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Ranking of national-level adaptation options. An editorial comment

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Abstract de Bruin et al. (Clim Change, 2009) report on an expert assessment aimed at prioritizing adaptation options in several climate-sensitive sectors of the Netherlands. Their results show that even in a country with high economic, institutional and technical capacity, it is not currently feasible to prioritize national-level adaptation options based on social cost-benefit analysis because of methodological difficulties and insufficient quantitative data. Multi-criteria analysis based on qualitative indicators can help prioritizing adaptation options but the analysis detected strong conflicts between priority and feasibility criteria. The specific results of the ranking exercise should be treated with caution due to weaknesses in the selection of adaptation options and the definition of evaluation criteria. The authors assert that their methods can be transferred to other regions but substantial modifications are likely required in developing countries with large current climate risks, fewer economic resources, and substantial social inequalities.

1 Introduction

Adaptation is increasingly recognized as a necessary complement to mitigation for reducing the risks of climate change to an acceptable level (IPCC 2007). In recent years, adaptation research has evolved from a "handmaiden to impacts research" in the mitigation context to a crucial role in the development of adaptation policy (Burton et al. 2002). Key questions for adaptation policy are: Who should do what, where, and when to reduce vulnerability to climate variability and change? Who should bear the costs of adaptation and the residual damages? The different purposes of adaptation research—to provide more realistic climate impact estimates,

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to guide the prioritization of scarce resources for adaptation at different levels, and to recommend specific adaptation measures and make suggestions for their implementation—is also reflected in the evolution of adaptation assessments. Recent assessments are characterized by stronger stakeholder involvement, stronger integration of natural and social sciences, and stronger integration of future climate change with current climate variability (Füssel and Klein 2006).

de Bruin et al. (2009) present the results of a study aimed at prioritizing a wide range of adaptation options in the Netherlands. The Netherlands are a small, densely populated, low-lying country with about 60% of its population currently living up to 6 m below sea level. These geographic features make the country highly vulnerable to river floods and coastal floods. At the same time, the Netherlands are consistently placed in the top decile of countries in terms of economic resources, equality of income distribution, and governance quality, and the country can look back on a very long and successful history of flood control. This combination of high biophysical sensitivity to climate change and high coping and adaptive capacity make the Netherlands an interesting showcase for adaptation research.

2 Key findings and limitations of de Bruin et al.

de Bruin et al. (2009) propose a method for partially ranking adaptation options and apply it to 96 options from 7 climate-sensitive sectors in the Netherlands: agriculture (27 options), nature (12), water (31), energy & transport (15), housing & infrastructure (7), health (3), and recreation & tourism (1). These adaptation options comprise specific measures such as 'improved air conditioning in nursery homes or hospitals' as well as broad policy packages like 'integrated coastal zone management' and 'more space for water'. The wide range of options considered raises questions regarding their specificity and comparability.

The partial ranking of options applies multi-criteria analysis. In a first step, all options are assessed according to several qualitative criteria by experts and stakeholders. In a second step, a priority index and a feasibility index are calculated as the weighted sum of these discrete indicators. The clear separation of 'priority' and 'feasibility' criteria is a particularly strong point of this study because these criteria cannot be integrated on an objective basis. In fact, even the 'priority' dimension of adaptation is highly subjective because the ultimate goals of adaptation are themselves dependent on diverse values (Adger et al. 2009). However, the lack of any attempt at synthesizing the results for these two dimensions is surprising. Are there any options that have high priority *and* high feasibility? Does the trade-off between priority and feasibility differ across sectors? How sensitive is an integrated priority and feasibility index to different aggregation methods and weights?

The 5 priority indicators (importance, urgency, no regret, co-benefits, and mitigation effect) agree well with criteria for prioritizing adaptation discussed in the literature (Smit and Lenhart 1996; Smith 1997; Fankhauser et al. 1999; Füssel 2007). Unfortunately, the authors provide insufficient information on the exact meaning of these indicators. For instance, the most highly weighted indicator, 'importance' is defined as the "effectiveness in avoiding damages [...] in terms of the expected

gross benefits that can be obtained". It is not clear whether this vague definition was introduced on purpose (*e.g.*, to allow for different normative interpretations of 'importance') or not. Independent of the vague definition of the 'importance' criterion, doubts remain whether it is really meaningful to consider the gross benefits of adaptation options without considering their respective costs. Furthermore, defining the importance of adaptation options in *absolute* terms creates a systematic bias in favour of comprehensive policy options. This bias is clearly reflected in the top 6 adaptation options according to the importance index, all of which represent rather broad policy packages: integrated nature and water management; integrated coastal zone management; more space for water; risk-based allocation policy; risk management as basic strategy; and new institutional alliances. The 3 feasibility indicators (technical, social, and institutional complexity) are intuitively plausible but it is quite surprising that the economic feasibility of adaptation options is neither considered in the priority nor the feasibility indicator.

