

# The Costs and Benefits of Adaptation

*Results from the ECONADAPT project*



Funded by  
the European Union

Policy Summary



## ECONADAPT

The ECONADAPT project (Economics of Adaptation) is a research project funded by the European Union Seventh Framework Programme (FP7). The objectives are to build the knowledge base on the economics of adaptation to climate change and to convert this into practical information for decision makers, in order to help support adaptation planning.

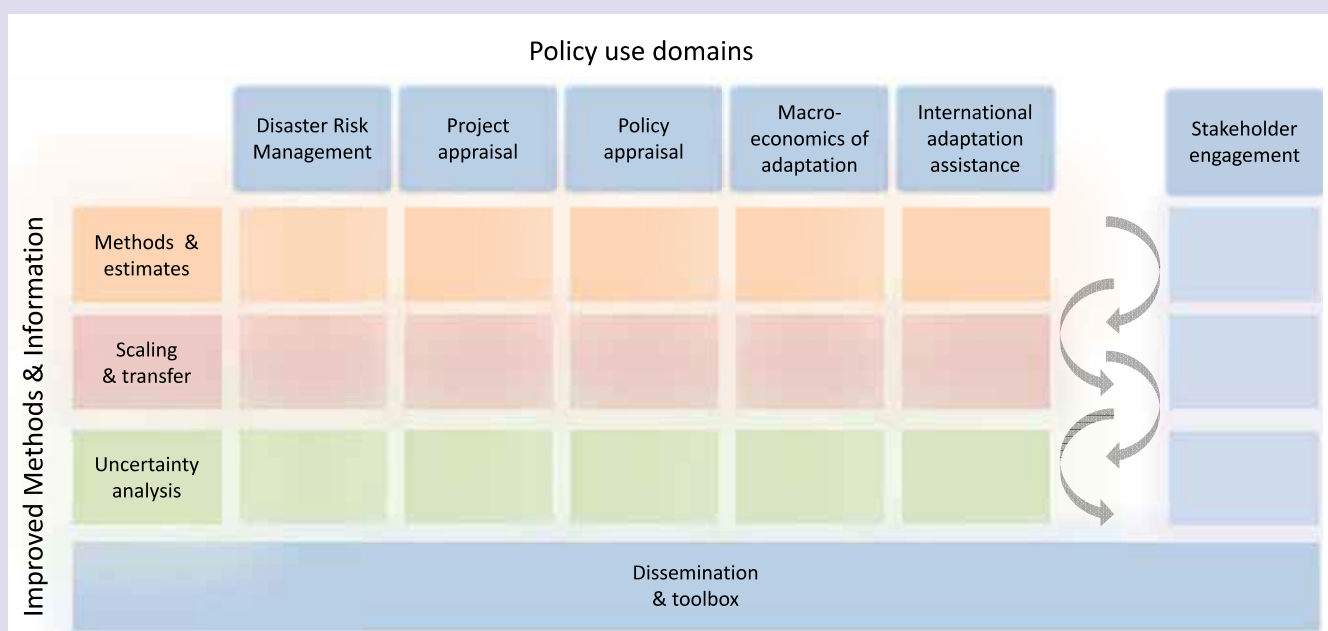
To advance these objectives, the project is focusing on key methodological issues and producing empirical data for a range of adaptation problems, and centring the research on the main challenges for European adaptation. The project frames the overall research by asking two questions, each addressed in a separate but linked work-stream.

- First, what are the key methodological advances needed to improve the economic assessment of adaptation?
- Second, what are the big adaptation decisions facing Europe in the next decade where these improved economic methods could be applied?

The first stream of research therefore focuses on improving the analytical methods to tackle the challenges of adaptation and to enhance the information base. The second stream frames the project from an end-user perspective, focusing on those areas (policy domains) which are likely to need more advanced economic analysis of adaptation. The two streams are combined together as shown in the Figure below.

