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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 Federal 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 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
<ul style="list-style-type: none"> - Sector - Type of measure - Relevance for public sector - Urgency, Time-lag between implementation and effect, life-time 	<ul style="list-style-type: none"> - costs: direct costs, further economic costs, external costs - Benefits: economic, environmental, socio-economic benefits - Uncertainty of evaluated costs and benefits 	<ul style="list-style-type: none"> - Relevance - Effectivity - 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 north 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

- ▶ Benefit-cost-ratio: costs (14-18 mio. €) lower than benefits (30-45 mio.)
(Discounted costs and benefits until 2100)



Case study: restoration of pastureland

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

▶ Benefit-cost-ratio:

	Business as usual	With climate change	Main factors
Costs	10 mio. €	10 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
- Effectivity: High, restoration would increase adaptive capacity of ecosystems, 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 activities 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 home, etc faced by additional costs



Results: Cost-benefit ratio of different measures

Benefits higher than costs	Balanced costs and benefits	Costs higher than benefits
<ul style="list-style-type: none"> - Information campaigns for companies - Heat warning systems - Regional/urban planning - Road/rail infrastructure - Restoration pastureland - Adapted crops 	<ul style="list-style-type: none"> - Green roofs, efficient cooling of offices or hospitals - Cooling of thermal power stations - Diversified tourism offers - Improved disaster management 	<ul style="list-style-type: none"> - 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 costs) can be avoided by the measure?
- ▶ Monetarisaton of benefits -> vary over different sectors (better for sectors, where market price is available, e.g energy, agriculture, worse for biodiversity)
- ▶ Monetarisaton of health impacts – in principle possible, strong influence on the results of benefit assessment
- ▶ Monetarisaton 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 prioritisation 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 always 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 (no



Vielen Dank für Ihre Aufmerksamkeit.

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