The ranking of adaptation options in de Bruin et al. (2009) is contingent on the particular climate change scenario considered. This scenario projects a regional temperature change increase of 2 °C and a rise in sea level of 0.60 m by 2100, which is in the lower range of recent projections. Specifically, a recent report commissioned by the Dutch government has suggested "a regional sea level rise of 0.65 to 1.3 m by 2100" (Deltacommissie 2008). It would have been interesting to find out how sensitive the expert-based ranking of adaptation options is to different climate change projections.

In addition to the indicator-based ranking of adaptation options, de Bruin et al. (2009) also assessed their social costs. The most revealing finding in this context is the sparsity of monetary data available: monetary benefits are provided for only 5 out of 96 adaptation options. This result may, however, be biased by the vague definition of many adaptation options in this study.

Several potentially interesting aspects of this study are explained rather briefly in the paper. For instance, the authors mention the construction of a database on the interconnection between adaptation options but they do not explain how this was done, what was learned, and whether this database might be applicable outside their study region.

What are the main lessons to be learned from de Bruin et al. (2009)? First, multi-criteria analysis based on expert judgement can help ranking national-level adaptation options. As the authors note, the method itself is not new but its application in this concrete example is nevertheless interesting. Some weaknesses in this application that should be addressed in future work include vague definitions, limited comparability, and sectoral imbalance of adaptation options included. Second, there seems to be a conflict between importance and feasibility of adaptation options (*i.e.*, many of the adaptation options ranked highest in terms of priority are assessed to have low feasibility). This topic warrants further study that should include some indicator on the costs of adaptation options so that the trade-offs between economic costs and non-economic constraints to adaptation can be assessed as well. Third, even in a showcase country for adaptation like the Netherlands, the prioritization of national-level adaptation options cannot currently be based on social cost-benefit analysis due to insufficient data and the difficulty of separating incremental adaptation costs from baseline costs.

3 Transferability of methods and results

de Bruin et al. (2009) assert the transferability of the ranking approach to other regions. They do not, however, substantiate their claim or discuss any caveats that might apply. Let us imagine a national-level policy-maker concerned with adaptation from Bangladesh. Bangladesh is a least developed country with similar geographical conditions as the Netherlands but with fewer economic resources, larger social inequalities, weaker institutions, and less comprehensive data on future climate change and impacts. What can this policy-maker learn from the study on the Netherlands?

First, a Bangladeshi policy-maker will likely observe with admiration (or envy) that despite the geographical vulnerability of the Netherlands to sea-level rise, current climate risks are not mentioned at all in the study. Furthermore, large-scale migration is associated with the lowest importance score of all 31 adaptation options in the water sector. Considering projections that a 1 m sea-level rise in Bangladesh may cause the forced migration of more than 20 million people (Myers 2002), these observations emphasize the crucial importance of adaptive capacity for adaptation (and residual impacts). Second, many of the adaptation options mentioned are general enough to be applicable in Bangladesh as well. This lack of specificity, however, has also been mentioned as a weakness of this study. Third, a Bangladeshi policy-maker will likely recognize the applicability of the importance and feasibility indicators. She will, however, be surprised that cost estimates or the economic feasibility of adaptation measures have not been considered in the ranking. Fourth, a Bangladeshi policy-maker would surely be interested to learn whether there were large differences across experts and stakeholders regarding the ranking of different adaptation options, how these differences were handled, how the results of the study were perceived by their sponsors, and how they were used by the the national government and other relevant adaptation actors. Unfortunately, de Bruin et al. (2009) provide limited information only on the process of the expert assessment and on the policy context of this study.

Finally, a policy-maker from a developing country will certainly notice that the prioritization of adaptation options in de Bruin et al. (2009) does not consider the distributional aspects of climate change. Fairness in adaptation requires considering the distribution of adaptation benefits, costs, and residual climate impacts across regions, sectors, and population groups (Adger et al. 2006). Attention to distributional aspects of climate change and adaptation is relevant at the national level as well as at the international level where policy-makers debate the prioritization of financial and other adaptation assistance to ‘particularly vulnerable’ countries based on criteria such as their exposure and sensitivity to climate change and their adaptive capacity (Verheyen 2002). The lack of consideration of distributional issues by de Bruin et al. (2009) may well be appropriate for the Netherlands, a country characterized by relatively low social inequalities and limited geographical heterogeneity. Adaptation rankings in many other countries, however, will have to pay considerably more attention to the equity dimension of climate change adaptation.

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