The ECONADAPT has also adopted a policy-centred approach. The research incorporates stakeholder involvement throughout the project, and a series of policy workshops are planned to ensure a dialogue with potential end-users. The project will develop a toolbox that provides guidance on the methodological approaches and summarises the case study findings.

The ECONADAPT project commenced in October 2013 and will run for 36 months. To find out more about the ECONADAPT project, please visit the web-site: [www.econadapt.eu](http://www.econadapt.eu)



# KEY MESSAGES

This policy summary synthesises the evidence base on the costs and benefits of adaptation, based on a detailed review. It draws on the research and analysis of the ECONADAPT project, funded by the European Union's Seventh Framework Programme. The key messages are summarised below.

- The knowledge base on the costs and benefits of adaptation has evolved significantly in recent years. There are now many more studies at national, regional and local scale, with coverage in both developed and developing countries.
- In terms of the coverage by sector and risk, estimates of the costs and benefits of adaptation have moved beyond the previous focus on coastal zones and now extend to water management, floods, agriculture and the built environment. However, major gaps remain for ecosystems and business/services/industry.
- The methods for identifying options and assessing costs and benefits have also changed. More recent studies use iterative climate risk management, which puts more emphasis on current climate variability for the short-term, as well as future risks and uncertainty for the long-term.
- The focus of more recent studies has been on different types of adaptation, with a greater emphasis on early low-regret options, including capacity building and non-technical options. Many recent studies are also shifting to decision making under uncertainty, using new economic appraisal approaches. However, the wide range of methods and approaches now in use makes direct comparability between studies challenging.
- More recent implementation-based and policy-orientated studies indicate higher costs of adaptation than the previous literature. This is because these studies address existing policy objectives and standards, they consider multiple risks and recognise and plan for uncertainty, and they include the additional opportunity and transaction costs associated with policy implementation.
- While important gaps exist in the empirical evidence, and there are emerging issues over the transferability of estimates, the new evidence base provides an increased opportunity for sharing information and good practice.
- A full version of the review on the costs and benefits of adaptation is available at the ECONADAPT project web-site, [www.econadapt.eu](http://www.econadapt.eu)



### Introduction

This policy summary synthesises the estimates and evidence base on the costs and benefits of adaptation at the global, national, regional and local scale. It draws on research, analysis and review of the ECONADAPT project, funded by the European Union's Seventh Framework Programme<sup>1</sup> and from co-funding provided by the UK Department for International Development and by Canada's International Development Research Centre<sup>2</sup>.

The summary starts with a brief introduction to the challenges involved in estimating the costs and benefits of adaptation. It then assesses the recent evidence, looking at national and sectoral studies, and considering the available estimates and their use in economic assessments. Finally, the findings from the review are highlighted and gaps identified.

A full version of the report on the costs and benefits of adaptation is available at the ECONADAPT project web-site, [www.econadapt.eu](http://www.econadapt.eu)<sup>3</sup>.

### Methods

A number of methods have been developed to derive estimates of the costs and benefits of adaptation. Most of these use some form of scenario-based impact assessment, assessing future projections of climate change, the subsequent impacts and then considering adaptation responses.

However, this theoretical framework runs into a number of challenges in practice. This is

due to the difficulty in estimating the future impacts of climate change, and the costs and benefits of adaptation, especially given the high uncertainty. It also due to the fact that these studies are highly stylized and focus on technical adaptation costs as a response to defined future projections. Importantly, studies that use this framework tend to approach adaptation from a science-based perspective, considering it separately from the broader policy background and wider non-climatic drivers.

In response to these issues, the framing of adaptation has changed considerably over recent years. First, there has been a shift to more practical and policy-orientated analysis, i.e. for informing early implementation and climate mainstreaming (integration). Second, there has been a move to recognise the timing and phasing of adaptation, taking account of future uncertainty. This includes increasing use of iterative climate risk (adaptive management) and new decision support methods.

