INNOVATIONS IN THE USE AND MANAGEMENT OF GROUNDWATER IN HARD ROCK REGIONS IN INDIA

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The Background:

More than ninety per cent of the total hard rock areas in India is estimated to be concentrated in the Deccan Plateau covering roughly the states of Maharashtra, Karnataka, Andhra Pradesh and Tamil Nadu. A few other states like Gujarat, Madhya Pradesh and Bihar also contain large chunks of rocky formations. Poor porosity (of less than 3 per cent) and negligible permeability of the rocks in these regions restrict the availability of groundwater. The underlying rock being folded, fractured, jointed and channeled, the thickness of weathered mantle varies considerably - ranging between 3 and 20 meters, and makes the measuring of the stock of groundwater a formidable task. Poor porosity limits the rate of recharge in these areas (Sivanappan). The situation is rendered worse with the rainfall in hard rock regions being low and uncertain. In essence, the physical and geo-hydrological characteristics of the acquifers matter a great deal in determining the recharge, renewability and stock of groundwater.

Several micro-studies undertaken in various locations of these hard rock regions have documented the evidence of depletion in water table. Whether this depletion in water table is secular in its nature or is only cyclical or seasonal is still a debatable point. In contrast to some micro-studies which report a

conspicuous decline in water table over the past few years (Chandrakant, Prahladachar), some others report a perceptible recovery (Swaminathan and Kandaswamy) suggesting groundwater resource is renewable in hard rock regions. Field situations vary a great deal across hard rock regions, but all of them do indicate that groundwater resource is getting increasingly scarce. Researches have identified two major factors for this to have happened: (i) over-drafting and (ii) over-crowding.

Historically, prior to the introduction of modern groundwater technology (based on power pumps - electric or diesel) extraction of groundwater for irrigation was undertaken to a very large extent by small farmers[1] through traditional water lifts (human and/or animal operated). Drudgery and not-too-attractive economic gains associated with irrigated farming by traditional water lifts were possibly the primary reasons why large farmers did not choose then to extract groundwater for irrigation in a big way. This former scenario has come to be drastically altered with the introduction of modern groundwater technology, with large farmers dominating the lift irrigation scene. The major factors for skewness in the ownership pattern of modern water extraction mechanisms (WEMs) in favour of large farmers are identified in literature to be their advantageous resource position, capacity for lumpy investment, political-cum-bureaucratic influence and access to

institutional credit markets. Conspicuous private economic gains associated with irrigated farming by modern groundwater technology (especially since the green revolution phase) has been the driving force behind the alacrity with which large farmers are going in for groundwater extraction. The sum result has been the over-drafting[2] and over-crowding of wells. This unplanned and unregulated development of modern WEMs has caused externalities - both of short-term and long-term nature - disfavouring the small farmers in owning and/or operating successfully modern WEMS.[3] In extreme situations because of the overwhelming burden of these externalities small farmers have abandoned their wells.

The Problem:

Concerns underlying the unregulated and over-exploited groundwater resource use in hard rock regions have prompted state governments of these regions to intervene in the area of groundwater use and management through some indirect regulatory mechanisms. Spacing and licensing norms and linking the enforcement of these through certain provisions and restrictions in availing institutional finance and the issuance of electricity connections are important measures in this regard. Though one could grant well-meaning intentions behind these measures, however, these have left the questions of over-drafting and over-crowding abegging due to inherent inadequacies and loopholes in designing and

required, unlike quick field survey techniques adopted generally by economists for the purpose. Also this entails questions to be answered in the realm of political economy.

