



## Adaptation pathways in planning for uncertain climate change: Applications in Portugal, the Czech Republic and the Netherlands



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### ABSTRACT

Adaptation pathways are developed to design adaptive policies to handle climate change uncertainty. Use of this tool varies across planning practices and adaptation challenges and adjusting the tool to particular practices can foster its adequate use. To gain insight into the use of adaptation pathways, we compared four initiatives (one each in Portugal and the Czech Republic and two in the Netherlands) with regard to design choices made. We found six design choices which need to be considered when adjusting adaptation pathways. Design choices about the geographic scale, inclusion of sectors, the generation and delineation of adaptation options, specification of possible pathways, the related performance metrics and the type of assessment are interdependent, but they are also influenced by contextual aspects. Analysis of the institutional diversity, planning culture and framing shows that the use of adaptation pathways is flexible enough to be adjusted for diverging planning practices. However, the tool is best suited to deliver local adaptation solutions, and adequate use depends on consensus about the adaptation problem, setting objective thresholds and determining uncertainty about future change. We conclude that understanding the customised use of tools for local planning practices is essential for adaptive policy design.

### 1. Introduction

Climate change is full of uncertainty, therefore adaptation should entail a portfolio of response options (Pielke, 1998; Henstra, 2016). To prepare climate adaptation policy, adaptive planning tools address these uncertainties by assessing different proposed responses. The adaptation pathways approach (Haasnoot et al., 2012, 2013) is a promising adaptive planning tool. In addition to traditional scenario analysis tools, in which the impact of different climate scenarios and possible responses are assessed (Van Vliet and Kok, 2015), adaptation pathways start analysis with the possible extension over time of feasible options under climate change. Additionally, the tool aids in studying if and how current portfolios of responses can be diversified through adaptation measures. Adaptation pathways claim to support policy-making by offering five contributions: (1) using objective-based thresholds; (2) handling uncertainty in principal drivers; (3) structuring

a wealth of adaptation options; (4) pointing out possible lock-ins; and (5) incorporating multiple stakeholder preferences (Haasnoot et al., 2012).

In planning processes, planners and policymakers need to make choices about issues, such as the demarcation of the system, the geographic scale at which adaptation responses are assessed, specification of adaptation measures and the necessity and possibility of quantifying the effects of interventions. These choices will influence the contributions and outcomes of using the adaptation pathway tool. A clearer understanding of how these design choices are made and their consequences will enable planners to better operationalize them for their particular planning practices. Better choices and operationalization of tools can improve the quality and effectiveness of adaptive policies. Moreover, planners may want to know the possible pitfalls of any tool. Such knowledge can increase the quality of the process and enhance usefulness and legitimacy of the developed adaptation responses.

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We start from the premise that design choices about the use of adaptation pathways determine the process after a specific direction is chosen. These can be conceptualized as boundary choices which structure how a planning process will unfold (Karstens, 2009; Van Broekhoven et al., 2015). When choosing the design of an adaptation pathway, planners are confronted with dilemmas concerning the benefits and downsides of particular choices. Analysis of the use of one specific tool in different planning practices can contribute to studies comparing various policy tools or adaptation policies across multiple contexts (e.g., Bubeck et al., 2015; Eikelboom and Janssen, 2017). Studying applications of adaptation pathways in different situations offers the opportunity to learn how the tool was used and which choices were made to adjust it to diverging circumstances. Moreover, such analysis can offer insight in the adequacy of the tool to deliver the five claimed contributions in different adaptation planning practices.

Our main objective is to study the use of the tool in different planning practices to gain an understanding of the design choices available to planners. Additionally, we want to gain insight into their consequences and the relation of choices to specific adaptation practices. We answer two related questions: ‘Which choices structure the use of adaptation pathways in different adaptation planning practices?’ and ‘To what extent is the customised use of adaptation pathways in different planning practices adequate?’ To this end we studied four applications of adaptation pathways (one each in Portugal and the Czech Republic and two in the Netherlands) and compared the processes of how users (e.g. planners, facilitators, policy-makers) of the tool chose a particular design of pathway and how the tools were used during specific planning processes. In the next section, we outline our research approach. Following this, we describe which design choices determined the use of the adaptation pathways in the four cases and outline why planners made particular choices. In the fourth section, we reflect on the design choices and contextual aspects which influenced which choice was made. Lastly, we discuss our findings in light of the use of adaptive planning tools for climate adaptation and present our conclusions.

