

Methodology for a Cost-Benefit Analysis of Disaster Risk Management

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Strategic Tools for Disaster Risk Management
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Outline

- CBA in Disaster Risk Management
- Process of CBA
- Some examples
- Outlook



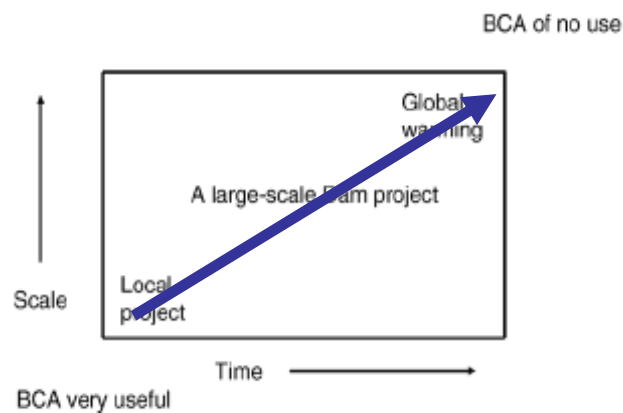
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Cost-Benefit Analysis

- CBA an established tool for determining the economic efficiency of development interventions.
- CBA compares the costs of conducting such projects with its benefits and calculates the net benefits or economic efficiency
- Stages of project cycle and uses of CBA
 1. Programming
 2. **Project identification and specification**
 3. **Appraisal: technical, environmental and economic viability**
 4. Financing
 5. Implementation
 6. **Evaluation**
- Often used for selecting among alternatives, not project *per se*

Limitations to CBA - generally

- Which benefits to include? Use vs. abuse...
- Lack of accounting for the distribution of benefits and costs in CBA
- Challenges with monetarizing non-market impacts
- Time and scale

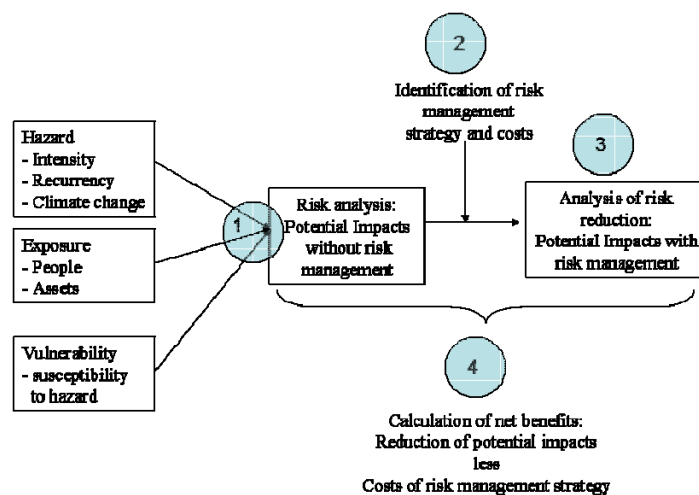


Usefulness of CBA in time and space
Source: Gowdy, 2007

Limitations to CBA in DRM

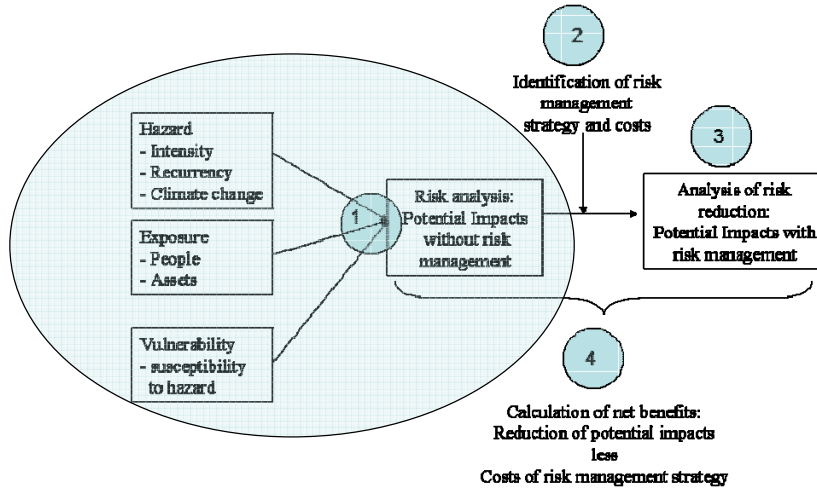
- Limited number of systematic studies and evidence
- Reasons
 - Disasters complex
 - Data and estimating risk as a function of hazard, exposure and **vulnerability**
 - Lack of simple tools and techniques
 - Large hidden costs only being discovered now
- Can it help with investing more into DRM?