Notwithstanding this general shortcoming on the empirical-research-front relating to groundwater, there are many in-depth field investigations which have convincingly brought to the fore the common finding that in respect of individual-access-elements referred above small farmers are disfavourably placed generally as compared to large farmers. Moreover, certain limiting factors from which small farmers suffer inhibit their access to modern groundwater technology and in turn their access to groundwater. These limiting factors are small and fragmented landholdings, poor resource position, limited capacity to bear risk and uncertainty and so on (Prahladachar,1987). Therefore innovations designed towards improving the access of small farmers to lift irrigation will have to resolve these various inhibiting factors. Several institutional arrangements have been experimented aimed at improving the access of small farmers to lift irrigation. In what follows, we briefly examine some of these experiments in hard rock regions in India. While doing so, our intention is not so much to present a description of these experiments as to comment on the circumstances and factors contributing to their pluses and minuses.

Institutional Arrangements:

(1) Public Tube Wells:

As stated earlier, empirical evidence emanating from many parts of India including hard rock regions indicates that, for a variety of reasons, large farmers have appropriated the gains of lift irrigation disproportionately more than the small farmers. This has given rise to the apprehension that the extraction of groundwater through the spread of private wells with modern WEMs would worsen the problems of inter-personal equity with regard to the use of groundwater resource. Therefore, public tubewells are frequently advanced as an institutional alternative to lessen, if not eliminate the inter-personal inequity in groundwater use.

It is also argued by several scholars (Dhawan, Sakthivadivel) that public tube wells have a definite role to play where landholdings are essentially small and fragmented because small farmers would find it extremely difficult on many counts (both economic and non-economic in nature) to compete with large farmers in owning and managing modern WEMs. The landholding pattern in hard rock regions by and large conforms to this description apparently supporting the case for public tubewells.

The line of argument cited above in favour of public tube wells as an institutional alternative however loses much of its relevance in the context of hard rock regions, in view of their incompatability on technical grounds. For hard rock regions, open dug wells are technically found to be ideally suited. Average command area of dugwells being rather low (less than 2 hectares), it would mean, in operational terms, government coping with innumerable number of open dug wells. This renders the argument in favour of public wells in hard rock regions an unattractive, if not an infeasible and impracticable proposition.

Nevertheless there are some efforts in selected pockets of hard rock regions in installing public tubewells as an institutional alternative. As a case in point, we borrow the findings from the study done by Satya Sai and Dhawan in respect of public tube wells in Andhra Pradesh, the specific study area being Khammam district of Telangana region.

The survey data pertaining to 80 farmers benefitting from public tube wells (located in the command of 12 selected tube wells) of which the majority were small farmers and belonged to scheduled caste and scheduled tribe,during the year 1983-84 were used for the analysis. It was found that small farmers did benefit through improvement in crop pattern, crop yields and cropping intensity. The private benefit-cost ratio

from the view point of farmers was quite high and this explained the step up in demand for more public tube wells in the region. But the social benefit-cost ratio estimated for the public tube wells suggested that the project could barely breakeven.

Besides the overall experience with public tube wells in various regions of the country is uniformly and resoundingly disappointing from the point of view of both efficiency and equity.[4]

In the light of these findings, one gets sceptical about the policy option in favour of public tube wells, more so in hard rock regions where these are found to be incompatible on technical grounds.

(2) Community Wells:

The disillusionment experienced with the working and performance of public tube wells with regard to both efficiency and equity concerns has led to the search of alternative institutional arrangements for groundwater management. Based on the theoretical premise that involving of beneficiaries in the management of groundwater would help solve the problems from which public tube wells are otherwise bogged with, certain forms of institutional arrangements like community wells and cooperatives have been advocated and tried out in several parts of India including hard rock regions.

Empirical investigations undertaken by researchers into the functioning and management of these forms of institutional arrangements have documented experiences of both successes and failures in this regard. Crucial factors for "success stories" have been small size of the groups and a high degree of homogeneity in the group membership in terms of both caste and landholding, quality of leadership, external support in both leadership and management (Nagabrahmam, Sathe,Patil and Kulkarni).

Factors that caused failures of community wells ranged from wrong siting of wells, insufficient water yield in wells to more importantly inadequate technical and managerial support from the promoting agency (Nagabrahmam, Sathe).