This new framework leads to very different methods and adaptation interventions. More recent studies have greater emphasis on early adaptation actions. They address the current risks of climate variability, to provide early benefits and build future resilience, and focus on low-regret options, including capacity building and non-technical responses. Complementing this, there is an increasing use of new approaches that inform future orientated decisions, to analyse the risks of lock-in, the value of information and future option values, as well as the benefits of flexibility and robustness.

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1. The ECONADAPT project is funded by the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no 603906. The views expressed in this publication are the sole responsibility of the authors and do not necessarily reflect the views of the European Commission. The European Community is not liable for any use made of this information.

2. Co-funding was provided by: i) UK Department for International Development, as part of the project 'Early Value-for-Money Adaptation: Delivering VfM Adaptation using Iterative Frameworks and Low-Regret Options' - this project has been funded by UK aid from the UK government; however the views expressed do not necessarily reflect the UK government's official policies; ii) Canada's International Development Research Centre (IDRC), as part of the project 'The Economics of Adaptation and Climate-Resilient Development' - however the views expressed in this report are entirely those of the authors and do not necessarily reflect the views of IDRC.

3. A summary of the findings are included in the Organisation for Economic Co-Operation and Development (OECD) book on Climate Change Risks and Adaptation: Linking Policy and Economics (2015), chapter 3.

Importantly, this range of methods and assumptions makes it more difficult to compare – and especially to aggregate – different studies on the costs and benefits of adaptation. The focus in this summary, and the main report, is therefore on compiling the evidence base and reflecting on the state-of-the-art to provide initial policy insights.

### Evidence Base on Costs and Benefits

Over the past decade, there have been a number of reviews of the costs and benefits of adaptation. These generally report a low evidence base.

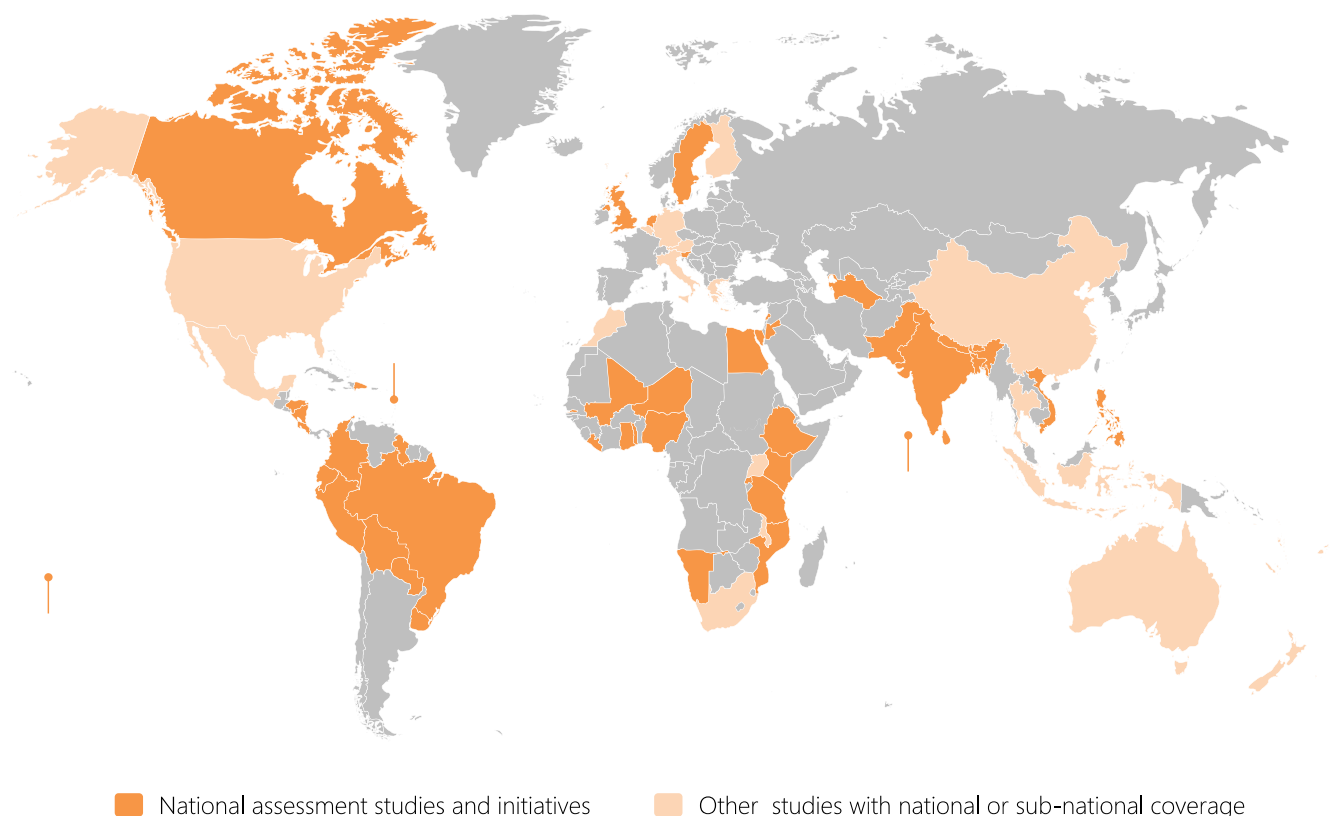
In recent years, however, additional evidence has emerged. There have been a large number of national level initiatives: varying from one or two key sectors through to economy wide assessments. These are shown in the figure below. There are also more sectoral and risk-based studies that focus on early adaptation, considering the application of existing options to new contexts or locations.