Methodological framework



Methodological framework

Step 1



Types of assessment

Type of assessment	Methodology	Data requirements	Costs and applicability
Forward-looking assessment - risk-based	Estimate hazard, vulnerability, then combine to risk, combine with climate modeling, e.g. regional climate downscaling	Locale and asset-specific data on hazards and vulnerability. Global or regional climate circulation modelling	More accurate, but time and data-intensive. Time effort: month to years
Backward-looking assessment - impact-based	Past damage information as manifestations of past risk, then update to current risk	Data on past events, information on changes in hazard and vulnerability	Leads to rougher estimates, but more realistic and typical for developing country context. Time effort: weeks to months.

Types of CBAs conducted

Product	Purpose	Risk assessment	Resource and time commitment	Case study
Informational study	Provide a broad overview over costs and benefits	Backward-looking, qualitative, direct impacts	+	Pakistan Lei basin case (flood), Nepal case (flood)
Preproject appraisal	Singling out most effective measures for matters of more detailed evaluation in project appraisal	Mixed: backward and forward looking, focus on direct impacts	++	UP flood case
Project appraisal	Detailed evaluation of accepting, modifying or rejecting project	Forward-looking	+++	UP drought case
Evaluation (ex-post)	Evaluation of project after completion	Backward-looking, focus on direct impacts	++	UP flood case



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Direct and indirect risks in UP drought case

		Monetary Impacts		Non-monetary Impacts	
		Direct/financial	Indirect/economic	Direct	Indirect
Social	Households Farmers Community			Affected	Food security Malnutrition Migration
	Private sector Households Economic sectors Agriculture Industry Commerce Services Public sector Education Health Water and sewerage Electricity Transport Emergency spending	Crops affected or destroyed	Livelihood income Poverty Debt Production Market activity Trade with outside markets Relief expenses	Drinking water (people & livestock)	
Environmental				Natural habitats Land degradation Groundwater Levels and quality	Biodiversity

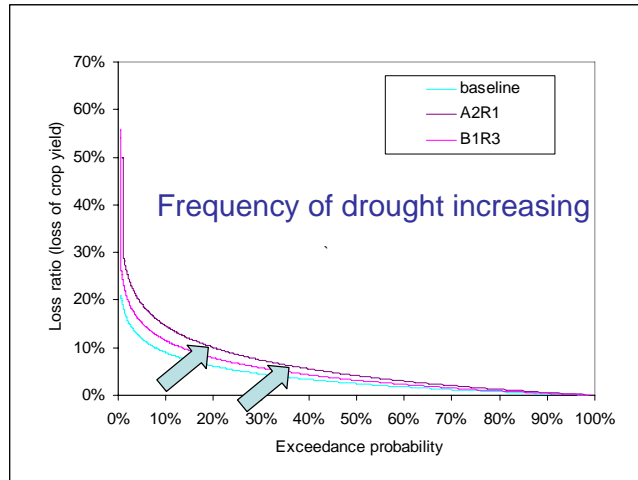
Matrix to organize data collection

UP drought analysis: direct-indirect developmental risks of interest



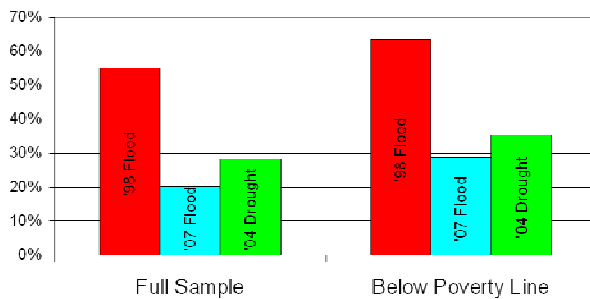
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Direct risks and need to consider climate change



Loss-frequency curve for crop yield losses for baseline and future climate scenarios

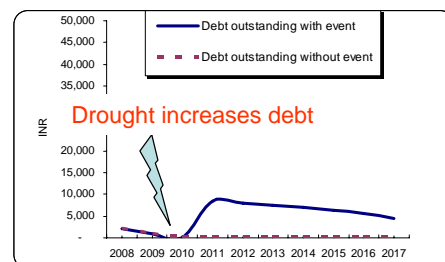
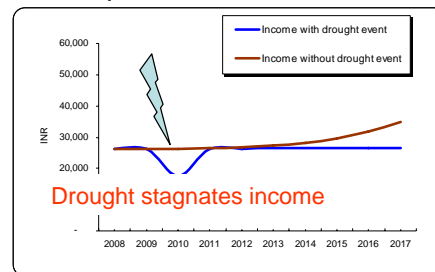
Uttar Pradesh drought: Indirect risks and development impacts important



