A Framework for the Assessment of Research Needs in National Climate Adaptation Strategies

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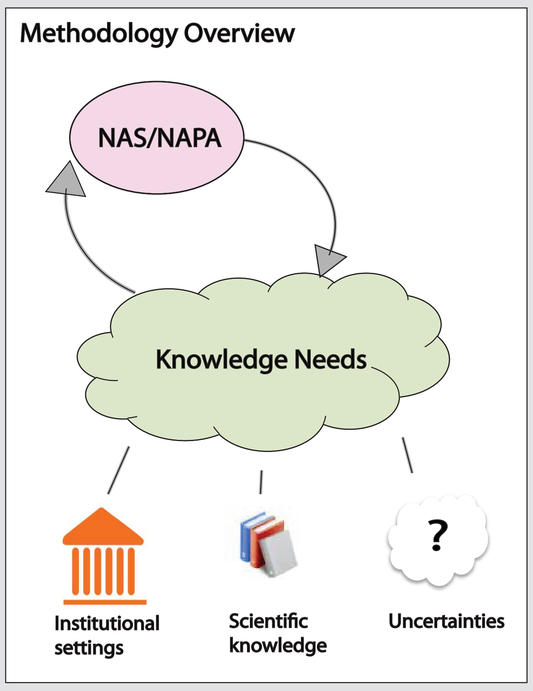
Abstract

This paper analyses scientific knowledge and addresses scientific knowledge needs of national adaptation strategies by looking at three main aspects: i) the institutional setting in which the strategy was elaborated; ii) the status of scientific knowledge used for the formulation of the strategy; and iii) the treatment of uncertainties. For this purpose, we selected six National Adaptation Strategies (NAS) and two National Adaptation Plan of Actions (NAPA). The following countries and states have been chosen for this purpose: Austria, France, Germany, Nepal, Switzerland, Washington State, Colombia and Bhutan. Preliminary results highlight a wide range of scientific methods and accuracy, with few countries having integrated their own detailed impact assessments. The main research gaps that emerge are i) availability of impact and vulnerability assessments at regional and local level; ii) needs for integrated assessments; and iii) improved climate data and iv) integration of socio-economic research. Needs appear to be dependent on the institutional capability of the country in terms of scientific research and to a certain extent on whether a top-down or bottom up approach was used. Uncertainties are mainly associated with knowledge gaps and appear to be addressed either explicitely or implicitely by almost all countries.

Methodology

The methodology is based on literature review analysis and data gathered from questionnaires. We discuss three institutional settings: a) top-down, b) bottom-up [1] and c) top-down inclusive (which has some elements of a and b) and three stages of scientific knowledge [1]: 1) Climate system research (climate dynamics and climate change attribution), 2) Impact research (impact of climate change on environmental and human systems), 3) Vulnerability and adaptation assessments (understand the factors that make a system vulnerable to climate change and how vulnerability can be reduced).



We identify general approaches in adaptation planning under uncertainties (e.g. adaptive management, scenario planning, robust and resilient strategies) [2] and specific key adaptation options: 1) no-regret, 2) win-win, 3) safety margins, 4) promote soft adaptation options, 5) reducing decision time horizons, 6) delaying action [2].

Results

We observe that all NAS analysed in this study are based on a top-down inclusive approach, while the two NAPAs have a bottom-up approach. In terms of scientific knowledge and uncertainties, results are summarised in Table 1 and Table 2 respectively.

The literature review and the questionnaire have highlighted the following main needs in scientific knowledge:

- Integrated assessments
- Climate impacts at higher spatial resolution (regional/local level)
- Vulnerability assessments at higher spatial resolution (regional/local level)
- Socio-economic assessments
- Continous long-term quality proofed climate data

