
Abstract of Ph.D Thesis in Agricultural Economics

Feasibility, Sustainability, Equity and Institutional Aspects of Groundwater Irrigation in Over-Exploited Areas of North Gujarat, Thesis submitted by F.A. Shaheen and accepted by Department of Agricultural Economics, College of Agriculture, Junagadh Agricultural University, Junagadh in 2004.

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The study aims to examine the feasibility, sustainability, equity and economics of groundwater irrigation in highly over-exploited areas of North Gujarat. Two highly over-exploited districts, viz., Mehsana and Banaskantha were selected. In all, 160 borewell farmers, 80 from each district were interviewed by survey method during the agricultural year 2002-03. The secondary data were collected from the GWRDC and Directorate of Agriculture, Gandhinagar. Concordance coefficient test was used to examine the change in cropping pattern over the period. The annual cost of irrigation was worked out by summation of amortised cost of irrigation well, conveyance, pumpset and electrical installation, annual cost of repair and maintenance, and electricity charges. Cobb Douglas production function was used to estimate the water use efficiency and economic optimum level. Economic feasibility of investment on borewell/groundwater irrigation was evaluated by employing the project appraisal criteria such as benefit-cost ratio, net present worth, internal rate of return and pay back period. Besides Lorenz curve, various inequality measures were estimated to examine the inequity to resource. To sustain the resource in the region, optimal control theory model was applied which gave the optimal groundwater extraction path over time.

The major findings of the study revealed that there was no significant shift in the cropping pattern within decades, but over the entire period of 42 years, a meagre shift in cropping pattern from water intensive crops to relatively less water consumptive crops has taken place in both the districts. The classification of talukas on the basis of growth and instability in depth to groundwater level revealed worst situations for most of the talukas. The average life of borewells was found to be 7 years in both the districts. Borewells in Mehsana district were having comparatively higher yield as well as more depth to that of Banaskantha district. Physical access to resource was more skewed to higher shareholder farmers and sole well owners, because of their higher investment but the access realised to resource per unit of investment (economic access) was found to be more skewed towards the farmers with lower shares in borewell investment in Mehsana district. In case of Banaskantha district, the physical as well as economic access was skewed towards large size farmers.

Lorenz curve as well as other inequality measures revealed that the income realised from groundwater irrigation was more evenly distributed among the farmers of Mehsana as compared to Banaskantha district. The feasibility measures revealed that the returns to investment are highly feasible at both (old and new) flat tariff rates when only paid out costs are considered, but becomes infeasible for Banaskantha at C_1 and C_2 cost levels. The sensitivity analysis revealed that the specific yield of an aquifer has a greater bearing on borewell yield and well life. The benefits to optimal groundwater management were higher than the myopic/no control regime. The sensitivity analysis indicated that the age of borewell increases at higher tariff rates because of lower withdrawals at higher pumping costs in the initial years. Higher tariff rates were found to take care of inter-generational equity of the resource. Likewise, the sensitivity analysis of OCT at different discount rates depicted that lower interest rates encourages resource conservation and keeps more regard for the future generations, whereas, higher interest rates encourages the exploitation of resource. Furthermore, the benefits from groundwater management were found to decline with the increase in interest rate. Regulatory measures for the worst affected talukas, high priority to the development of water harvesting structures, introduction of pro-rata tariff regime, and withdrawal of power subsidy in a phased manner, formation of groundwater committee or users' association are the major suggestions that emerged from the study.

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