Costs-Benefit Analysis for natural disaster management: methodological background

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Session
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Overview

- Challenges and background
- Elements of CBA
- Pros and Cons
- Evidence of return on natural disaster risk management
- Users of CBA
- Conclusions

Challenges

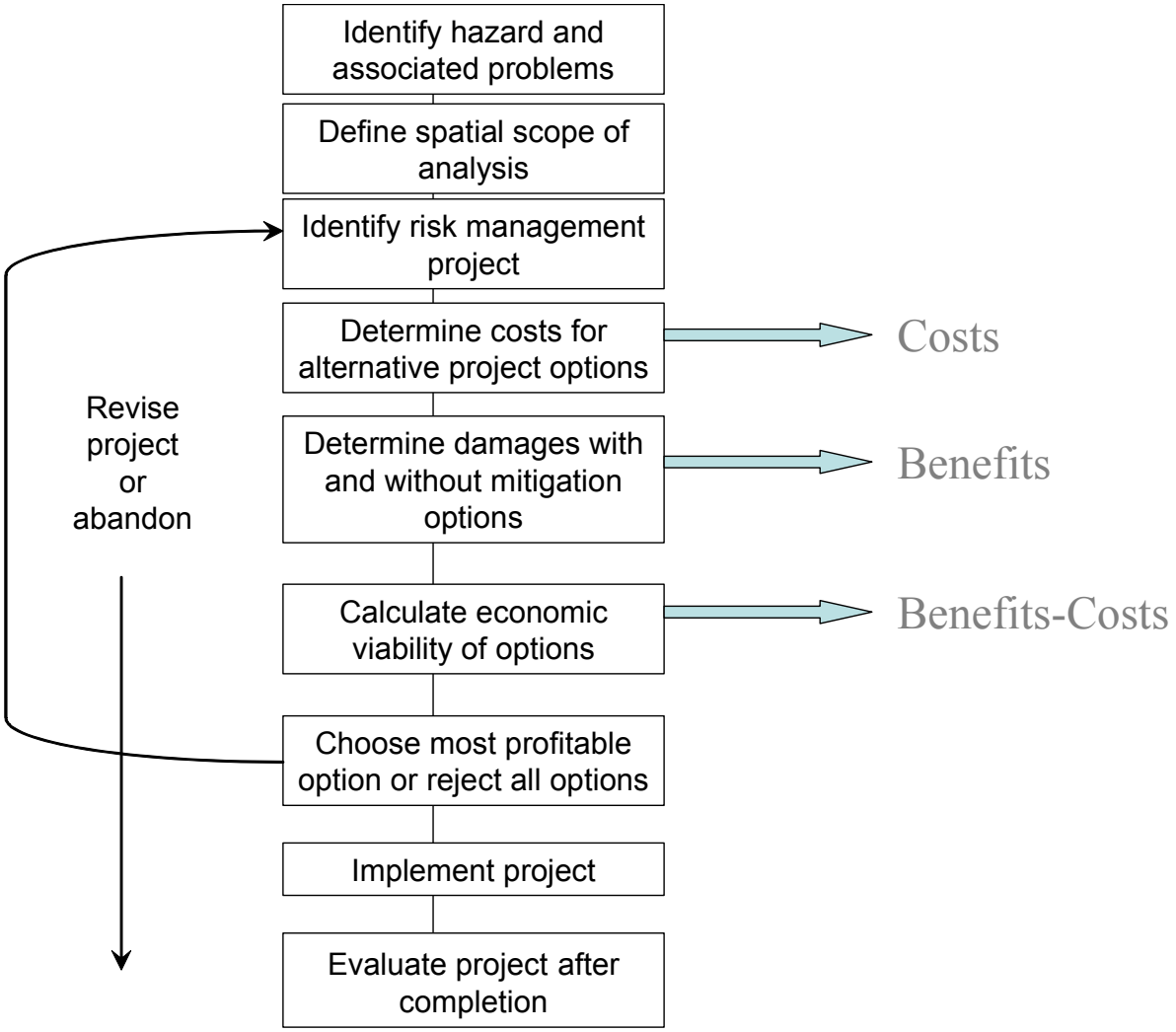
Building a culture of prevention is not easy. While the costs of prevention have to be paid in the present, its benefits lie in a distant future. Moreover, the benefits are not tangible; ***they are the disasters that did NOT happen.*** (Kofi Annan 1999)