Country	Climate Dynamics and Attribution	Impact Assessment	Vulnerability and Adaptation
Austria	• IPCC Scenarios • GCM and RCM models for Austria • Past observations of climate change	• Qualitative assessment per sector based on vulnerability assessment	• IPCC Sectoral Vulnerability Assessment (qualitative) • Sectoral Adaptation based on Impact and Vulnerability assessments • Adaptation strategy includes socio-economic aspects
Bhutan	• Climate Data	• Not developed	• Vulnerability assessment through participatory methods
Colombia	• IPCC Scenarios • RCM (GSM-MRI Japan, Precis, WRF)	• RCM models + Indexes = impacts in different areas and sectors	• IPCC Vulnerability Assessment (quantitative) • Include quantitative assessment of adaptive capacity • Adaptation assessment with socio-economic + institutional analysis
France	• IPCC Scenario • RCM (ARPEGE-Climat and LMDZ) • Observations	• Development of observation based climate change indicators • Assessment of sectoral impacts (including costs): - Socio-economics aspects included - Quantitative + Qualitative Assessment	• Vulnerability as part of the impact assessment • Adaptation (national to local) based on the impact assessment • Resulting adaptation measures and actions cover different sectors and several thematic areas
Germany	• IPCC Scenario • Statistical and dynamic downscaling • Medium-term climate forecast (foreseen) • Some regions carried on individual regional climate projections	• Qualitative assessment • Sectoral and Regional approaches are in progress	• Vulnerability study on expected highly exposed areas (e.g. alpine region) • A standardised cross-sectoral vulnerability across all Germany is in preparation • Vulnerability Assessments at regional level have been undertaken
Nepal	• IPCC and other literature (OECD 2003) • GCMs and RCMs for Nepal	• Local perceptions • Past events • Qualitative evaluation from GCM and RCM models and data trends	• GIS-based vulnerability assessment from IPCC in different areas • Local perceptions • Very general socio-economic analysis • Identify adaptation options from impact and vulnerability assessment (from national to local)
Switzerland	• Climate observations from 19th century onwards • Scenarios CH2007 and 2011 (IPCC based + a new emission scenario limiting GHG 2°C)	• Impacts for 2050 as resulting from the scenarios CH2007 for different sectors	• Risk based assessment • Sectoral Qualitative Vulnerability analysis. • Adaptation options from vulnerability assessment per different sectors
Washington State, USA	• IPCC Scenario • GCM • Statistical Downscaling & RCM	• Sectoral impact models, e.g.: – Hydrological Model (WRM) – Cropping system simulation model (CropSyst)	• IPCC 2007 vulnerability approach • Adaptation actions for priority sectors

Table 1: Overview of scientific knowledge used in support to the formulation of the adaptation strategy. Data are collected from the respective adaptation strategies and support documents as well as from questionnaires to policy makers or researchers.

Country	Type of uncertainties	Treatment of uncertainties
Austria	• Impacts at local and regional scales • Normative uncertainties	• No regret, win-win, and flexible approaches in adaptation
Bhutan	-	• Not addressed
Colombia	• Socio-economic uncertainties • Climate projections and scenarios • Impacts on sensitive ecosystems	• Adaptive management
France	• Natural climate variability • Numerical models • GHG emissions	• Implementation of no-regrets measures • Reversible measures • Measures increasing safety margins • Measures requiring long term implementation • Measures which can be adjusted and reviewed periodically
Germany	• Impacts and interconnections between different impacts • Effectiveness of adaptation measures	• Accept, document and communicate uncertainties that cannot be reduced • Regular review of measures • Adaptive management • Precautionary principle
Nepal	• Projections and future scenarios	• Planning for climate variability rather than climate change
Switzerland	• Regional/local impacts • Interconnections between different impacts • Socio-economic impacts • Barriers to adaptation	• Transparently and rigorously communicate uncertainties
Washington State, USA	-	• Adaptive management

Table 2: Overview of uncertainties type and methods to treat uncertainties. Data are collected from the respective adaptation strategies and support documents as well as from questionnaires to policy makers or researchers.

Discussions and Conclusions

The following main aspects from this qualitative preliminary study can be summarised as follow:

- A combination of adaptive capacity assessments, local perceptions and quantitative vulnerabilty assessments in top-down inclusive approaches can improve undestanding of local/regional impacts and vulnerabilities.
- Developing countries can benefit from improvements in climate data coverage and climate projections.
- Integrative assessments implicitely accounting for uncertainties would benefit stages 2) and 3) of the scientific knowledge and reduce the overall uncertainties highlighted in Table 2.
- Systematic inclusion of contributions from social science in the strategy formulation to better understand socio-economic trends.
- Almost all strategies analysed here attempt to address uncertainties (Table 2). Therefore steps could be taken towards a uniform terminology and global framework for the treatment of uncertainties in adaptation policies.

References

[1] Swart R., Biesbroek R., Binnerup S., Carter R.T., Cowan C., Henrichs T., Loquen S., Mela H., Morecroft M., Reese M., Rey D., (2009). Europe Adapts to Climate Change: Comparing National Adaptation Strategies. PEER Report N°1 Helsinki: Partnership for European Environmental Research.

[2] http://climate-adapt.eea.europa.eu/uncertainty-guidance/topic2 and references therein.