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Cost-benefit evaluation of adaptation measures in Germany: lessons learnt

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Project overview: „Costs and benefits of adaptation to climate change“

- Research project for German National Environmental Agency (UBA)
- Duration: 28 months (Nov. 2009 – Febr. 2012)
- Lead: Ecologic Institute (Berlin), Partners: INFRAS (Zuerich), Fraunhofer ISI (Karlsruhe)
- Research Questions:
  - How can cost-benefit analysis support the prioritisation and selection of adaptation measures?
  - How is the database in Germany and which recommendations can be formulated based on the existing data?

Structure of the project

- Literature analysis on state of the art: main climate risks, sectoral damages and adaptation costs
- Development of criteria set for comparison and evaluation of different adaptation measures
- Assessment of 25 selected adaptation measures in different sectors based on the criteria set (mainly based on literature and small number of expert interviews)
- Detailed analysis of three case studies (measures) in sectors: urban/regional planning, biodiversity, water

Criteria set

- Three categories of criteria (further splitted in 14 individual criteria)
  - **Basic information** – to describe a measure
  - Information on **costs** and **benefits** of measures
  - Criteria for **evaluation** of measures

Criteria set II

Basic information	Cost/benefit	Evaluation
- Sector - Type of measure - Relevance for public sector - Urgency, Time-lag between implementation and effect, life-time	- costs: direct costs, further economic costs, external costs - Benefits: economic, environmental, socio-economic benefits - Uncertainty of evaluated costs and benefits	- Relevance - Effectiveness - Windfall profits - Dynamic incentives - Acceptance - Interactions with other adaptation measures - Flexibility (no-regret, scenario-variability)

Case study: restoration of pastureland

- Basic information:
  - Analysed a concrete example at the river Elbe in the Northern part of Germany
  - sector: biodiversity, water (flood protection)
  - urgency: high, because long implementation time and time-lag between implementation and effect
- Cost/benefit analysis:
  - Included costs:
    - costs to rebuilt dikes and built new dikes

Case study: restoration of pastureland

- Costs to buy land from farmers
- Lossed income for farmers
- Planting costs for pasture forest

- Included benefits:
  - Lower maintenance costs for dikes, due to shorter length
  - Avoided damage costs in case of flooding
  - Nutrition retention
  - Evaluation of biodiversity

Case study: restoration of pastureland

- Calculated two scenarios:
  - first – business as usual (without climate change)
  - Second – with climate change
- Benefit-cost-ratio:

	Business as usual	With climate change	Main factors
Costs	14-18 mio. €	14-18 mio. €	Dike re/building, income losses
Benefits	20-35 mio. €	+ 10 mio. € (total: 30-45 mio. €)	Value for biodiversity conservation
Discounted costs and benefits until 2100.			

Case study: restoration of pastureland

- Evaluation:
  - Relevance: High, because biodiversity conservation is basis for human livelihood
  - Effectiveness: High, restoration would increase adaptive capacity of eco-systems, effect is proofed
  - Windfall profits: low, because nature conservation mainly task of public institutions

Case study: Heat warning systems

- Basic information:
  - Health-related measure, which consists of warning systems and additional activitities in case of warning: additional support for especially vulnerable people (e.g. in nursing homes), opening of cooling rooms, etc.
- Costs/benefits:
  - Included costs:
    - Costs for establishing warning system, information delivery to public, support at heat day: hotline, additional nursing staff

Case study: Heat warning systems

- Included benefits:
  - Avoided heat deaths and heat-related costs in hospitals (based on heatwave 2003, Willingness to pay)
- Cost-benefit ratio: costs (5 mio. € per year, 2100) lower than benefits (up to 2,5 bn. €)

- Evaluation:
  - Relevance: high – Health of population
  - Effectiveness: medium – only part of damages on heat days avoidable
  - Acceptance: high, but nursing homes, etc. faced by additional costs

Results: Cost-benefit ratio of different measures

Benefits higher than costs	Balanced costs and benefits	Costs higher than benefits
- Information compaigns for companies - Heat warning systems - Regional/urban planning - Road/rail infrastructure - Restoration pastureland - Adapted crops	- Green roofs, efficient cooling of offices or hospitals - Cooling of thermal power stations - Diversified tourism offers - Improved disaster management	- Irrigation in agriculture - Adaptation of electricity grid - Cooling of homes

Results/Summary

- Cost-benefit-ratio should be accompanied by further criteria: relevance, no-regret/regret, urgency, etc.
- Main problem: estimation of effect of measures -> which part of climate impact (and damage costs) can be avoided by the measure?
- Monetarisation of benefits –> vary over different sectors (better for sectors, where market price is availabe, e.g energy, agriculture, worse for biodiversity)
- Monetarisation of health impacts – in principle possible, strong influence on the results of benefit assessment
- Monetarisation of decrease of productivity (e.g. transport, energy, cooling of offices) – quite unproblematic

Results/Summary II

- Local effects of climate change and implementation of measures – problematic for national evaluations (e.g. regional planning)
- Urgency varies over different measures – important for priorisation and selection
- Not only costs and benefit estimates are relevant, also distribution of costs/benefits over different stakeholder groups, risk of windfall profits, separation of autonomous adaptation
- Effects allways assessed against business-as-usual scenario:
  - Difficulties: Integration of other developments, like demographic change
  - A lot of trends can only be assessed very rough – e.g. technological development, change of consumer behaviour

Thank you.

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