Survey: reported impacts of droughts and floods on rural livelihoods in Uttar Pradesh, India (losses as percent of income)

Indirect income-debt relationship crucial, informed by survey

Model representation

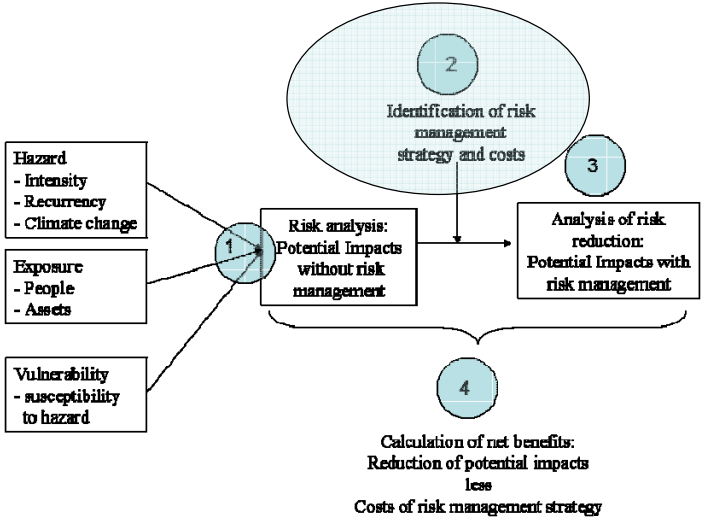


UP flood case

		In financial and economic terms		In quantitative or qualitative terms	
		Direct financial	Indirect economic	Direct	Indirect
Social	Households			Number of casualties Number of injured Number affected	Increase of diseases Stress symptoms
Economic	Private sector Households	Housing damaged or destroyed	Loss of income, increase in poverty and inequality, reduced purchasing power		
	Economic Sectors Agriculture Industry Services	Assets destroyed or damaged: buildings, machinery, crops etc.	Loss due to reduced production		
	Public sector Central government State government Local government	Assets destroyed or damaged: buildings, roads, machinery etc.	Opportunity costs due to diversion of budget for reconstruction and relief, loss of infrastructure services		
Environmental				Loss of natural habitats	Effects on biodiversity

UP drought analysis:
focus on direct, financial risks and performance of embankments

Methodology Step 2



Framework for estimating risk as a function of hazard and vulnerability

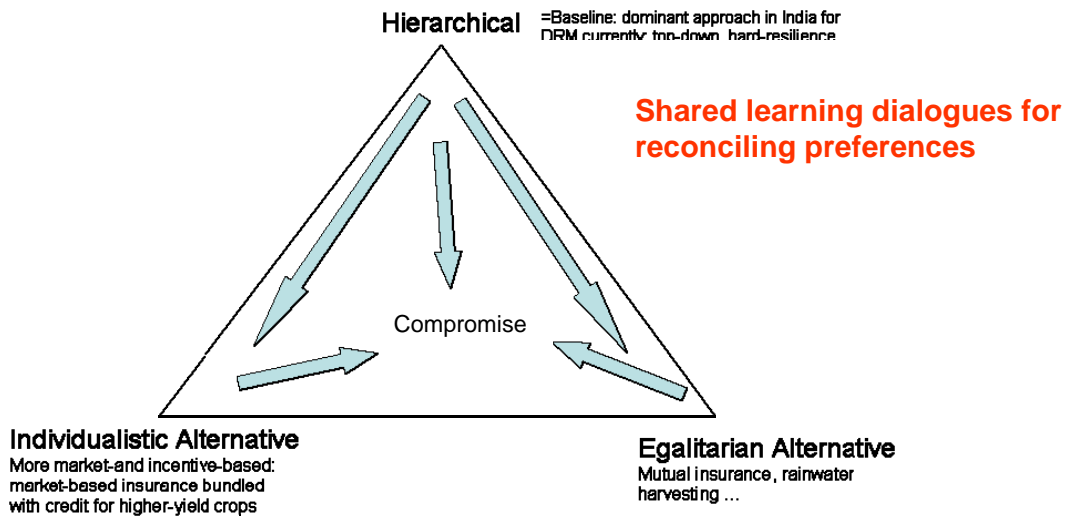
Interventions studied organized according to role in risk management

