahmen. Leitfaden zur Entscheidungsunterstützung bei der urbanen Klimaanpassung, BMVBS-Online-Publikation 11/13, Berlin

Gerring, J. (2006). *Case study research: principles and practices*. Cambridge University Press.

Hadorn, G., Bradley, D., & Pohl, C. (2006). Implications of transdisciplinarity for sustainability research. *Ecological Economics*, *0*. Retrieved from http://www.sciencedirect.com/science/article/pii/S0921800905005781

Henfrey T., Penha-Lopes G. (2016): Permaculture and climate change adaptation: Inspiring ecological, social, economic and cultural responses for resilience and transformation. Permanent Publications.

Juhola, S., & Westerhoff, L. (2011). Challenges of adaptation to climate change across multiple scales: a case study of network governance in two European countries. *Environmental science & policy*, *14*(3), 239-247. doi:10.1016/j.envsci.2010.12.006

Kovats, R S, Valentini R, Bouwer L M, Georgopoulou E, Jacob D, Martin E, Rounsevell M, and Soussana J F (2014): In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Barros, V.R., C.B. Field, D.J. Dokken, M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1267-1326.

Lang, D. J., Wiek, A., Bergmann, M., Stauffacher, M., Martens, P., Moll, P.... & Thomas, C. J. (2012). Transdisciplinary research in sustainability science: practice, principles, and challenges. *Sustainability Science*, *7*(1), 25-43. doi: 10.1007/s11625-011-0149-x

Laszlo, A. (2015) Living systems, seeing systems, being systems: Learning to be the system we wish to see in the world. Spanda Journal, 165-173.

Lim, B. (2005). *Adaptation policy frameworks for climate change: developing strategies, policies and measures*. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.452.9748&rep=rep1&type=pdf

Lowe I (2002): The Need for Environment Literacy. ALNARC Online Forum 2002, ANTA National Literacy Project, Australian Government Department of Education, Science and Training (DEST), 15 March–19 April 2002.

Mansilla, V. B., Lamont, M., & Sato, K. (2015). Shared Cognitive–Emotional–Interactional Platforms Markers and Conditions for Successful Interdisciplinary Collaborations. *Science, Technology & Human Values*, 0162243915614103.

Martinez G, Orbach M, Frick F, Donargo A, Ducklow K, Morison N (2014): The Cultural Context of Climate Change Adaptation: Cases from the U.S. East Coast and the German Baltic Sea Coast, In: Martinez, G.; Fröhle, P.; Meier, H.-J. (eds.): Social Dimension of Climate Change Adaptation in Coastal Regions, volume 5, München: oekom publishing, Pgs. 85-103.

Metzger M J, Bunce R G H, Jongman R H G, Mucher C A, Watkins J W (2005): A climatic stratification of the environment of Europe. *Global Ecology and Biogeography* 14(6): 549-563.

Meyer V, Becker N, Markantonis V, Schwarze R J C J M,. van den Bergh J C J M, Bouwer L M, Bubeck P, Ciavola P, Genovese E, Green C, Hallegatte S, Kreibich H, Lequeux Q, Logar I, Papyrakis E, Pfurtscheller C, Poussin J, Przyluski V, Thieken A H, Viavattene C (2013): Review article: Assessing the costs of natural hazards – state of the art and knowledge gaps. *Natural Hazards and Earth System Sciences* 13: 1351–1373

Nelson, D. R., Adger, W. N., and Brown, K. (2007) Adaptation to environmental change: contributions of a resilience framework. *Annual review of Environment and Resources*, *32* (1), 395. doi:/pdf/10.1146/annurev.energy.32.051807.090348

Ng K, Phillips M R, Borges P, Thomas T, August P, Calado H, Veloso-Gomes F (2014): Maintaining a way of life for São Miguel Island (the Azores archipelago, Portugal): An assessment of coastal processes and protection. *Science of the Total Environment* 481: 142-156

Nillesen A L (2014): Improving the allocation of flood-risk interventions from a spatial quality perspective. *Journal of Landscape Architecture* 9(1): 20-31.

Nisbet, M. C. (2009). Communicating climate change: Why frames matter for public engagement. *Environment: Science and Policy for Sustainable Development*, *51*(2), 12-23. Retrieved from: http://www.climateaccess.org/sites/default/files/Nisbet_Communicating%20Climate%20Change_0.pdf

O'Neill, S. J., & Hulme, M. (2009). An iconic approach for representing climate change. *Global Environmental Change*, *19*(4), 402-410. doi:10.1016/j.gloenvcha.2009.07.004

OECD (2015) Climate Change Risks and Adaptation:Linking Policy and Economic, OECD Publishing, Paris. http://dx.doi.org/10.1787/978926423611-en

Olsson, P., Gunderson, L. H., Carpenter, S. R., Ryan, P., Lebel, L., Folke, C., & Holling, C. S. (2006) Shooting the rapids: navigating transitions to adaptive governance of social-ecological systems. *Ecology and society*, *11* (1), 18. http://hdl.handle.net/10535/3412

Pidgeon, N., & Fischhoff, B. (2011). The role of social and decision sciences in communicating uncertain climate risks. *Nature Climate Change*, *1*(1), 35-41.). doi:10.1038/nclimate1080

Pohl, C., & Hadorn, G. H. (2007). *Principles for designing transdisciplinary research*. Munich: oekom.Retrieved from: http://transdisciplinarity.ch/documents/knowledgeforms_principles.pdf

Porter, J. J., Demeritt, D., & Dessai, S. (2015). The right stuff? Informing adaptation to climate change in British local government. *Global Environmental Change*, *35*, 411-422.