These two factors have led to a much larger number of studies – and evidence – on the costs and benefits of adaptation. The ECONADAPT project has identified over 500 relevant studies and these form the basis of this review.

A number of preliminary findings have emerged from an analysis of this new knowledge base.

At the current time, most studies are from the grey literature – only around 25% are academic peer review articles. This reflects the recent rapid growth of this area of research, but does raise some issues.

At the national level, there are relatively few policy-orientated studies that consider iterative risk management or decision making under uncertainty: those that do exist are primarily in OECD countries. In developing countries, more recent policy orientated studies are focusing more on low-regret adaptation, i.e. as part of national adaptation planning and early project implementation. While this provides a clear and rationale priority for investment, there is a question of the additionality over development.



Finally, and noting the caveats earlier on comparability, a compilation of the evidence from the national studies (i.e. those in the figure) indicates that the aggregated costs of adaptation are higher in the medium-term than estimated previously in global assessments.

### Coverage by Risk and Sector

Previous reviews have also assessed the coverage of adaptation costs and benefits by sector. These have shown relatively high coverage for the coastal sector and for agriculture (for benefits), as well as some studies of energy and infrastructure costs.

This coverage of adaptation costs and benefits has been reviewed as part of the ECONADAPT project. The findings are summarised in the Table.

The results clearly show that there is a greatly expanded coverage of costs and benefits – estimates now extend to water management, floods, agriculture and the built environment. However, major gaps still remain for ecosystems and business/services/industry. Moreover, even in the areas of high coverage, the full range of climate risks and adaptation options, the number of policy orientated studies, and the consideration of uncertainty, is partial.

The study has also looked at a number of cross cutting themes, including adaptive capacity, cross-sectoral convergences, macro-economic effects, the limits of adaptation and transformative adaptation. The coverage in all these areas was found to be very low, and their investigation is a future research priority.

A more detailed review by sector and risk reveals some further insights. Following the earlier discussion, there are now two distinct sets of literature. The first set of studies use impact-assessment and focus on technical adaptation. These studies generally show adaptation is extremely beneficial and has low costs. The second set uses the more recent iterative framing, and has a focus on early options to

address current climate variability and longer-term adaptation under future climate change uncertainty.