- Costs certain, benefits not, disincentives for political and institutional actors in context of very scarce resources
- Need for long-term commitment, longer planning horizons
- Often post-event period as window of opportunity

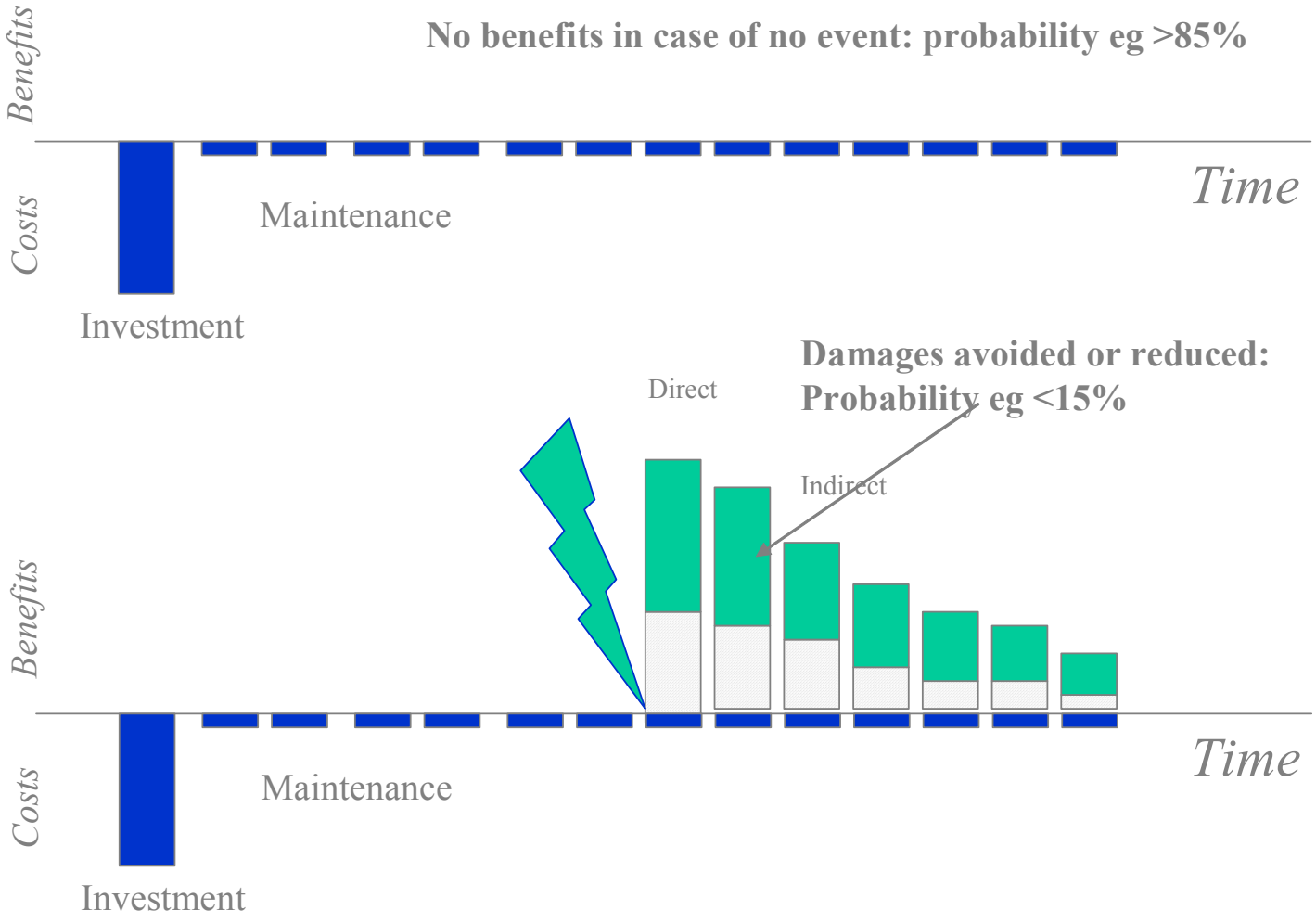
Background

- CBA can demonstrate benefits of and need for undertaking risk management measures („return“ on risk management)