Rowley, J. (2002). Using case studies in research. *Management research news*, *25*(1), 16-27.

Salamanca F, Martilli A, Yagüe C (2012): A numerical study of the Urban Heat Island over Madrid during the DESIREX (2008) campaign with WRF and an evaluation of simple mitigation strategies. *Int. J. Climatol.* 32: 2372–2386. doi:10.1002/joc.3398.

Sayce, K., Shuman, C., Connor, D., Reisewitz, A., Pope, E., Miller-Henson, M., … Owens, B. (2013). Beyond traditional stakeholder engagement: Public participation roles in California's statewide marine protected area planning process. *Ocean & Coastal Management*, *74*, 57–66. doi:10.1016/j.ocecoaman.2012.06.012

Seawright, J., & Gerring, J. (2008). Case selection techniques in case study research a menu of qualitative and quantitative options. *Political Research Quarterly*, *61*(2), 294-308.

Seyfang, G. & Haxeltine, A. (2012). Growing Grassroots Innovations: Exploring the role of community-based social movements in sustainable energy transitions. *Environment and Planning C*, 30(3), 381-400. doi: 10.1068/c10222

Seyfang, G. & Smith, A. (2007). Grassroots Innovations for Sustainable Development: towards a new research and policy agenda. *Environmental Politics*, 16(4) pp. 584-603. doi: 10.1080/09644010701419121

Seyfang, G. & Smith, A. (2007). Grassroots Innovations for Sustainable Development: towards a new research and policy agenda. *Environmental Politics*, 16(4), 584-603. doi: 10.1080/09644010701419121

Sharma V, Orindi V, Hesse C, Pattison J, Anderson S (2014): Supporting local climate adaptation planning and implementation through local governance and decentralised finance provision. *Development in Practice Special Issue on climate change adaptation and development* 24(4): 579-590.

Smit, B., & Wandel, J. (2006). Adaptation, adaptive capacity and vulnerability. *Global Environmental Change*, *16*(3), 282–292. doi:10.1016/j.gloenvcha.2006.03.008

Smit, B.; and Wandel, J. (2006) Adaptation, adaptive capacity and vulnerability. *Global Environmental Change*, 16(3), 282–292. DOI:10.1016/j.gloenvcha.2006.03.008

Stokols, D. (2006). Toward a science of transdisciplinary action research. *American journal of community psychology*, *38*(1-2), 63–77. doi:10.1007/s10464-006-9060-5

Susskind L E, Cruikshank J L (2006): Breaking Roberts Rules: The new way to run your meeting, build consensus, and get results. Oxford University Press.

Susskind L E, McKearnan S, Thomas-Larmer J (1999). The consensus building handbook: A comprehensive guide to reaching agreement. Thousand Oaks: SAGE.

Tompkins, E. L., Adger, W. N., Boyd, E., Nicholson-Cole, S., Weatherhead, K., & Arnell, N. (2010). Observed adaptation to climate change: UK evidence of transition to a well-adapting society. *Global environmental change*, *20*(4), 627-635. Retrieved from: http://www.tyndall.ac.uk/sites/default/files/wp39.pdf

Urwin, K., & Jordan, A. (2008). Does public policy support or undermine climate change adaptation? Exploring policy interplay across different scales of governance. *Global environmental change*, *18*(1), 180-191. doi:10.1016/j.gloenvcha.2007.08.002

Vogel, C., Moser, S. C., Kasperson, R. E., & Dabelko, G. D. (2007). Linking vulnerability, adaptation, and resilience science to practice: Pathways, players, and partnerships. *Global environmental change*, *17*(3), 349-364. doi:10.1016/j.gloenvcha.2007.05.002

Wise, R. M., Fazey, I., Smith, M. S., Park, S. E., Eakin, H. C., Van Garderen, E. A., & Campbell, B. (2014). Reconceptualising adaptation to climate change as part of pathways of change and response. *Global Environmental Change*,*28*, 325-336.

Yin, R. K. (2013). *Case study research: Design and methods*. Sage publications.

Yin, R.K. (1994) Case study research: design and methods. 2nd edition. Thousand Oaks, CA: Sage.

Zhao, J., Li, S., Yu, J., Dong, K., Nan, K., & Yan, B. (2010). A Cross-disciplinary Collaborative Research Platform-Study on Qinghai Lake Joint Research Environment. In :*Signal-Image Technology and Internet-Based Systems (SITIS), 2010 Sixth International Conference on* (pp. 211-216). IEEE.

