

ECRAN –TAIEX workshop on national climate adaptation
policies and legislation

Ankara, Turkey
18 – 19 February 2016

Assessment of Adaptation options

PART 3

Assessing costs and benefits of adaptation options

Definitions

Cost and benefit analyses – processes by which adaptation measures are **compared** and **prioritised** based on **systematic, unbiased assessment**, using **common standardized metric or scoring**.

Adaptation costs - the **costs of planning, preparing** for, **facilitating**, and **implementing** adaptation measures, including transition costs as well as **costs of residual risks**/impacts.

Adaptation benefits - the **avoided damage** costs and/or the **accrued benefits** following the adoption and implementation of adaptation measures.

Overview of methods

Methodologies – large scale/scientific

Approach	Description	Advantages	Limitations
Economic integrated assessment models (IAM)	Global aggregated economic models that assess the costs of climate change and the costs and benefits of adaptation.	Provide headline values for awareness. Range of economic outputs. Used to provide economic information on global climate policy.	Very aggregated approach with highly theoretical form of adaptation, no technological detail. Insufficient detail for national or sub-national adaptation planning.
Investment and financial flows (IFF)	Early studies estimate costs of adaptation as percentage uplift. More recent national studies estimate cost of marginal increase needed to reduce climate risks.	Highlights scale of short-term investment needs in sectoral or development plans.	Often little linkage with climate change scenario, and little consideration of uncertainty.
Computable general equilibrium models (CGE)	Multi-sectoral and macro-economic analysis of the economic costs of climate change, and emerging analysis of adaptation.	Captures cross-sectoral linkages across economy, including autonomous market adaptation. Can represent global trade effects. Can link to sector studies.	Utilises aggregated representation of impacts and adaptation, no technical detail, no consideration of uncertainty. Omits non-market effects. Not suitable alone for detailed national or sector-based planning.
Impact assessment (scenario based)	Projects physical impacts and welfare costs from climate model outputs using impact functions, plus costs and benefits of adaptation options.	Sector-specific analysis at regional, national or sub-national scale. Physical impacts as well as welfare values. Can capture non-market sectors.	Not able to represent cross-sectoral, economy-wide effects. Treats adaptation as a menu of technical options to defined scenarios. Medium- to long-term focus, thus less relevant for short-term policy.
Impact assessment (extreme weather events)	Variation of above, using historic damage-loss relationships. Adaptation costs from replacement expenditures or analysis of options.	Consideration of future climate variability. Provides information on short-term priorities (with current climate extremes).	May be inappropriate to apply historical relationships to future socioeconomic conditions. Robustness limited by current high uncertainty in predicting future extremes.
Risk assessment	Risk-based variations include probabilistic analysis and thresholds.	As above, but risk-based context allows greater consideration of risk and uncertainty.	Risk-based approach introduces extra dimension of complexity with probabilistic approach.
Econometric based	Econometrics used for relationship between economic production and climate – applied to future scenarios.	Provides information on multiple factors and can capture autonomous adaptation.	Mainly focused on autonomous or non-specified adaptation. Simplified relationships for complex parameters. No information on specific attributes.
Adaptation assessments	Economic analysis of adaptive management (iterative adaptation pathways).	Focus on immediate adaptation policy needs, soft and hard adaptation, and decision making under uncertainty.	Resource intensive.

