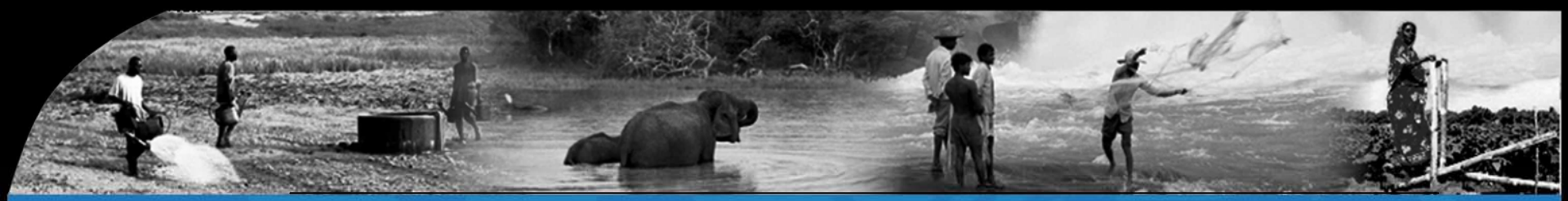

Economic Assessment of water storage for adaptation to climate change in Sub-Saharan Africa

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Hard time in decision making of water storage

- There are always trade-offs, unequal power and influence of actors
- Divergence of values, different prioritizations
- Ambiguous understanding of ecological, cultural values
- Biases and subjectivity in valuation analyses

Is the decision making only an economic dilemma?

- Economics are to counter pros and cons in decision-making

- Cost -Benefit Analysis (CBA) for the optimal solutions in water storage and mainly dams is dominant

- If direct, indirect benefits outweigh costs, project goes ahead

- However, often reductionism with loss of information

- Environmental, cultural, and broader social values are ignored while only market values are considered

- Especially problematic in developing countries where components are more heterogeneous (i.e. irrigation, poverty alleviation, environmental flows, hydro-power)

What is proposed

- A more diffused approach based on diversified qualitative-quantitative criteria through outranking methodology

- The economic efficiency principle is still pursued but with an attempt to overcome CBA related weaknesses

- Propose to use it supplementary with CBA - enclose CBA input in outranking methodology or vice versa

What is needed for outranking

- Ingredients

- a, b…n = Alternatives of a proposed project (e.g. a= big reservoir, b= small reservoir, c=deep wells, d=dugouts, etc.)
- j = A number of j criteria proposed for the ranking of the examined alternatives
- p = strong preference threshold, a**P**b, g(a)-g(b) > p
- q= weak preference threshold, a**Q**b, q < g(a)- g(b) < p
- I= indifference condition, a**I**b, g(a) - g(b) < q
- v= veto threshold, g(a) +v < g(b)
- w= weights for different criteria

- The outranking relation can be interpreted as:

a is at least as good as b and/or a is not worse than b

Criteria to be introduced

Group 1 : Direct and Indirect economic effects (quantitative)	
Net revenues from agricultural produce *E.g. 3200 USD/yr (Cost)- 2600 USD/yr (Revenues)= 600USD/yr Net Revenues*	
Ratio of net revenues from agricultural produce and water charges *E.g. 600USD/yr (Net Revenues) / 50 USD/yr (Water Charges)= 12 USD reven./ 1 USD water charge*	
Ratio of net revenues from agricultural produce and water consumption *E.g. 600USD/yr (Net Revenues) / 60 m3/yr (Water Consumption)= 10 USD reven./ 1 m3water consumption*	
Costs of water related illnesses *I.e. Cost of Working days lost+ Drug expenses+ Recovery Level*	
Costs of water for domestic Use *I.e. Cost of Working hours lost (family member, means of transport)*	
Group 2 : Farmers' preferences in water use (qualitative) (Scale : 1/Very Little – 5/ Very much)	
Level of satisfaction from water volume	Crops - Livestock - Domestic Sector
Level of satisfaction from water quality	
Level of satisfaction from water abstraction methods	

Water Storages Cases selected in Ethiopia

Guder- Idris

Upstream

Downstream

Rainfed

Koga Dam

Survey, 500 hsd in total
Stratified sampling

Gumera

Wells

Pump (diversion)

Soil Canal (small reservoir)

Cement Canal (small reservoir)

Water Storages Cases selected in Ghana

Options	Reservoir	Dugout	Shallow Well	Borehole	River diversion
Sata-Upstream	Very Small	-	-	-	Very High
Vea-Upstream	Moderate	Very Small	Small	Very Small	Very Small
Vea-Downstream	Very High	-	-	Very Small	-
Gollinga-Upstream	Very High	Very Small	-		Very Small
Gollinga-Downstream	Very High	Very Small	-	-	-
Dependence Level %	0-20 (Very Small)	20-40 (Small)	40-60(Moderate)	60-80 (High)	80-100(Very high)

Outranking Results

Ethiopian Options	Scoring	Ghanaian Options	Scoring
Idris Upstream (river diversion)	7.30	Gollinga-Upstream	3.43
Fogerra (furrows linked with cement canal)	7.19		
Fogerra (directly linked with cement canal)	6.63	Sata – Upstream	2.86
Idris Rainfed	6.60		
Idris downstream Irrigated (small reservoir)	6.06	Vea-downstream	2.11
Fogerra (pump-river diversion)	5.87		
Koga (will not get connected)	5.52	Gollinga-downstream	2.01
Fogerra (Wells)	4.65		
Koga (to be connected)	3.34	Vea- Upstream	0.36
Koga (connected)	3.03		

Key Messages from Case Studies

ETHIOPIA

- Not apparently the larger, the better
- Not apparently the more water, the better but efficient use of it
- Not financial factors the only ones to lead the decision
- Preference towards water quantity-abstraction rather influential

GHANA

- Not apparently the diversification in water storage leads to best option
- Not great difference between upstream-downstream users
- Reservoir seems of significant factor but also direct abstraction from river seems strong substitute
- Economic related factors the only ones to lead the decision , very small variance between preference criteria

- People however respond in respect to what they know or anticipate to occur
- Also, some storage options have not reached its full potential

Conclusions and lessons learnt

- Elements from outranking Multi Criteria Decision Aid methods (MCDA) and mainly Electre III
- Often criticism on subjectivity and manipulation
- The approach still conforms with welfare economics and economic efficiency
- More work need to be done in decision making by including criteria-weights- thresholds from climate change scenarios
- However, hope that the approach could act complementary with CBA for better assessment of water storage

Thank you very much for your attention!