Appendixes

Appendix 1

Structure of feedback questionnaire to BASE research consortium members and comments received on the CSLD

I. Feedback questionnaire for case study owners and case study cluster leaders

1. Please refer your case study ID (name)
2. Characterize the CSLD template regarding its level of comprehensiveness (i.e. usable for the different phases of adaptation, sectors, topics of research) *

(1=very low, 2=low, 3=reasonable, 4=high, 5=very high)

3. Classify the CSLD regarding its user-friendliness (i.e. understand the information requested)
4. Classify the CSLD regarding its ease of reporting (i.e. reporting the case study information in the responses to the CSLD sections)
5. Characterize the CSLD regarding its usefulness (e.g. support the design of your case study methodology; avoid multiple reporting for different deliverables)
6. Please refer to the impact of the CSLD framework on case study clusters dynamics (e.g. Agriculture and Forestry clusters used similar questionnaires)
7. Any final comments that explain or extend the evaluation above?

II. WP 5, 6 and 7 deliverable and task leaders' evaluation of the CSLD

1. Please state your role in BASE (e.g. D5.2 or D5.3 leader, WP6 coordinator)
2. Refer to the usefulness of the CSLD for monitoring the tasks you have or are coordinating

2.1 Please provide specify comments taking into account the strengths, weaknesses, opportunities and threats

3. Refer to the usefulness for producing and writing deliverables you have or are coordinating

3.1. Please provide specify comments taking into account the strengths, weaknesses, opportunities and threats

Comments from case study owners on the CSLD
'Overlaps of sections should be avoided or better managed. Implementation of macros could help harmonize the reporting. Determination of binding dates for updates. Updates of the entire document, including timelines etc., representing the current state of work (not just partial updates that might create contradictions). Notation of date of last changes.'

'CSLD was good idea, but needs to be developed further. One problem was the size of the document, which became too big for easy communication (e.g. for emailing). Another problem was when information was collected to deliverables, the amendments to deliverable document had to be transferred into the CSLD also (=double work). So, maybe in future, technical systems lets us avoid word-documents, but more interactive cloud systems.'
'Despite the fact that I collaborated in designing the CSLD, and in the analysis of the CSLD for the participation for D5.3 the answers provided in the CSLD were not detailed or clear enough regarding the details of analysis required in D5.3. Likewise, in other BASE deliverables, the deliverable leaders had to ask specific questions for the deliverable. I identified the same need.'
'I think the CSLD lacked in having a section where partners could relate their theoretical frameworks. Methodologies are described in a piecemeal format, according the document's sections (e.g. participation, economic analysis). However, it would be interesting to have a section where the methodologies were presented has part of a theoretical approach guiding the research. This section could provide additional points of contact between case study owners. For instance, if a set of case studies were departing from a similar theoretical background, there could be a higher incentive to co-design together the methodological frameworks applied to their case studies and therefore find later a higher level of comparability. This could be particular relevant for case study clusters.'
'Perhaps using an online version of the CSLD would enable easier updates when new templates of sections and chapters became available, and prevent floating around different versions of the CSLD.'
'At times the CSLD required a repetition of things that have already been reported and updated. It was cumbersome and not user-friendly. Although, it is a good tool to comprehensively have all information together on each case study.'
'In the end, the information for most of the WP5 deliverables was required separately. In general, it did not seem the CSLD was used as a source of information on the case studies at all.'

Appendix 2

Decision-maker and civil society stakeholders by adaptation phase

1. Decision-maker stakeholders by adaptation phase

Case study cluster	Case study	BASE Partner	Climate risk/s	Adaptation Phase	Stakeholders involved	Level of participation
Agriculture and forestry	Alentejo	FFCUL	Water availability (drought)	1.Initiative/decision to act	National pub. Adm.	Self-mobilisation
Agricultur	Lolland	AU	Flooding (pluvial)	1.Initiative/decision to	Local pub.	Collaborati

e and forestry				act	Adm.	on
Cities and infrastructure	Cascais	FFCUL	Heat stress	1.Initiative/decision to act	Local pub. Adm.	Collaboration
Cities and infrastructure	Copenhagen	DBT	Flooding (Cloudburst)	1.Initiative/decision to act	Local politicians	Consultation
Cities and infrastructure	Copenhagen	DBT	Flooding (Storm-surge)	1.Initiative/decision to act	Local pub. Adm.	Collaboration
Cities and infrastructure	Jena	UFZ	Heat stress and flooding (pluvial)	1.Initiative/decision to act	Local pub. Adm.	Consultation
Cities and infrastructure	Prague	CzechGlobe	Heat stress and flooding (pluvial)	1.Initiative/decision to act	Local politicians	Consultation
Cities and infrastructure	Prague	CzechGlobe	Heat stress and flooding (pluvial)	1.Initiative/decision to act	National pub. Adm.	Consultation
Cities and infrastructure	Rotterdam	Deltares	Flooding (fluvial and coastal)	1.Initiative/decision to act	National pub. Adm.	Consultation
Coastal zone	Kalundborg	DBT	Flooding (coastal and pluvial)	1.Initiative/decision to act	Local pub. Adm.	Collaboration
Coastal zone	South Devon	UniExeter	Flooding (fluvial and pluvial)	1.Initiative/decision to act	Local pub. Adm.	Collaboration
Coastal zone	South Devon	UniExeter	Flooding (fluvial and pluvial)	1.Initiative/decision to act	National pub. Adm.	Collaboration
Coastal zone	South Devon	UniExeter	Flooding (fluvial and pluvial)	1.Initiative/decision to act	State owned enterpr.	Collaboration
Coastal zone	Timmendorfer Strand	EI	Flooding (coastal)	1.Initiative/decision to act	Local politicians	Collaboration
Coastal	Timmendorfer	EI	Flooding (coastal)	1.Initiative/decision to	National pub.	Collaborati