An analysis of the second set of literature indicates increasing coverage of the costs and benefits of early low-regret options. The review identified a large number of early adaptation interventions with high benefit to cost ratios, though the coverage of capacity building and non-technical options was low, as these are more challenging to appraise in economic terms. Some of these studies also consider longer-term adaptation, either associated with decisions today that have a long life-time (e.g. infrastructure) or large future risks where early action is warranted. A number of these studies are also using new decision-support methods which can consider uncertainty, such as real options analysis, robust decision making and portfolio analysis.

Across all areas, a key finding was that more recent policy-orientated studies estimate higher adaptation costs than the earlier, technical literature. This is because these policy studies work with existing objectives and standards, they consider multiple risks and wider non-climatic drivers, they factor in uncertainty, and they include the opportunity and transaction costs associated with policy implementation.

Importantly, the diversity of studies and approaches cautions against the simple reporting of the costs of adaptation, i.e. costs depends on the method, objectives and assumptions used. There is therefore an increasing recognition that the transferability of existing estimates is difficult, and care should be taken in reporting and compiling estimates.

Finally, it is highlighted that the evidence base in this area is still emerging. There is an urgent need for more empirical studies, to address key gaps, as well as ensuring existing information and lessons are shared. Further work in this area is being progressed by the ECONADAPT project, and the existing estimates – as well as guidance on use and transferability – will be published as the project is finalised.

## Updated Coverage of the Sectors in the Adaptation Literature

Risk / Sector	Coverage/ Discussion	Cost estimates	Benefit estimates
Coastal zones and coastal storms	Comprehensive coverage (flooding and erosion) at global, national and local level in I-A studies. Good evidence base on early low regret options and long-term iterative adaptive management including policy studies and decision making under uncertainty.	✓✓✓	✓✓✓
Floods including infrastructure	Growing number of I-A adaptation cost and benefit estimates in number of countries and local areas, particularly on river flooding. Evidence base emerging on low regret options and non-technical options. Some applications of decision making under uncertainty.	✓✓	✓✓
Water sector management including cross-sectoral water demand	Recent supply-demand studies at national level, and a range of global, river basin or local studies available. Focus on supply, engineer measures; less attention on demand, soft, and ecosystem-based measures (and non-market values). Some examples of decision making under uncertainty, particularly RDM.	✓✓	✓
Other infrastructure risks	Several studies on road and rail infrastructure. Number of examples of adaptation costs for wind storm and permafrost.	✓	✓
Agriculture (multi-functionality)	High coverage of benefits of farm level adaptation (crop models), and some costs and benefits from I-A studies at global and national level. Evidence base emerging on low regret adaptation, e.g. climate smart agriculture (soil and water management).	✓✓	✓✓
Over-heating (built environment, energy and health)	Good cost information on heat-alert schemes and some cost-benefit studies for future climate change. Increasing coverage of autonomous costs* associated with cooling (I-A studies) at global and national level. Growing evidence base on alternative options for built environment (e.g. passive cooling).	✓✓	✓
Other health risks	Increasing number of studies of preventative costs for future disease burden (e.g. water, food and vector borne disease), but coverage remains partial.	✓	✓
Biodiversity / ecosystem services	Low evidence based, with limited number of studies on restoration costs and costs for management of protected areas for terrestrial ecosystems.	✓	
Business, services and industry	Very low – very few quantitative studies found, except for tourism, where some studies of winter tourism and some studies of autonomous adaptation from changing summer tourism flow*.	✓	✓

### Key

- ✓✓✓ Comprehensive coverage at different geographical scales and analysis of uncertainty
- ✓✓ Medium coverage, with a selection of national or sectoral case studies.
- ✓ Low coverage with a small number of selected case studies or sectoral studies.

The absence of a check indicates extremely limited or no coverage.

I-A = impact assessment

\*note can be considered an impact or an adaptation.

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ECONADAPT is co-ordinated by the University of Bath (UK) and involves 14 teams across Europe.