Type	Prevention	Preparedness	Risk financing
Effect	Reduces risk	Reduces risk	Transfers risk (reduces variability)
Key options	Physical and structural mitigation works (e.g. irrigation, embankments)	Early warning systems, communication systems	Risk transfer for public infra-structure and private assets, microinsurance
	Land-use planning and building codes	Contingency planning, networks for emergency response	Alternative risk transfer
	Economic incentives for proactive risk management	Shelter facilities, evacuation plans	National and local reserve funds

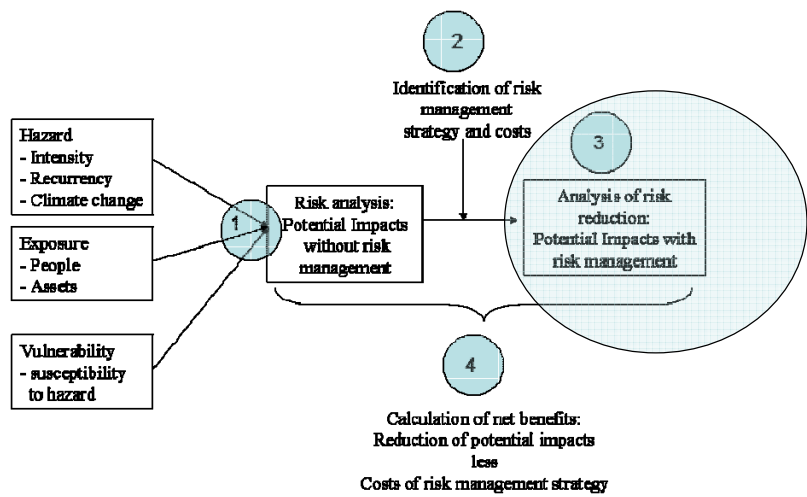
Characteristics of Interventions

	Irrigation	Insurance
Activities	Groundwater irrigation	Parametric micro-insurance
Costs to government	Construction of borehole	Premium subsidies
Costs to farmer	Costs of pumping water	Non-subsidized premium portion
Direct Benefits	Reduce hazard	Compensate direct losses
Indirect Benefits	<ul style="list-style-type: none"> ▪ Smoothen food supply, consumption & income (farmer) ▪ Reduction in relief expenses (government) 	<ul style="list-style-type: none"> ▪ Smoothen consumption & income, reduce variability (farmer) ▪ Reduction in relief expenses (government)

Identification of risk reduction interventions and strategy relatively straightforward, but...

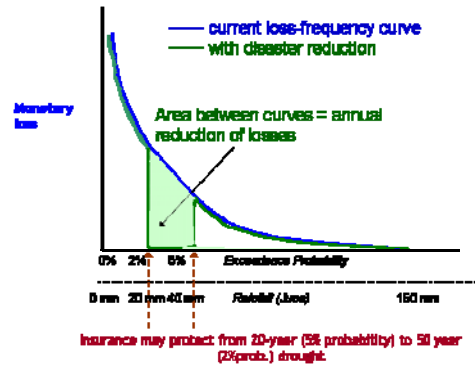
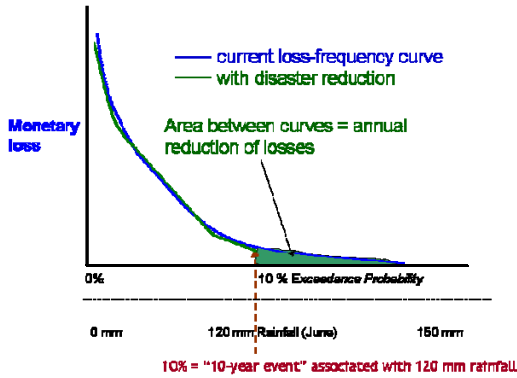