zone	Strand			act	Adm.	on
Coastal zone	Cornwall	UniExeter	Heat stress	1.Initiative/decision to act	Local pub. Adm.	Information
Water resources	Kalajoki	SYKE	Flooding (fluvial)	1.Initiative/decision to act	National pub. Adm.	Collaboration
Water resources	Ijsselmeer	Deltares	Water availability (drought and flooding)	1.Initiative/decision to act	National pub. Adm.	Collaboration
Agriculture and forestry	Alentejo	FFCUL	Water availability (drought)	2.Development of potential adaptation options	National pub. Adm.	Self-mobilisation
Coastal zone	Ílhavo and Vagos	FFCUL	Flooding (coastal)	2.Development of potential adaptation options	Local politicians	Collaboration
Coastal zone	Ílhavo and Vagos	FFCUL	Flooding (coastal)	2.Development of potential adaptation options	Local pub. Adm.	Collaboration
Coastal zone	Ílhavo and Vagos	FFCUL	Flooding (coastal)	2.Development of potential adaptation options	National pub. Adm.	Collaboration
Coastal zone	Ílhavo and Vagos	FFCUL	Flooding (coastal)	2.Development of potential adaptation options	State owned enterpr.	Collaboration
Cities and infrastructure	Cascais	FFCUL	Heat stress	2.Development of potential adaptation options	Local pub. Adm.	Collaboration
Cities and infrastructure	Cascais	FFCUL	Heat stress	2.Development of potential adaptation options	State owned enterpr.	Collaboration
Cities and infrastructure	Copenhagen	DBT	Flooding (Storm-surge)	2.Development of potential adaptation options	Local politicians	Collaboration
Cities and infrastructure	Copenhagen	DBT	Flooding (Storm-surge)	2.Development of potential adaptation options	Local pub. Adm.	Collaboration

Cities and infrastructure	Copenhagen	DBT	Flooding (Cloudburst)	2.Development of potential adaptation options	Local pub. Adm.	Consultation
Cities and infrastructure	Copenhagen	DBT	Flooding (Storm-surge)	2.Development of potential adaptation options	National pub. Adm.	Collaboration
Cities and infrastructure	Copenhagen	DBT	Flooding (Storm-surge)	2.Development of potential adaptation options	State owned enterpr.	Collaboration
Coastal zone	Cornwall	UniExeter	Heat stress	2.Development of potential adaptation options	Local pub. Adm.	Information
Coastal zone	Cornwall	UniExeter	Heat stress	2.Development of potential adaptation options	National pub. Adm.	Information
Biodiversity and ecosystems	Dartmoor	UniExeter	Drought and flooding (pluvial)	2.Development of potential adaptation options	Local politicians	Consultation
Biodiversity and ecosystems	Dartmoor	UniExeter	Drought and flooding (pluvial)	2.Development of potential adaptation options	Local pub. Adm.	Consultation
Biodiversity and ecosystems	Šumava	CzechGlobe	Ecosystem degradation	2.Development of potential adaptation options	Local politicians	Collaboration
Biodiversity and ecosystems	Šumava	CzechGlobe	Ecosystem degradation	2.Development of potential adaptation options	Local pub. Adm.	Collaboration
Biodiversity and ecosystems	Šumava	CzechGlobe	Ecosystem degradation	2.Development of potential adaptation options	State owned enterpr.	Collaboration
Agriculture and forestry	Holstebro	AU	Flooding (fluvial and pluvial)	2.Development of potential adaptation options	Local pub. Adm.	Collaboration
Cities and	Jena	UFZ	Heat stress and flooding	2.Development of	Local pub.	Collaborati

infrastructure			(pluvial)	potential adaptation options	Adm.	on
Cities and infrastructure	Jena	UFZ	Heat stress and flooding (pluvial)	2.Development of potential adaptation options	State owned enterpr.	Collaboration
Water resources	Kalajoki	SYKE	Flooding (fluvial)	2.Development of potential adaptation options	Local pub. Adm.	Collaboration
Water resources	Kalajoki	SYKE	Flooding (fluvial)	2.Development of potential adaptation options	State owned enterpr.	Collaboration
Coastal zone	Ílhavo and Vagos	FFCUL	Flooding (coastal)	2.Development of potential adaptation options	Reg. Pub. Adm.	Collaboration
Coastal zone	Kalundborg	DBT	Flooding (coastal and pluvial)	2.Development of potential adaptation options	Local politicians	Collaboration
Coastal zone	Kalundborg	DBT	Flooding (coastal and pluvial)	2.Development of potential adaptation options	Local pub. Adm.	Collaboration
Coastal zone	Kalundborg	DBT	Flooding (coastal and pluvial)	2.Development of potential adaptation options	State owned enterpr.	Collaboration
Water resources	Ijsselmeer	Deltares	Water availability (drought and flooding)	2.Development of potential adaptation options	Local pub. Adm.	Collaboration
Agriculture and forestry	Lolland	AU	Flooding (pluvial)	2.Development of potential adaptation options	Local pub. Adm.	Collaboration
Agriculture and forestry	Lolland	AU	Flooding (pluvial)	2.Development of potential adaptation options	State owned enterpr.	Collaboration
Cities and infrastruct	Prague	CzechGlobe	Heat stress and flooding (pluvial)	2.Development of potential adaptation	Local pub. Adm.	Consultation