- Guidelines exist, however, natural disaster risk often not considered in project appraisal due to difficulties with
  - Complexity (LPHC events): probabilistic analysis required,
  - Accounting for non-monetary values: value of life, „safety“
- CBA manual developed at GTZ as complementary effort for specific context with often little data and resources, and for application in a developing country context

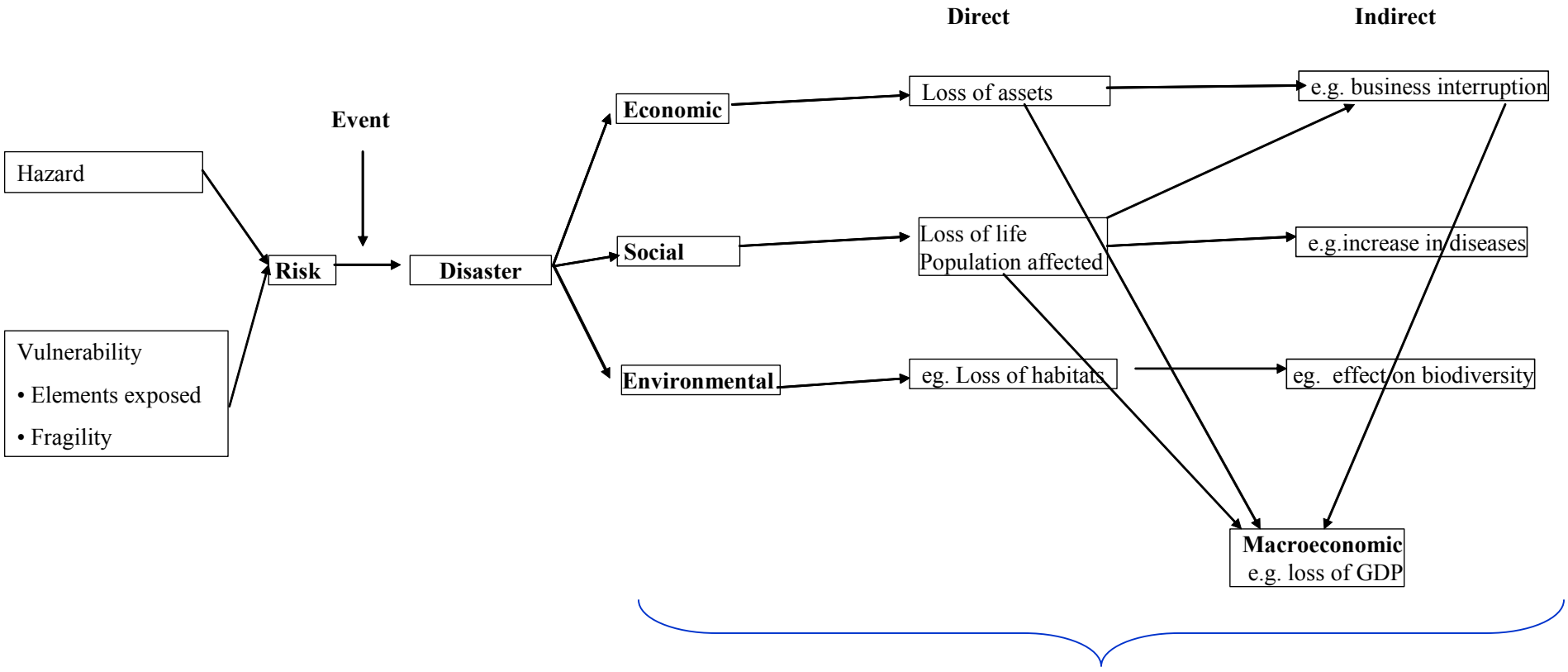
Cycle of CBA in disaster risk management