Methodology Step 3



Mechanics of interventions in the UP case

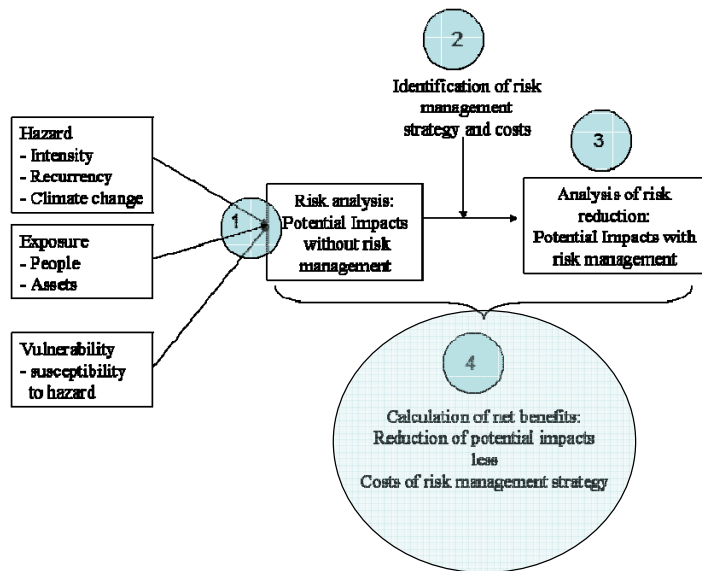
How is risk managed?



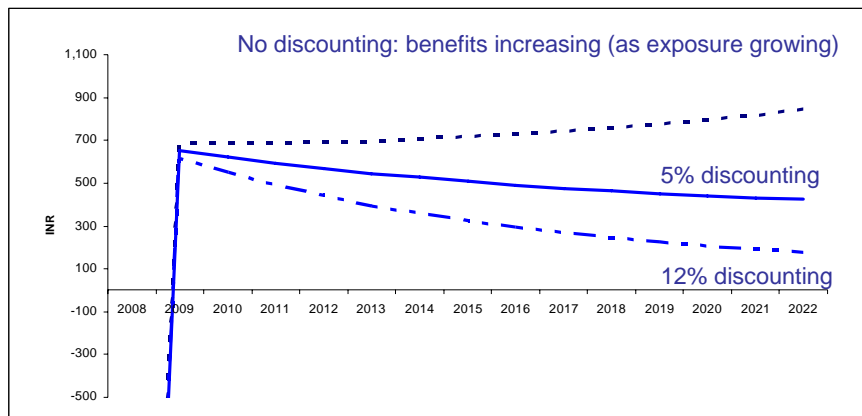
Irrigation reduces risk

Insurance transfers risk in exchange for premium payment (often a "layer" is transferred)

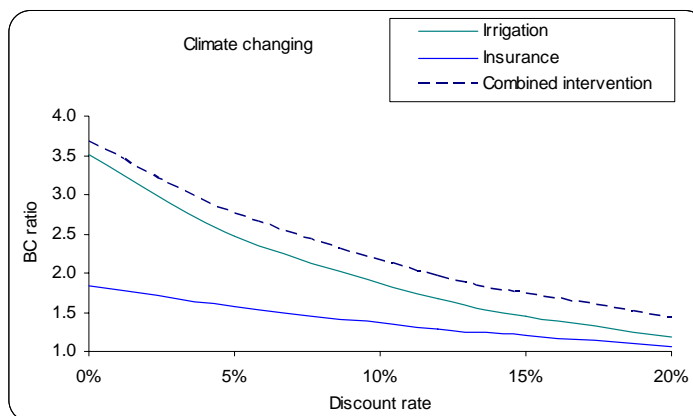
Methodology Step 4



Net benefits of crop insurance option in the UP drought case and discounting



Results: UP drought



**Preferrable:
Integrated package with
higher benefits in UP case,
also under climate
change:
Physical plus financial risk
management**

B/C ratios for interventions considered given a changing climate for UP drought risk case

Key findings

CBA process and complexities

- Estimating risk and the costs and benefits of risk management is feasible
- Risk-based analytical approach necessary and helpful
- More detailed analysis leads to be better insights: “hidden” costs of disasters
- Can be complex, costly and time intensive, important uncertainties, part. given climate change

Clarify objectives

- At outset, check objectives of conducting a CBA
- Combination of scoping exercises, shared learning dialogues and more qualitative assessments may be suitable to involve hierarchies, people and private sector equally

Key findings

Process-orientation

- CBA can be a useful as a tool for identifying, estimating, organizing and presenting risks and benefits of risk management
- In many circumstances role of CBA in DRM may be more related to *process* rather than *outcome*.
 - Refine and bound assessments of recurrence periods, impact valuations, etc.
 - Avenue for assessing many of the variables where quantitative data are lacking or insufficient
- In some cases: detailed and risk-based analysis will be essential, i.e. when assessing risk-based insurance interventions and developmental consequences

Thank you for your attention!