ure				options		
Cities and infrastructure	Prague	CzechGlobe	Heat stress and flooding (pluvial)	2.Development of potential adaptation options	State owned enterpr.	Consultation
Cities and infrastructure	Rotterdam	Deltares	Flooding (fluvial and coastal)	2.Development of potential adaptation options	Local politicians	Collaboration
Cities and infrastructure	Rotterdam	Deltares	Flooding (fluvial and coastal)	2.Development of potential adaptation options	National pub. Adm.	Collaboration
Cities and infrastructure	Rotterdam	Deltares	Flooding (fluvial and coastal)	2.Development of potential adaptation options	State owned enterpr.	Collaboration
Water resources	Madrid	UPM, BC4	Heat stress	2.Development of potential adaptation options	Local pub. Adm.	Consultation
Water resources	Madrid	UPM, BC5	Heat stress	2.Development of potential adaptation options	National pub. Adm.	Consultation
Water resources	Madrid	UPM, BC7	Heat stress	2.Development of potential adaptation options	State owned enterpr.	Consultation
Coastal zone	Timmendorfer Strand	EI	Flooding (coastal)	2.Development of potential adaptation options	Local pub. Adm.	Collaboration
Agriculture and forestry	Alentejo	FFCUL	Water availability (drought)	3.Decision-making	National pub. Adm.	Self-mobilisation
Cities and infrastructure	Cascais	FFCUL	Heat stress	3.Decision-making	Local pub. Adm.	Collaboration
Cities and infrastructure	Cascais	FFCUL	Heat stress	3.Decision-making	State owned enterpr.	Collaboration

Cities and infrastructure	Copenhagen	DBT	Flooding (Cloudburst)	3.Decision-making	Local pub. Adm.	Consultation
Cities and infrastructure	Copenhagen	DBT	Flooding (Cloudburst)	3.Decision-making	Local politicians	Consultation
Cities and infrastructure	Jena	UFZ	Heat stress and flooding (pluvial)	3.Decision-making	Local politicians	Consultation
Cities and infrastructure	Prague	CzechGlobe	Heat stress and flooding (pluvial)	3.Decision-making	Local politicians	Consultation
Cities and infrastructure	Rotterdam	Deltares	Flooding (fluvial and coastal)	3.Decision-making	National pub. Adm.	Consultation
Coastal zone	Ílhavo and Vagos	FFCUL	Flooding (coastal)	3.Decision-making	Local pub. Adm.	Collaboration
Coastal zone	Ílhavo and Vagos	FFCUL	Flooding (coastal)	3.Decision-making	Reg. Pub. Adm.	Collaboration
Coastal zone	Ílhavo and Vagos	FFCUL	Flooding (coastal)	3.Decision-making	National pub. Adm.	Collaboration
Coastal zone	Ílhavo and Vagos	FFCUL	Flooding (coastal)	3.Decision-making	Local politicians	Collaboration
Coastal zone	Kalundborg	DBT	Flooding (coastal and pluvial)	3.Decision-making	Local pub. Adm.	Collaboration
Coastal zone	Timmendorfer Strand	EI	Flooding (coastal)	3.Decision-making	Local politicians	Collaboration
Water resources	Kalajoki River Basin	SYKE	Flooding (fluvial)	3.Decision-making	Local pub. Adm.	Collaboration
Water resources	Kalajoki River Basin	SYKE	Flooding (fluvial)	3.Decision-making	National pub. Adm.	Collaboration
Water resources	Kalajoki River Basin	SYKE	Flooding (fluvial)	3.Decision-making	Local politicians	Collaboration