Costs and benefits of a risk management project



Measuring risk and benefits of risk reduction

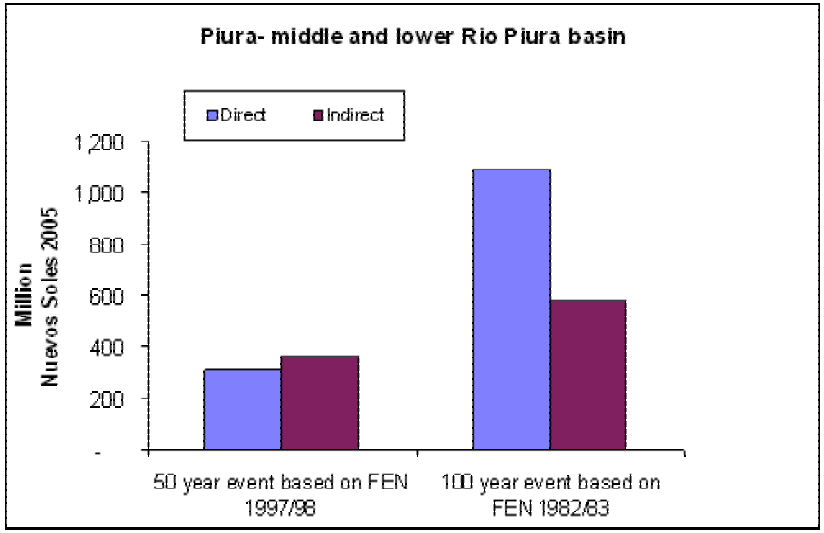


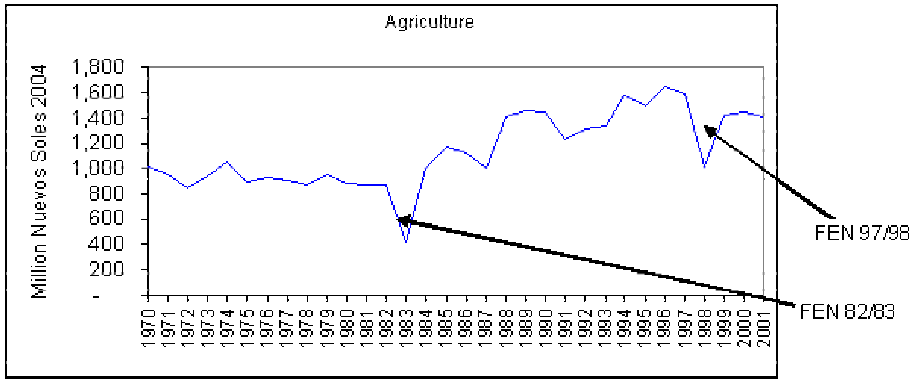
= Benefits when reduced/avoided

Categories of important potential impacts

	Indicated in monetary terms		Indicated in non-monetary terms	
	Direct	**Indirect**	**Direct**	**Indirect**
Social				
Households			Health	Health Sense of Insecurity
Economic				
Private sector				
Households	Housing damaged or destroyed	Eg loss of wages, reduced purchasing power		Increase in poverty
Public sector and Infrastructure				
Education Health Water and sewage Electricity Transport	Assets destroyed or damaged: buildings, roads, machinery, etc.	Reduction/loss of infrastructure services and/or increased cost		
Emergency spending				
Economic Sectors				
Agriculture Industry Commerce …	Assets destroyed or damaged: buildings, machinery, crops etc.	Profit losses due to reduced production		
Environmental			Loss of natural habitats	Loss of services