## 2. Research approach

Key ingredients of the adaptation pathways are to identify adaptation tipping points (Kwadijk et al., 2010), to explore possible pathways and to monitor critical developments that start from the premise that policy responses have an expiration date. An adaptation tipping point is reached when the magnitude of external change is such that a policy response no longer meets its objectives. The ineffectiveness of a policy response will depend on how the future develops and can be assessed through scenario studies. Tipping points can be assessed to gain insight into the opportunity to appropriately adapt, postpone or antedate a response when new information about changing conditions is gained (Van der Vlist et al., 2015).

The aim of adaptation pathways is to select a set of policy responses by timing and sequencing different response options in light of one or more drivers of future change (Haasnoot et al., 2013). Planners generally do this in several steps, which results in a sequence of policy responses over time to achieve a set of pre-specified objectives under uncertain changing conditions (Haasnoot et al., 2012). For the purpose of communication, pathways can be depicted as a map showing different interconnected paths (Fig. 1). Planners can assess paths regarding different time horizons and scenarios using multi-criteria scorecards or cost-benefit analysis techniques (Haasnoot et al., 2013).

Planners need to take four steps to create an adaptation pathways map. These are related to four of the contributions mentioned in the introduction:

1. Set the objectives, performance metrics and related threshold values. This contributes to using objective based thresholds.
2. Assess adaptation tipping points for the current policy or

management situation, based on thresholds under different scenarios. This contributes to the handling of uncertainty in drivers of change.

3. Explore and select policy responses and assess their adaptation tipping points. This supports the structuring of a wealth of options.
4. Combine the different responses into combinations of alternative pathways which can be assessed on costs and benefits and multiple criteria to enable the selection of a preferred path. This helps highlight possible lock-ins.

The fifth contribution, incorporating multiple stakeholder preferences, is not embedded in a specific step but relevant for each of the four steps.

When an adaptation pathways map is created, planners need a monitoring system to collect information for early warning signals (triggers) to alter, or adjust (i.e. advance or postpone) policy responses. In each of the steps, design choices have to be made which are of profound importance for the use of adaptation pathways, but those choices are not set by the tool itself. Instead, users assess their specific situations, which determines to a large extent the effectiveness of the tool and the quality of its outcomes. The contribution of each step depends on the design choices of planners regarding the operationalization of each step in their particular situation.

We approached the use of adaptation pathways through the aforementioned steps and explored these steps for possible design choices and contextual variables that determined the outcome of these choices in the four cases. We carried out a comparative case study of applications of the pathways in four planning processes to develop policies to adapt to climate change (Farthing, 2016). Our cases differ regarding their planning objective, scope, amount of participation and planning culture. The cases were part of the European research project Bottom-up climate Adaptation Strategies towards a sustainable Europe (BASE) (BASE, 2016). In this project, 22 case studies across Europe were conducted to gather insight into sector-specific adaptation activities and to examine interactions across multiple policy levels. For this, planners used multiple adaptation analysis methods in which they received training through workshops.

We used four of these case studies for our comparison: the Ílhavo and Vagos Coast in Portugal, Prague in the Czech Republic and IJsselmeer and Rotterdam in the Netherlands. In each of these cases, planners used adaptation pathways to assess climate adaptation responses, but for different types of climate impacts. Moreover, we chose these cases because they have distinctly different planning objectives and scopes (both spatially and in adaptation responses) and a different emphasis on participation within BASE. Lastly, in the design of the study, the planners in the cases went through each of the four steps described above.

We took a comparative approach in which the planners in each of the cases were trained to use the adaptation pathways and apply them in their specific case studies. Subsequently, during the planning process, the experimental application of pathways was observed and reflected upon as the cases progressed through the different steps of the adaptation pathways. Each of the cases has a distinct methodology, data collection and analysis. The Ílhavo and Vagos Coast case was based on participatory action research, spatial modelling and interviews; the Prague case on spatial analysis, and additional interviews and a workshop; the IJsselmeer case on focus groups and interviews; and Rotterdam on action research, interviews and spatial and economic assessments. The results of these studies were separately documented for each case (BASE, 2016). These case documents were analysed to identify a list of questions for a comparative analysis. Based on these questions and written data, the first author conducted reflective interviews with the case study planners about their use of the tool and choices during the process. We used these reflections to create case narratives, describing the use of pathways, the justification of different methodical steps in the cases, the aspects that may influence why a

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