(3) Community Wells based on the Principle of Pani Panchayat in Maharasthra:

The credit of evolving "Pani Panchayat" as a concept and as an experiment goes to the charitable trust: "Gram Gaurav Pratisthan" (GGP) founded at Naigaon village, Purandar taluka of Maharasthra. The village is located in drought-prone area. According to the concept of "Pani Panchayat", (i) when scarce, water should be shared on the basis of the number of members in the family and not in proportion to landholdings; (ii) crops such as sugarcane requiring more frequent watering and

consequently greater quantity of water should be banned; (iii) the landless should also have a share in water so that they gain command over greater farm employment in the village by trading their water share in land lease markets.

GGP does not, on its own, form the groups. Prospective beneficiaries have to first form the groups in order to qualify for the help from the GGP for their proposed scheme. It is mandatory that 20 per cent of the total cost of the scheme is borne by all the members without exception, constituting the group. This restriction is deliberately incorporated into the scheme to ensure a sense of involvement and commitment from the individual members of the group.

Several researchers have studied various facets: technical, organisational, social, political. and so on, of selected schemes under the Pani Panchayat. Despite various weaknesses and shortcomings observed in the design and implementation of these schemes, and compromises made to various degrees with regard to the principles set out in the Pani Panchayat concept, there is no denying of the fact that this concept has made a singular contribution in creating a social awareness and commitment in regard to the equitable sharing of water, especially in a drought-prone region, through community participation.

(4) Groundwater Markets:

In the realm of institutional arrangements for groundwater use and management, groundwater markets that have come to stay and prosper in parts of Gujarat deserve a special attention. In the context of agrarian structures characterised by substantial skewness in private ownership, water sales provide non-well owning small farmers access to groundwater.

Immense possibilities that well developed groundwater markets hold forth towards achieving the twin objectives of efficiency and equity in groundwater use in different situations have been cogently argued, supplemented with empirical evidence by Shah. Also the role of water markets in promoting conjunctive water use in tank canal commands has been brought out in some studies (Palanisami, Sakthivadivel).

Shah has reviewed the water market research in India. He noted that most of the Indian work on water markets has been heavily concentrated in Gujarat. Also, in many water scarce areas, especially in southern peninsula, water markets are either non-existent or in primitive forms.

It is curious to observe how farmers situated in comparable locations within water-scarce hard rock regions respond differently so far as water sales are

concerned. For instance, in some hard rock areas of Karnataka, well owners with modern WEMs due to a variety of inhibitions and taboos did not choose to sell water even if they could (Prahladachar, 1987). In contrast to this, in some hard rock areas of Tamil Nadu (Madurai district) water markets were fairly well established, the facilitating factors being the attractive economic ~~groups~~ gains derived from modern crop production technologies (Copestake). These contrasting responses within hard rock regions underline the need for studying salient conditions that would stimulate water markets where they do not exist.

Summary and Conclusion:

Equity and efficiency concerns regarding the use and management of a common property resource like groundwater form the basis for alternative institutional arrangements that have been evolved and experimented, among others, in hard rock regions in India. Except for the fact of water scarcity running as a common strand binding these regions, field situations among them vary a great deal in respect of political economy; in turn account also for the varying levels of success or failure of a given institutional arrangement governing the use and management of water and suggest the need for evolving location-specific solutions rather than advocating any rigid solutions based on one's ideological preferences.

NOTES

1. In the Indian context, farmers owning less than 2 hectares are considered for all practical purposes as small farmers.

2. Overdrafting in the specific context of groundwater resource means that withdrawals tend toexceed the annualreplenishments via groundwater recharge,the excess being accounted for by a permanent reduction in the volume of groundwater stock underneath (See Dhawan, 1987).

3. For a succinct discussion on these externalities and their impact on small farmers, dependent on traditional water lifts, see, Dhawan.

4. For a very lucid account of the Indian experience with public tube wells, See, Ballabh and Shah (1989).

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