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Cost-Benefit Analysis *for* R. Mayur, Khulna

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Overview

- R. Mayur’s (potential) to alleviate water stress in a long term sustainable manner
- Consequence of loss in ecosystem services from river: climatic, demographic causes (development)
- Economic analysis : CBA for net worth of natural capital asset
- Socio-economic & Quantitative analysis; decision – making on allocation for funds in resource scarce situations

Why? Where?

- Pre 1982: relatively higher tidal activity and less polluted; later embankment to prevent saline water intrusion
- Current scenario:

  Solid waste dumps, effluent discharge (drains), stagnant flow stretches; restricted tidal flows downstream; increasing salinity

  - Activities: bathing along river banks; agriculture upstream (small canals upstream); limited fishing; boatmen downstream; restricted domestic use during monsoons.
- Minimum provisioning, regulating or cultural services; possibly some supporting services and biodiversity

From here to where…

The future: Freshwater / tidal water ?

Developmental perspective: sustainable source of fresh water

Gainers : Urban and peri-urban residents

Losers: Boatmen, fishermen, *encroachers*

Source: rainwater; hydrological flows from surrounding aquifers

Water : stress and future security

- Climatic effects: increase in sea level, increasing salinity, storm surges and flooding from extreme events.
- Socio-ecological costs: groundwater extraction;
- Socio-economic: costlier alternatives; conflicts
- “Avoided damages” : agricultural productivity, flood regulation, access to freshwater (drinking)
- Can it be a “no-regrets” option?

Theoretical framework

- Ecosystem services : Provisioning, regulating, cultural, supporting
- Gainers and losers from proposed intervention
- Economic valuation: a mix of appropriate methods , a careful selection of what values to monetise
- Perspective of use-and non-use values; market and non market; direct and in-direct

Mapping Economic Values for River Mayur

Direct Use Values	**Indirect and Non Use Values**
Consumptive	*Indirect*
Water for residential purposes e.g. Drinking water	Flood control
Water for industrial and commercial purposes	Biodiversity (e.g. visitation by birds)
Fish production	Reduced erosion of river banks
Non-Consumptive	Climate regulation
Land and property values	Nutrient and Water cycling
Recreation	*Non use*
Tourism	Option values – biodiversity, future use (e.g. watershed services)
Educational, cultural and aesthetic values	Existence value
Health benefits	Bequest value

Cost-Benefit Analysis

- **Approaches for valuation of changes in ecosystem services include:**

  Cost-benefit analysis, risk assessment, multi-criteria analysis, cost effectiveness analysis, precautionary principle and vulnerability analysis

- **Origin in welfare economics; principle of greatest benefit for greatest numbers (utilitarianism)**
- **Problem set-up: net benefits from river clean-up versus no-action**

Cost-Benefit Analysis

- **Making decisions by weighing gains and losses : net gain**
- **benefit - that which increases well being**
- **cost - that which reduces well being**

Social Cost Benefit Rule ~ $\sum [B - C] > 0$

- **Discount costs and benefits since these accrue over a period of time; at different points in time maybe**
- **Various decision criteria used to judge alternatives**

- **Present value (PV) of costs/ benefits –**
- **PV (B) = $\sum [B_t / (1 + r)^t]$**
- **PV (C) = $\sum [C_t / (1 + r)^t]$**

Comparing Benefits and Costs to reach decisions:

Principle that benefits must outweigh costs for a feasible project / policy

3 tests: benefit-cost ratio (B-C); net present value (NPV); internal rate of return (IRR)

- **NPV : If PV of benefits exceeds PV of costs, the option is a feasible one or PV (B) - PV (C) >0**

- **$= (\sum [B_t / (1 + r)^t] - \sum [C_t / (1 + r)^t]) > 0$**
- **Apply the Internal rate of return (IRR): Refers to the rate of interest "r" that yields NPV = 0. Indicator of the Rate of return on investment funds used in the project**
  - **If IRR > market rate of interest – accept the project**
  - **If IRR < market rate of interest – reject the project**
- **Benefit-cost ratio: benefits per dollar of costs incurred**
  - **If B/C > 1 – accept the project**

Data & Method

- Household interviews : upstream and downstream locations – drudgery / time costs, use of river water, *encroachment issues*
- Focus group discussion: farmers, boatmen, fisherman, soil cutters
- Expert consultation: academia, officials of government agencies, land developers
- Secondary data sources:
  - Benefit / Avoided cost estimates : non-market values (estimates and inference); biophysical aspects of the river; extent of settlements along the river; demand for water; demographic details, floods.
  - Costs: Solid waste Management, dredging, waste water treatment, R & R for displaced; demolition of structures

Health:73.13	Secondary Data / Cost of illness :
Water for urban and peri-urban use :4.407 mln*	Replacement Cost / Cost savings
Fish production: 1.84mln	Benefit Transfer
Housing and Land Values: 99mln	Secondary Data / Key informant interviews
Recreation and Tourism: 4.95 mln	Survey / Adjusted Benefit transfer
Flood Control: 731.95 mln	Avoided Damages
Non-market benefits : 237 mln	Secondary data - inference
Reduced Drudgery from water collection: 26 mln**	Cost savings / Survey data
Reduced water stress from climate change & other future benefits	Escalation factor – 5%

Implications

Benefit – Cost ratio positive, NPV (@ 10.11% for 10 years) demonstrates feasibility

Cost-Benefit Estimates

Total benefits (10 years)	12990.54 mln Tk
Net benefits	7456.54 mln Tk
Benefit Cost Ratio	2.13
NPV	61.81 mln Tk

Implications

- Fresh water ecosystem a feasible option

Specifically:

- Drinking water : residents
- Reduced salinity: farmers (closing of sluice gates)
- Amenity: land developers, city corporation, residents and visitors
- Health : humans, livestock , *soil*
- Co-benefits: interventions for SWM and sewerage systems
- Institutional: legal, political economy

Implications or Complications?!

- "social welfare" : what is it determined by?
  - unweighted sum of individual welfare;
  - atleast one benefits; no one loses
  - Gainers compensate losers and are still better off
  - Welfare levels differ across people; therefore distributional weights on consequences
  - Multicriteria

  Known that **equity matters** (aversion to risk, inequality)
  - buildi n R and R even if technically "illegal"
  - build in benefit escalation for environmental projects
  - Relatively do-able in our case; two relatively small communities versus large gains to large numbers
  - Reduced drudgery costs: gender and capabilities in the sustainable development discussion

Implications

There is no eligibility or distribution criteria that can be justified on scientific grounds only. The choice is a political choice, with significant distributional consequences. (Fussel 2009).