Designing a cooperation model for sustainable groundwater governance in coastal Odisha, India

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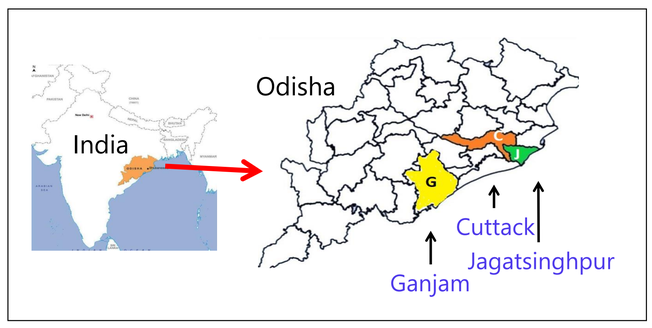
Background and objective

- Failures in theoretically and supposedly efficient and empirically proven market mechanism in **groundwater management** has led to a search for alternative arrangements. **Cooperation in water sharing** system so far showed mixed result, while government intervention through a subsidy scheme inflated successes.
- Government subsidy policies supported installation of a **community managed medium-deep tube well** in Odisha state of India to address the economic scarcity of groundwater procurement. However, its management through a **water user association** (WUA) seemed not to solve the long-standing distribution issue.
- In Odisha, around 30 % WUA are dysfunctional due to its **improper management of the groundwater resource system** and well maintenance. Moreover, reduced pumping cost for a WUA exaggerates water extraction that declines the water table and threatens its sustainability.
- **Res. Obj. :** To develop a cooperation model by linking farm level decisions at a community scale

Material and methods

Figure 1. Study area



Research design

From 17 villages 53 representative farms composed of 783 farm plots availing irrigation from four major

- **groundwater sharing system**: WUA, cluster tube well (CTW), private water seller (PW), and individually owned wells

Information on the land use and land cover change (LULCC), irrigation provision and its usage for different

- plot specific activities, irrigation sharing system, and decisions on crop product sale during 2018-19 crop season.

Analytical method

- A **principal-agent model** is used to save water through an **incentive scheme** (Amjath Babu, 2008).

Results

- Empirical evidence indicates that the community has **higher bargaining power** in benefit sharing after distributing the **fixed (r)** and **variable (alpha)** part of the **incentive** earned by individual member.
- Simulations through water price increase by 1.5 to 3 times (base price: INR 150 /ha-cm) do not significantly increase water saving, implying a **dominant type of cropping pattern** in the farming system.



- Model simulations by the dominant farm types revealed that *highly diversified irrigated agriculture for direct market supply* (HDIAM) farms are sensitive to water price increase though they are flexible to adopt a maximum water saving cap.
- Introduction of a moderate fixed initial payment (INR 2300 per ha) increased area allocation to water saving activities, that further increased the gross margins.
- *Least diversified irrigated agriculture for contracted sale* (LDIAC) farms showed indifferent water use behaviour with any increase in water price, because of their significant acreage under perennial **water-intensive crop enterprise** (sugarcane).
- Any acceleration of water-saving incentives showed that there should be a lower redistribution of water in the second-round, due to the higher marginal value that accounts for scarcity value of water.

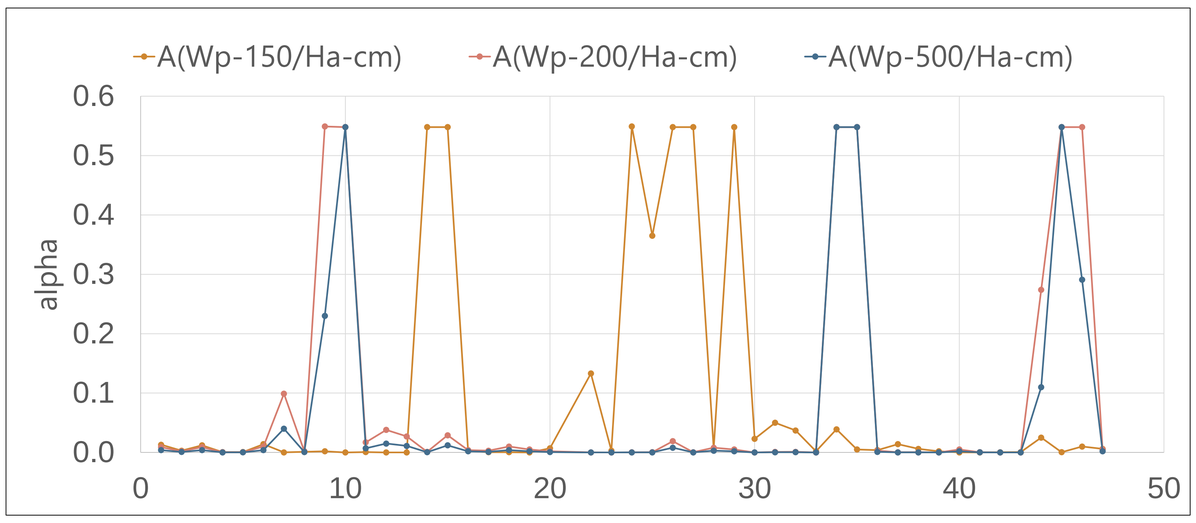


Figure 2. Values of the principal's instrument alpha at the water price of INR 150, 200 and 500 per Ha-cm



Conclusion

- The motive of water saving by introduction of an initial fixed payment attracted farmers to join the incentive scheme.
- HDIAM farms diversified to higher acreage under water saving activities.
- Model may show further improvement by introduction of inter WUA water sharing.

Reference

Amjath Babu, T. S. (2008). Economic and environmental impacts of political non-cooperative strategies in water management : an analysis of prospective policies in the Cauvery river basin of India. Justus Liebig University, Giessen.

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