Costs

Benefits

Cost and benefit analysis (CBA)

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History of CBA

Year	Topic
1808	Recommendation to compare costs and benefits for water related projects (USA)
1936-	Requirement of benefits exceeding costs for all water resources projects (USA)
1960-	Development of valuation methods. CBA of transport projects (UK)
1970-	CBA of environmental projects (US. UK)
1980-	Requirement of monetary valuation of environmental effects (US. UK)
1990-	CBA for transports and environmental projects in other countries. mainly EU

General approach of CBA

Calculate net benefits in present terms. *NB*. all benefits. B_{it}. and costs. C_{it} for all individuals *i* and time periods *t* of a specific project:

$$NB = \sum_i \sum_t \left(\frac{1}{1+r} \right)^t (B_{it} - C_{it})$$

r: discount rate

Approach in practice: Five main steps

- Define the project (what. where and when)
- Identify all benefits and costs of the project
- Calculate benefits and costs
- Make sensitivity analysis
- Make recommendation: yes or no to the project

Example: Mussel farming for mitigating eutrophication

Step 1:

A mussel farm of 1 ha in Stockholm archipelago in 2018-2023

Step 2:

Benefits; provision of food and feed. cleaning of nitrogen and phosporus

Costs; Investment. labor. eventual health control

3: Calculation of benefits of 1 ha musselfarm

Production of mussels: 75 ton/second year

Removal of nitrogen: 7.5 ton N/second year

Removal of phosphorus: 0.75 ton P second/year

Value in Euro:

Mussel as feed: 0.1/ kg mussel

N removal: 0 – 40 /kg N

P removal: 0 – 450/kg P

Step 3: Calculation of benefit. thousand Euro.

Year	Mussel production	Nitrogen cleaning	Phosphorus cleaning	Total
2018				
2019	7.5	150	168.75	326.25
2020				0
2021	7.5	150	168.75	326.25
2022				0
2023	7.5	150	168.75	326.25

Step 3: calculation of costs. thousand Euro

Year	Investment	Labour	Capital cost. 5%	Others (fuel etc.)	Total
2018	45	30	2.25	30	107.25
2019		30	2.25	30	62.25
2020		30	2.25	30	62.25
2021		30	2.25	30	62.25
2022		30	2.25	30	62.25
2023		30	2.25	30	62.25

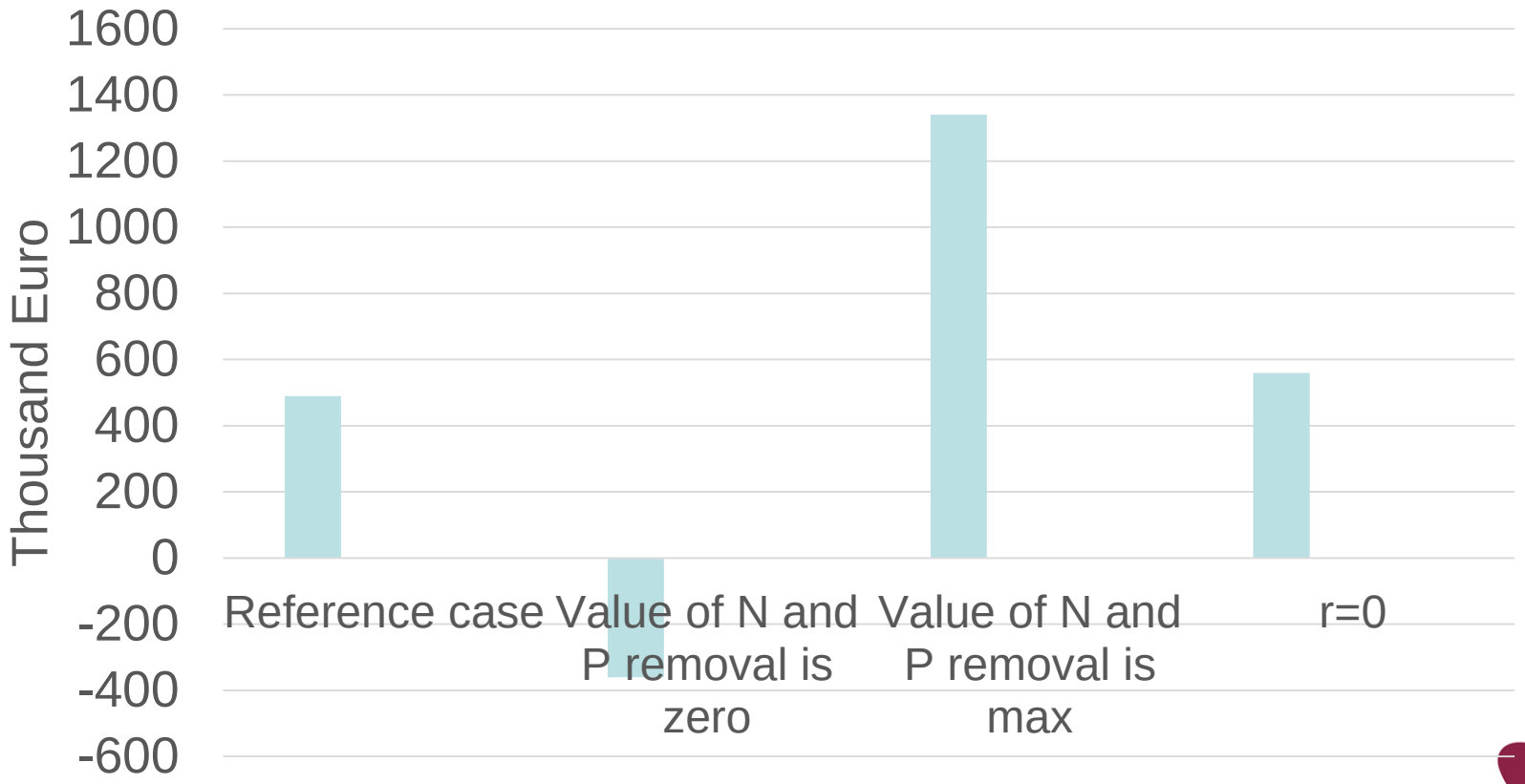
Step 3: Calculation of benefits at average N and P removal values and costs, discount rate *r*=0.03

Year	Benefits	Costs	Discounting	Net benefit
2018	0	107.25	$1/(1+0.03)^1$	-104.13
2019	326.25	62.25	$1/(1+0.03)^2$	248.85
2020	0	62.25	$1/(1+0.03)^3$	-56.97
2021	326.25	62.25	$1/(1+0.03)^4$	234.56
2022	0	62.25	$1/(1+0.03)^5$	-53.70
2023	326.25	62.25	$1/(1+0.03)^6$	221.10
Total				489.71

Step 4: make sensitivity analysis

- Value of N removal: 0, 40 Euro/kg
- Value of P removal: 0, 450 Euro/kg
- Discount rate r=0

Step 4: Make sensitivity analysis



Step 5: Make recommendations

Break-even value of N and P removal: 51% of the reference value

Yes if you beleive the value is higher

No if you beleive the value is lower

Exercise:

Make a recommendation of the mussel project when:

- the production of mussels, N and P removal is reduced by 50% but obtained every year
- all costs are doubled