Water resources	Lake Ijsselmeer Region	Deltares	Water availability (drought and flooding)	3.Decision-making	National pub. Adm.	Collaboration
Agriculture and forestry	Alentejo	FFCUL	Water availability (drought)	4.Implementation	National pub. Adm.	Self-mobilisation
Cities and infrastructure	Cascais	FFCUL	Heat stress	4.Implementation	Local pub. Adm.	Collaboration
Cities and infrastructure	Cascais	FFCUL	Heat stress	4.Implementation	State owned enterpr.	Collaboration
Cities and infrastructure	Copenhagen	DBT	Flooding (Cloudburst)	4.Implementation	Local pub. Adm.	Consultation
Cities and infrastructure	Copenhagen	DBT	Flooding (Cloudburst)	4.Implementation	State owned enterpr.	Consultation
Cities and infrastructure	Jena	UFZ	Heat stress and flooding (pluvial)	4.Implementation	Local pub. Adm.	Information
Cities and infrastructure	Prague	CzechGlobe	Heat stress and flooding (pluvial)	4.Implementation	Local pub. Adm.	Consultation
Coastal zone	Ílhavo and Vagos	FFCUL	Flooding (coastal)	4.Implementation	Local pub. Adm.	Collaboration
Coastal zone	Ílhavo and Vagos	FFCUL	Flooding (coastal)	4.Implementation	National pub. Adm.	Collaboration
Coastal zone	Ílhavo and Vagos	FFCUL	Flooding (coastal)	4.Implementation	Local politicians	Collaboration
Water resources	Kalajoki	SYKE	Flooding (fluvial)	4.Implementation	Local pub. Adm.	Collaboration
Water resources	Kalajoki	SYKE	Flooding (fluvial)	4.Implementation	Local politicians	Collaboration

Water resources	Ijsselmeer	Deltares	Water availability (drought and flooding)	4.Implementation	Local pub. Adm.	Collaboration
Water resources	Ijsselmeer	Deltares	Water availability (drought and flooding)	4.Implementation	Local politicians	Collaboration

2. Civil society stakeholders by adaptation phase

Case study	BASE Partner	Climate risk/s	Adaptation Phase	Stakeholders involved	Level of participation
Venice	CMCC	Flooding (coastal)	1.Initiative/decision to act	Citizens	Self-mobilisation
Alentejo	FFCUL	Water availability (drought)	1.Initiative/decision to act	Civil society orgs.	Self-mobilisation
Alentejo	FFCUL	Water availability (drought)	1.Initiative/decision to act	Farmers	Self-mobilisation
South Moravia	CzechGlobe	Water availability (drought)	1.Initiative/decision to act	Farmers	Self-mobilisation
Ústí	CzechGlobe	Water availability (drought)	1.Initiative/decision to act	Farmers	Self-mobilisation
Šumava	CzechGlobe	Ecosystem degradation	1.Initiative/decision to act	Knowledge inst.	Collaboration
Cascais	FFCUL	Heat stress	1.Initiative/decision to act	Knowledge inst.	Collaboration
Copenhagen	DBT	Flooding (Storm-surge)	1.Initiative/decision to act	Knowledge inst.	Collaboration
Aveiro Coast	FFCUL	Flooding (coastal)	1.Initiative/decision to act	Knowledge inst.	Collaboration
Madrid	UPM, BC3	Heat stress	1.Initiative/decision to act	Knowledge inst.	Consultation
Alentejo	FFCUL	Water availability (drought)	2.Development of potential adaptation options	Citizens	Self-mobilisation
Ílhavo and Vagos	FFCUL	Flooding (coastal)	2.Development of potential adaptation	Citizens	Collaboration

			options		
Cascais	FFCUL	Heat stress	2.Development of potential adaptation options	Citizens	Collaboration
Dartmoor	UniExeter	Drought and flooding (pluvial)	2.Development of potential adaptation options	Citizens	Consultation
Kalajoki	SYKE	Flooding (fluvial)	2.Development of potential adaptation options	Citizens	Collaboration
Kalundborg	DBT	Flooding (coastal and pluvial)	2.Development of potential adaptation options	Citizens	Collaboration
Timmendorfer Strand	EI	Flooding (coastal)	2.Development of potential adaptation options	Citizens	Collaboration
Venice	CMCC	Flooding (coastal)	2.Development of potential adaptation options	Citizens	Self-mobilisation
Alentejo	FFCUL	Water availability (drought)	2.Development of potential adaptation options	Civil society orgs.	Self-mobilisation
Ílhavo and Vagos	FFCUL	Flooding (coastal)	2.Development of potential adaptation options	Civil society orgs.	Collaboration
Cascais	FFCUL	Heat stress	2.Development of potential adaptation options	Civil society orgs.	Collaboration
Copenhagen	DBT	Flooding (Storm-surge)	2.Development of potential adaptation options	Civil society orgs.	Collaboration
Šumava	CzechGlobe	Ecosystem degradation	2.Development of potential adaptation options	Civil society orgs.	Collaboration
Holstebro	AU	Flooding (fluvial and pluvial)	2.Development of potential adaptation options	Civil society orgs.	Collaboration

Jena	UFZ	Heat stress and flooding (pluvial)	2.Development of potential adaptation options	Civil society orgs.	Collaboration
Lolland	AU	Flooding (pluvial)	2.Development of potential adaptation options	Civil society orgs.	Collaboration
Timmendorfer Strand	EI	Flooding (coastal)	2.Development of potential adaptation options	Civil society orgs.	Collaboration
Alentejo	FFCUL	Water availability (drought)	2.Development of potential adaptation options	Farmers	Self-mobilisation
Šumava	CzechGlobe	Ecosystem degradation	2.Development of potential adaptation options	Farmers	Collaboration
Holstebro	AU	Flooding (fluvial and pluvial)	2.Development of potential adaptation options	Farmers	Collaboration
Jena	UFZ	Heat stress and flooding (pluvial)	2.Development of potential adaptation options	Farmers	Collaboration
Kalajoki	SYKE	Flooding (fluvial)	2.Development of potential adaptation options	Farmers	Collaboration
Kalundborg	DBT	Flooding (coastal and pluvial)	2.Development of potential adaptation options	Farmers	Collaboration
South Moravian Region	CzechGlobe	Water availability (drought)	2.Development of potential adaptation options	Farmers	Self-mobilisation
Madrid	UPM, BC10	Heat stress	2.Development of potential adaptation options	Farmers	Consultation
Ústí	CzechGlobe	Water availability (drought)	2.Development of potential adaptation options	Farmers	Self-mobilisation
Alentejo	FFCUL	Water availability (drought)	2.Development of	Knowledge inst.	Self-