Direct and indirect impacts





Indirect losses
in agricultural sector in Piura, Peru

Pros and Cons of CBA of natural disaster risk management

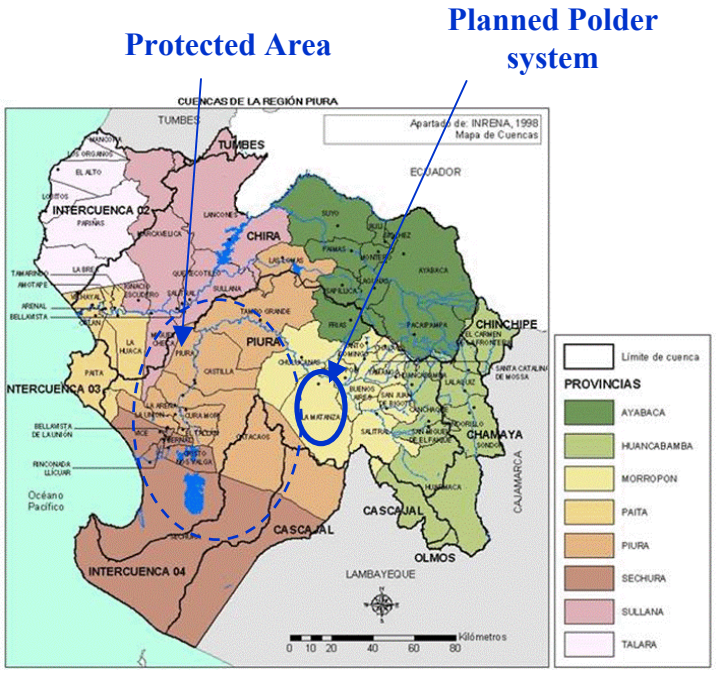
Pros

- Monetary framework for coherent and systematic decision-making
- Outlines monetary dimensions and benefits of natural disaster risk management

Cons

- Difficulty of accounting for non-market values, often left out, thus focus on easily measurable economic effects and investments only

Evidence I: Polder in Piura, Peru



Project alternative	Characteristics	Costs (2005 values)
Polder	Protection in medium and lower Rio Piura Up to 100 year event	20 km dikes: 84 million Soles construction costs, 1 million Soles annual operation and maintenance cost 2,600 ha will be flooded in case of event

Evidence I: Polder in Piura, Peru

- Impact-based assessment:
  El Ninos in 82/83 (~100 year event) and 97/98 (~50 year event)
- Good data on hazard and exposure, less on fragility
- Direct and indirect economic impacts
- Direct social impacts: loss of life

	Monetary		Non-monetary	
	Direct	Indirect	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 wages, reduced purchasing power		Increase in poverty
Public sector				
Education Health Water and sewage Electricity Transport Emergency spending	Assets destroyed or damaged: buildings, roads, machinery, etc.	Loss of infrastructure services		
Economic Sectors				
Agriculture Industry Commerce …	Assets destroyed or damaged: buildings, machinery, crops etc.	Loss due to reduced production		
Environmental			Loss of natural habitats	Effects on biodiversity

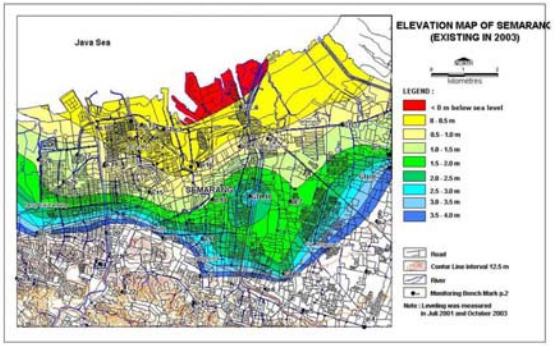
Results: best estimate and sensitivity analysis

	Best estimate	Costs: +30%	Without loss of life	Without indirect losses	Without increases in exposure
Sum: NPV (millions)	**260**	233	259	114	218
C/B ratio	**3.8**	2.9	3.8	2.2	3.4
IRR	**31%**	22%	31%	14%	29%