Tools/approaches – practical application

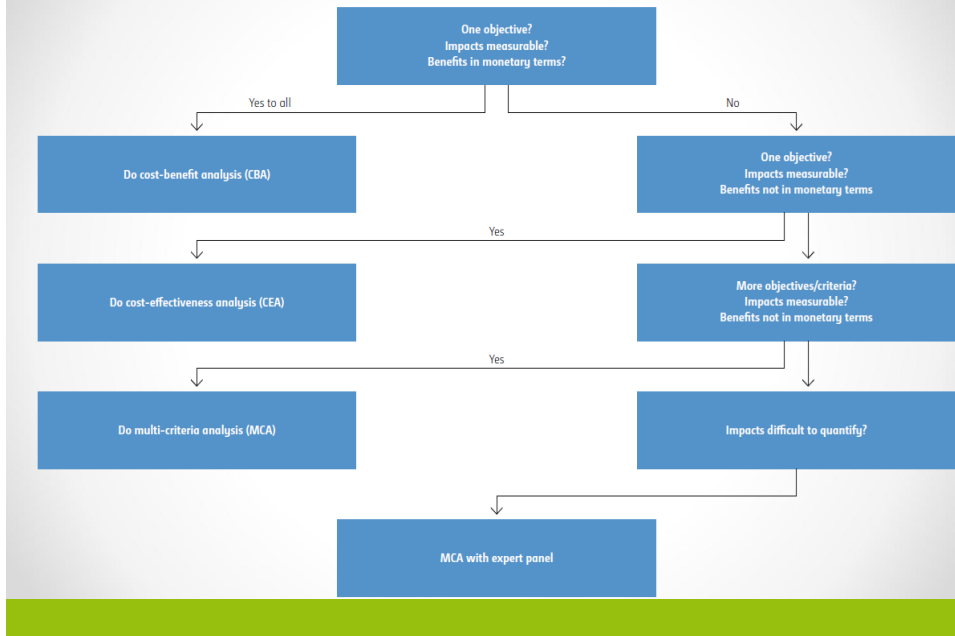
Decision tool	Brief description	Usefulness and limitations in climate adaptation context
Social cost-benefit analysis (CBA)	Evaluates all relevant costs and benefits to society of all options and estimates the net benefit/costs in monetary terms. CBA aims to directly compare costs and benefits, allowing comparisons within and across sectors.	Most useful when: <ul style="list-style-type: none"> climate risk probabilities are known; climate sensitivity is likely to be small compared to total costs/benefits; good-quality data exist for major cost/benefit components.
Social cost-effectiveness analysis (CEA)	Compares relative costs of different options and can assess alternative ways of producing same or similar outputs, identifying least-cost outcomes using cost curves. Used extensively in climate change mitigation.	Most useful when: <ul style="list-style-type: none"> as for CBA, but also applicable to non-monetary metrics (e.g. health); agreement exists on sectoral social objective (e.g. acceptable risks of flooding).
Multi-criteria analysis (MCA)	Allows consideration of quantitative and qualitative data using multiple indicators for integrating broad objectives (and related decision criteria) in a quantitative analysis. It provides systematic methods for comparing these criteria, some of which are expressed in monetary terms, some in other units.	Most useful when: <ul style="list-style-type: none"> there are broad objectives and qualitative data (including non-monetary metrics); there is opportunity/need for stakeholder input towards agreement.
Real options analysis (ROA)	Extends principles of CBA to allow economic analysis of learning, delay and future option values, providing context for decisions under uncertainty. Can also provide an economic analysis of benefits of flexibility and value of information on climate risks and actions.	Most useful for: <ul style="list-style-type: none"> large, irreversible capital-intensive investment, with potential for learning (especially in case of long decision/construction lifetime); climate risk probabilities are known or the range is within bounds.
Portfolio analysis (PA)	Allows an explicit trade-off to be made between the return (benefit), e.g. in net benefit terms from the CBA) and the uncertainty of that return (measured by the variance) of alternative combinations (portfolio) of adaptation options under alternative climate change projections.	Most useful when: <ul style="list-style-type: none"> a number of adaptation actions are likely to be complementary in reducing climate risks.
Robust decision making (RDM)	Aims to assess robust rather than optimal decisions and stress testing options against large numbers of future scenarios. Can work with climate uncertainty or in formal approach full-system uncertainty. Can trade off economic efficiency against other criteria.	Most useful when: <ul style="list-style-type: none"> there is deep uncertainty; scenarios for alternative climate, socioeconomic and vulnerability futures can be constructed and data for their characterisation are available.
Economic iterative risk management (adaptive management)	Iterative risk management (adaptive management) is an established approach that uses a monitoring, research, evaluation and learning process (cycle) to improve future management strategies, extended to capture economic appraisal using conventional or alternative decision tools.	Most useful when: <ul style="list-style-type: none"> climate risk probabilities are not well established or do not exist; there are threshold levels for risks (benefits expressed in quantitative or economic terms).

More information in: <http://mediation-project.eu/output/MediationBookFinal.pdf>

Most common approaches

Approach	Description	Strengths	Weaknesses
Cost-benefit analysis (CBA)	Assesses benefits and costs of adaptation options in monetary terms . Outputs include net present values, internal rates of return or benefit-cost ratios.	CBA can provide concrete quantitative justification for adaptation options rather than just relative information. It allows for a comparison between different aspects using a common metric (e.g. EUR).	CBA focuses on efficiency, when other criteria may be important (e.g. uncertainty or equity). It has difficulties with non-monetised costs and benefits and may need a subjective input into the choice of discount rate.
Cost-effectiveness analysis (CEA)	CEA identifies the least-cost option of reaching an identified target/risk reduction level or the most effective option within available resources.	CEA can assess options, using units other than monetary units, thus it is good for effects that are difficult to value . It can be applied within the context of routine risks (e.g. health effects) as well as major climate risks.	CEA is unable to offer an absolute analysis or common metrics . It deals insufficiently with uncertainty or equity. The selection of thresholds or target risk levels is not always easy or objective .
Multi-criteria analysis (MCA)	Assesses adaptation options against a number of criteria, which can be weighted, to arrive at an overall score .	MCA can consider monetised and non-monetised costs and benefits together . It also allows for considering a wide range of criteria including equity.	Scoring and ranking of options in MCA is subjective and not easily comparable.