			potential adaptation options		mobilisation
Holstebro	AU	Flooding (fluvial and pluvial)	2.Development of potential adaptation options	Knowledge inst.	Collaboration
Ústí	CzechGlobe	Water availability (drought)	2.Development of potential adaptation options	Knowledge inst.	Self-mobilisation
Šumava	CzechGlobe	Ecosystem degradation	2.Development of potential adaptation options	Knowledge inst.	Collaboration
Cascais	FFCUL	Heat stress	2.Development of potential adaptation options	Knowledge inst.	Collaboration
Copenhagen	DBT	Flooding (Storm-surge)	2.Development of potential adaptation options	Knowledge inst.	Collaboration
Jena	UFZ	Heat stress and flooding (pluvial)	2.Development of potential adaptation options	Knowledge inst.	Collaboration
Prague	CzechGlobe	Heat stress and flooding (pluvial)	2.Development of potential adaptation options	Knowledge inst.	Consultation
Rotterdam	Deltares	Flooding (fluvial and coastal)	2.Development of potential adaptation options	Knowledge inst.	Collaboration
Ílhavo and Vagos	FFCUL	Flooding (coastal)	2.Development of potential adaptation options	Knowledge inst.	Collaboration
Kalundborg	DBT	Flooding (coastal and pluvial)	2.Development of potential adaptation options	Knowledge inst.	Collaboration
Cornwall	UniExeter	Heat stress	2.Development of potential adaptation options	Knowledge inst.	Information
Kalajoki	SYKE	Flooding (fluvial)	2.Development of potential adaptation options	Knowledge inst.	Collaboration

Ijsselmeer	Deltares	Water availability (drought and flooding)	2.Development of potential adaptation options	Knowledge inst.	Collaboration
Madrid	UPM, BC6	Heat stress	2.Development of potential adaptation options	Knowledge inst.	Consultation
Holstebro	AU	Flooding (fluvial and pluvial)	2.Development of potential adaptation options	Labour unions	Collaboration
Dartmoor	UniExeter	Drought and flooding (pluvial)	2.Development of potential adaptation options	Labour unions	Consultation
Copenhagen	DBT	Flooding (Storm-surge)	2.Development of potential adaptation options	Labour unions	Collaboration
Timmendorfer Strand	EI	Flooding (coastal)	2.Development of potential adaptation options	Labour unions	Collaboration
Madrid	UPM, BC9	Heat stress	2.Development of potential adaptation options	Labour unions	Consultation
Alentejo	FFCUL	Water availability (drought)	3.Decision-making	Citizens	Self-mobilisation
Rotterdam	Deltares	Flooding (fluvial and coastal)	3.Decision-making	Citizens	Consultation
Alentejo	FFCUL	Water availability (drought)	3.Decision-making	Civil society orgs.	Self-mobilisation
Alentejo	FFCUL	Water availability (drought)	3.Decision-making	Farmers	Self-mobilisation
Kalajoki	SYKE	Flooding (fluvial)	3.Decision-making	Knowledge inst.	Collaboration
Alentejo	FFCUL	Water availability (drought)	4.Implementation	Citizens	Self-mobilisation
Copenhagen	DBT	Flooding (Cloudburst)	4.Implementation	Citizens	Consultation
Kalajoki	SYKE	Flooding (fluvial)	4.Implementation	Citizens	Collaboration
Venice	CMCC	Flooding (coastal)	4.Implementation	Citizens	Self-mobilisation
Alentejo	FFCUL	Water availability (drought)	4.Implementation	Civil society orgs.	Self-

					mobilisation
Cascais	FFCUL	Heat stress	4.Implementation	Civil society orgs.	Collaboration
Copenhagen	DBT	Flooding (Cloudburst)	4.Implementation	Civil society orgs.	Consultation
Alentejo	FFCUL	Water availability (drought)	4.Implementation	Farmers	Self-mobilisation
Moravia	CzechGlobe	Water availability (drought)	4.Implementation	Farmers	Self-mobilisation
Ústí	CzechGlobe	Water availability (drought)	4.Implementation	Farmers	Self-mobilisation
Cascais	FFCUL	Heat stress	4.Implementation	Knowledge inst.	Collaboration
Kalajoki	SYKE	Flooding (fluvial)	4.Implementation	Knowledge inst.	Collaboration
Ijsselmeer	Deltares	Water availability (drought and flooding)	4.Implementation	Knowledge inst.	Collaboration