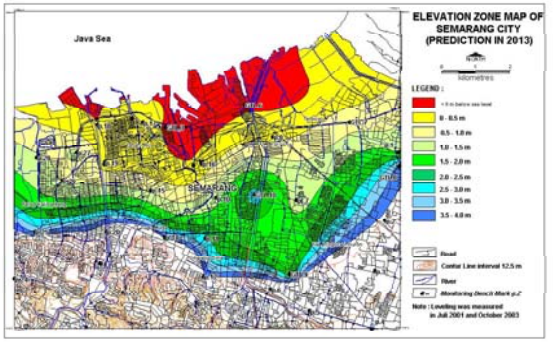
Evidence II: Integrated flood protection in Semarang, Indonesia

- City subject to seaside inundation due to land subsidence and riverine flooding in rainy season
- Land subsidence caused by (illegal) groundwater extraction

Elevation in 2003

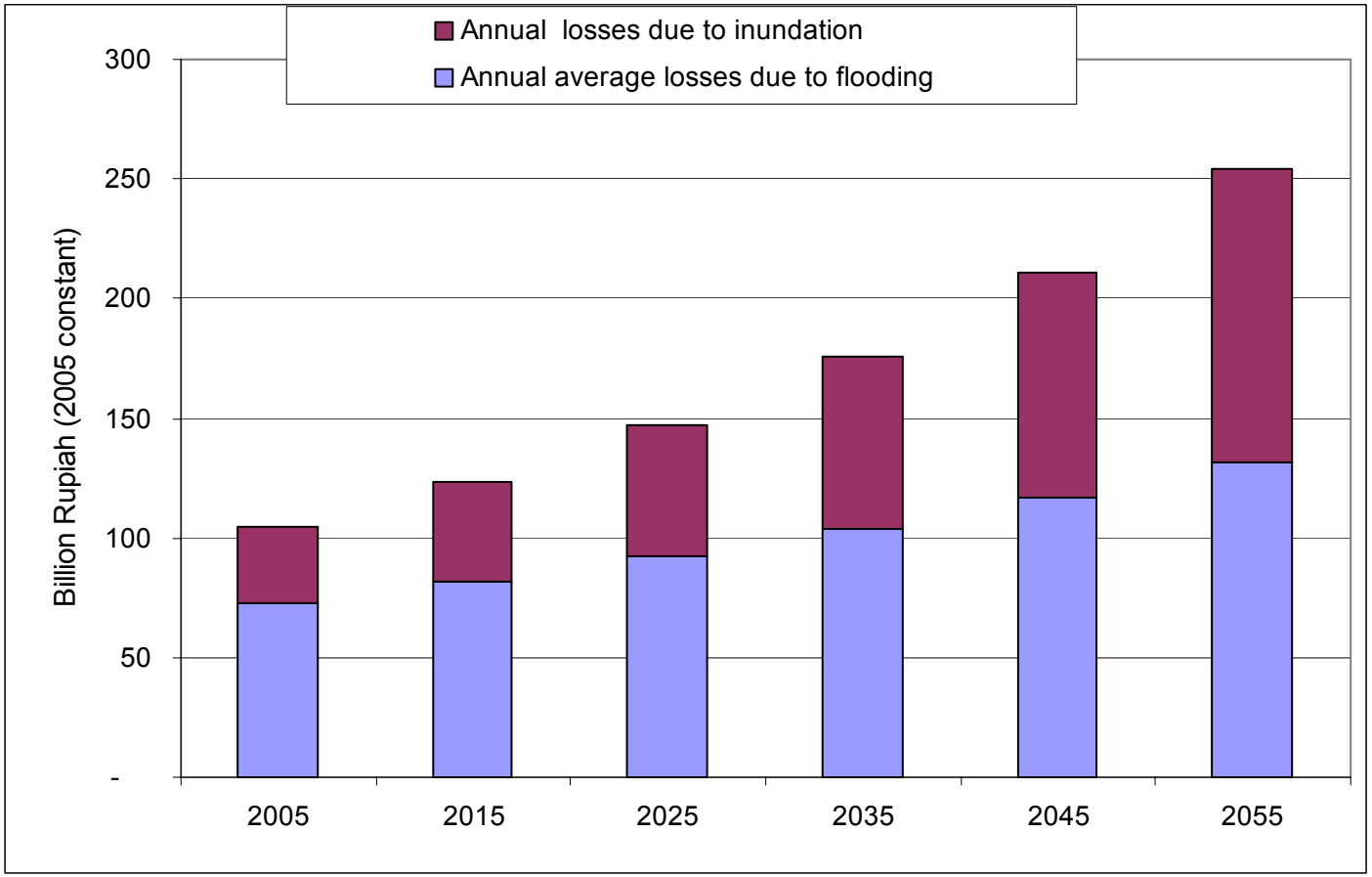


Elevation in 2013 (scenario)