Choosing the approach



Valuation of costs and benefits

Financial assessments - consider direct financial costs and benefits only

Economic assessments - consider wider impacts on the national economy as a whole

Socio-economic assessments - also includes non-market costs and benefits, such as human health, ecosystem services, etc.

Less complex, less informative



Most complex, most informative

Social Cost-Benefit Analysis Main steps

1. Agree on the adaptation objective and identify potential adaptation options –
what we would like to achieve and with which potential methods?
2. Establish a baseline –
what would happen without adaptation action?
3. Quantify and aggregate the costs over specific time period –
how much would it cost to implement this measure?
4. Quantify and aggregate the benefits over specific time period –
what is the value of avoided damages and co-benefits?
5. Compare the aggregated costs and benefits
which of the adaptation options provide most benefits for the lowest cost?



Indicators:

- Net Present Value (NPV)
- Benefit-cost ratio (BCR)
- Internal rate of return (IRR)

Social Cost-Effectiveness Analysis Main steps

1. Agree on the adaptation objective and identify potential adaptation options –
what we would like to achieve and which potential measures can lead to the same/similar result?
2. Establish a baseline –
what is the current situation and how far is the agreed objective?
3. Quantify and aggregate the costs over the life cycle of each option–
What are the costs of this measure until it achieves its maximum results?
4. Determine the effectiveness –
How far can this measure achieve the agreed objective?
5. Compare the cost effectiveness of the different options–
What is the cost per unit of improvement achieved (effectiveness)?

Multi-criteria Analysis Main steps

1. Agree on the adaptation objectives and identify potential adaptation options –
Which simultaneous objectives we would like to achieve and with which potential measures?
2. Agree on the decision criteria –
Which criteria are important to determine how well each adaptation measure will achieve our objectives?
3. Score the performance of each adaptation option against each of the criteria –
How good is the performance of this measure based on all criteria using standardised score?
4. Assign a weight to criteria to reflect priorities –
How important is each evaluation criteria in the 'big picture'?
5. Rank the options-
What are the preferable adaptation measures based on the weighted scores?

Cross-cutting issues, trade-offs and synergies

Assess whether an adaptation option:

- could potentially **create negative side effects** for another policy area/sector
- **delivers synergies** with other policy areas/sectors

Proposed measure: insurance of agricultural production

Implications for sustainable development:

Implications for sustainable development:

Option has no direct influence on environment.
Option can increase the ability of farmers to deal with shocks. Pilot projects proved to be affordable for poor farmers.
Main benefits of option include creating income smoothing opportunities for farmers, and enabling access to credit and therefore investment in higher-yielding crops, advanced technologies and potentially access to more lucrative markets.

Proposed measure: Sustainable Urban Drainage

Implications for sustainable development:

Implications for sustainable development:

SUDS can benefit wildlife and biodiversity by creating wetland habitats. Can contribute to a better microclimate through its cooling function, and promote well-being through increased greenery and natural landscapes. Promoted as a cheaper option than conventional drainage solutions, though long-term maintenance is a key issue, and critical to continued effective operation - therefore a whole life assessment is necessary. Could also be related to tax for occupation of urban space. In particular negative economic effects on big supermarkets.

Examples source: <http://adam-digital-compendium.pik-potsdam.de/adaptation-catalogue/option-database/>

Burning questions?

Further reading

- UNFCCC. Assessing the Costs and Benefits of Adaptation Options: An Overview of Approaches
http://unfccc.int/resource/docs/publications/pub_nwp_costs_benefits_adaptation.pdf
- MEDIATION. Identifying appropriate methods and tools to support climate change adaptation decision making
<http://mediation-project.eu/output/MediationBookFinal.pdf>
- Climate-ADAPT database (search using key words “cost benefit”)
<http://climate-adapt.eea.europa.eu/data-and-downloads>
- Climate- ADAPT case studies database including cost-benefit information for each case <http://climate-adapt.eea.europa.eu/sat>
- Climate-ADAPT adaptation measures database including cost-benefit information for each adaptation measure <http://climate-adapt.eea.europa.eu/adaptation-measures>



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