Appendix 3

BASE stakeholders' workshop: Agenda for the day

Time	Activity	Description
8:30	Arrival, Registration and coffee /snacks	
9:00	Welcome	Welcome words by Dr. Hans Sanderson (BASE Project Coordinator , Aarhus University , DK)
9:05	Introduction to the BASE research project	Presentation on project goals & case studies by Dr. Olivia Rendon (University of Leeds, UK)
9:20	Overview of participants & workshop agenda	Brief overview of participants, description of workshop agenda & questions by André Vizinho (FFCUL, Portugal)
9:50	Group discussions	Base researchers give brief overview of case studies & group discussions by clusters (agriculture & biodiversity, cities & health, coasts and water resources)
10:50	coffee break	
11:00	Group discussions (continue)	Stakeholders and researchers continue to exchange experiences on adaptation
12:00	Group summaries	Groups present their main conclusions
12:40	Lunch	
13:25	Overview of afternoon agenda	Structure of afternoon sessions explained by Andre Vizinho (FFCUL, Portugal)
13:40	World Cafe on key adaptation topics	Dynamic group discussions with rotations on: (1) participation, (2) economics, and (3) barriers and opportunities to adaptation
14:40	World Café summaries	Groups present main conclusions of World Café
15:15	coffee break	
15:30	The role of BASE case studies' research: a review	To obtain stakeholders' feedback on BASE case studies
17:00	Closing statements	Workshop summary and acknowledgements by Olivia Rendon (University of Leeds, UK)

Appendix 4

Base stakeholders questionnaire

A. Baseline Information

1. Briefly describe your areas of expertise relevant to this workshop.

2. Circle the themes that are most relevant to the BASE case study that is being or has been developed in your locality:

agriculture	*coastal*	*cities-heat stress*
cities-flooding	*biodiversity*	*water resources*
health	*drought*	*rural*

3. Which phase(s) of the adaptation process in your locality did the BASE project research?
   Please answer by drawing a Circle around the phases of the adaptation process of your locality that were researched by BASE

   Assessment; *Planning;* *Implementation; Evaluation;* *Not applicable*

4. Has the project BASE and its case study research contributed in any way to the adaptation process (assessment, planning, implementation or evaluation) at your locality?
   No (skip to Section C) Yes (continue to section B)

B. Participation in Case Study

Level of engagement

5. How involved have you been in the BASE case study and with the researchers? Tick all that apply.
   _ Contributed to data collection
   _ Contributed to data analysis
   _ Co-designed the methodology approach
   _ Provided my expert opinion
   _ Supported the establishment of links between the BASE team and other stakeholders
   _ Provided logistic support (e.g. place for meetings, email contacts)
   _ Co-facilitated workshops
   _ Contributed to draft reports and provided timely feedback
   _ Co-author of scientific papers
   _ Advised on follow-up research steps
   _ I have not involved at all
   _ Other:

6. How well informed are you about the research process and results of the BASE case study in your locality?
   1= very poorly informed
   2= poorly informed
   3= moderately well informed
   4= well informed
   5= very well informed
   N/A= Not applicable

7. How satisfactory was your level of involvement in the BASE case study? Circle one option.
   1= very low
   2= low
   3= medium

4= high
5= very high
N/A= Not applicable / no involvement

Quality of the work produced

8. How do you evaluate the quality of the research produced by the BASE case study? Circle one option.
   1= very low quality
   2= low quality
   3= medium quality
   4= high quality
   5= very high quality

9. How relevant is the information assessed for adaptation in your locality? Circle one option.
   1= very low relevance
   2= low relevance
   3= medium relevance
   4= high relevance
   5= very high relevance

Dissemination of results

10. How do you evaluate the quality of communication of the case study results?
    1= very low quality
    2= low quality
    3= medium quality
    4= high quality
    5= very high quality
    N/C= Case study not finished

11. Was the information and the results provided to you clear and easily understandable? Please explain.

12. Are the results useful for you and your organisation? Please explain.

Contribution to adaptation

13. How has the case study contributed to the process of adaptation at your locality? Circle one option.
    It was/is an obstacle — It was/is neutral
    It contributed/contributes positively — Not applicable/prospective

14. Please explain why.

Contribution to mitigation

15. How has the case study contributed to the process of mitigation at your locality?
    It was/is an obstacle — It was/is neutral
    It contributed positively — Not applicable/retrospective

16. Please explain why.

C. All BASE Case Studies

Quality of the work produced

17. How do you evaluate the quality of the research produced so far by the BASE case studies as a whole?
    1= very low quality

2= low quality
3= medium quality
4= high quality
5=very high quality

18. Were the results of the BASE case studies as a whole clear and easily understandable to you?
1= very unclear
2= unclear
3= understandable
4= clear and understandable
5= very clear and understandable

19. Please explain why.
20. Are the results of the BASE case studies as a whole useful to you and your organisation? Please explain.
1= not useful at all
2= poorly useful
3= useful
4= very useful
5= extremely useful

21. Please explain why.

22. What research questions related to adaptation to climate change at your locality do you still have?

23. Any other comments?