Evidence II: Integrated flood protection in Semarang, Indonesia

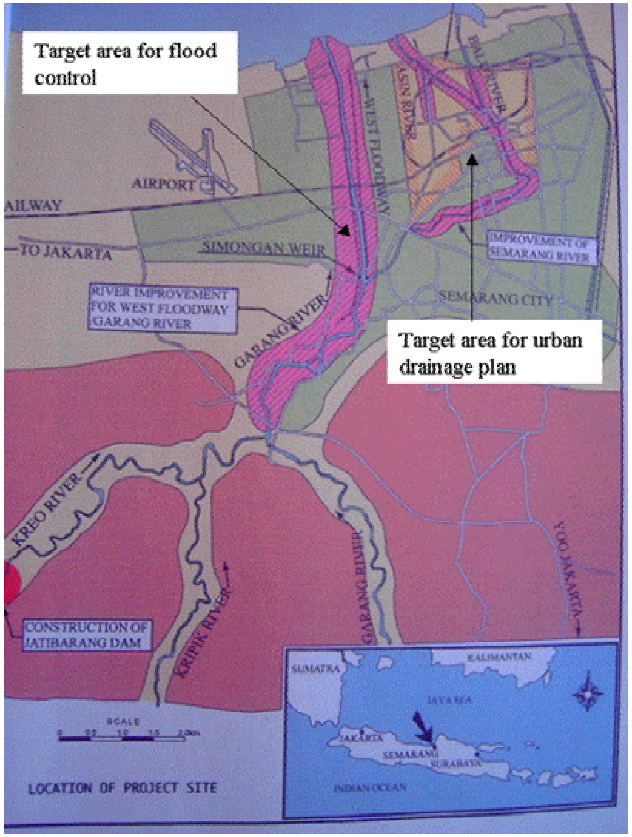
Important issue: dynamics



Development of annualized losses in Semarang 2005-2055
→ exposure and hazard

Evidence II: Integrated flood protection in Semarang, Indonesia

- Integrated solution necessary for effective drainage, flood control and water supply program
- Proposed project controls floods, improves drainage while and increases water supply



Evidence II: Integrated flood protection in Semarang, Indonesia

- Risk based assessment: good data on hazard, exposure and fragility, little on impacts
- Potential direct and indirect economic impacts assessed
- Future increase in exposure and subsidence accounted for

	Monetary		Non-monetary	
	Direct	Indirect	Direct	Indirect
Social				
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Economic				
Private sector				
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Agriculture Industry Commerce …	Assets destroyed or damaged: buildings, machinery, crops etc.	Loss due to reduced production		
Environmental			Loss of natural habitat	Effects on biodiversity

Results: best estimate and sensitivity analysis

	Best estimate	No exposure increase	No subsidence increase	No exposure and subsidence increase
NPV (billion Rupiah)	**369**	296	330	257
C/B ratio	**2.3**	2.0	2.2	1.9
IRR	**23%**	19%	21%	18%

Users of results

- Project practitioners
- Local, regional and central government institutions concerned with project planning and financing
- International donors

Involvement of local farmers in project planning in Peru

Planning agency in local government in Indonesia

Conclusions

- CBA demonstrates benefits of and need for undertaking risk management measures („return“ on risk management)
- Tool for systematic and coherent decisionmaking
- Context of risk to be acknowledged in analysis
- CBA involves some technical knowledge, therefore close collaboration between analysts and users necessary
- „Returns“ on risk management can be large as evidence demonstrates