How participatory irrigation management reform influences agriculture performance

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The effect of participatory irrigation management on agricultural performance reveals an increase in irrigation intensity, cropping intensity and yield with spatial and temporal variations. However, it is debated that the shift from government-managed to farmers-managed irrigation system may be one of the contributing, but not the only factor responsible for better agriculture performance. Non-rice producing irrigation systems can be more productive than the rice producing irrigation systems. The effect is found to be varied between sources of irrigation as well as across the command areas of different irrigation systems in the world.

Irrigated agriculture is the dominant user of water consuming up to 86% of a developing country's total water consumption. Population and income growth will boost demand for irrigation water to meet food production requirements and household and industrial water demand. Irrigation systems, designed top-down for hydraulic efficiency and convenience of the canal system management lack flexibility and are becoming increasingly inefficient. Irrigation water productivity is low; a large gap exists in the utilization of created potential; there is lack of equity, adequacy and reliability of water supply. Farmers' participation through formation of local-level water-user institutions, viz. water-user association (WUA) for the management of irrigation water is being recommended for efficient and economic use of water in agriculture. Looking into the issues of concern for effective water management in different regions of the world, irrigation management at grass-root level is being strengthened through implementation of participatory irrigation management (PIM) in many countries.

Global experience

Case studies on PIM and irrigation management transfer (IMT) around the world show that farmers' involvement in water management has led to a better and smoother performance of the systems. In an evaluation of 29 irrigation schemes around the world, the most often reported positive impacts of transfer programmes are reduction in the cost of irrigation to farmers and government, enhanced financial self-reliance of irrigation schemes, expansion of service areas, reduction in the amount of water delivered per hectare, and increases in cropping intensity and yields[1]. Evaluations of IMT programmes in Asia, Africa and Latin American countries reveal similar positive results[2].

Rice is the major crop in many countries; thus, impact of PIM and IMT is assessed on perspective of rice productivity. The study by NIACONSULT[3] (National Irrigation Administration Consultancy (a subsidiary corporation of the National Irrigation Administration, Philippines)) reported that participatory systems had higher dry season rice yields (93 versus 83 cavans per ha)[3]. Taking farmers' costs and labour contributions into account, farmers' net income per month increased from 764 to 1149 pesos after farmer participation was introduced in three irrigation systems in the Philippines, with clearest gains for tail-end farmers, due to improvements in the equity of water deliveries. Study of management transfer of a Dawhenya Smallholder Rice Irrigation Project in Ghana reported sustained high rice yields[4]. Rice productivity increased by more than 30% and the overall profits from agriculture has been doubled due to IMT in Nepal. Significant increases in rice production along with profits from agriculture may also be due to increased use of inputs, improved varieties and better management practices besides changes in irrigation managers from government to farmers' associations[5]. Results from the field study carried out in *du* Niger Irrigation Scheme (rice is the major crop) in Mali[6] revealed that collective action has improved irrigation efficiency by 14%. Increased total rice output was due to expansion of irrigated area after the operation, maintenance and management responsibility of the irrigation system taken up by the farmers. Increased yields and incomes arising from better water delivery services and maintenance are, ultimately, the most compelling reasons for farmers to take up additional responsibilities in system management.

IMT in Pakistan has resulted in 6–7% increase in irrigated area, even under severe drought-like conditions[7]. In Turkey, increase in irrigated areas has been reported in the post-transfer period[8]; another study revealed that the irrigation ratio increased by 4% (from 58% to 62%) after IMT[9].

Farmer organizations in Sri Lanka are exempted from paying water charges to the government as they operate and maintain the systems themselves which has led to improvement in irrigation and other input supplies[10].

International Water Management Institute (IWMI) examined the impact of PIM and IMT on crop yields as well as in crop intensities, the economic productivity of land and water under irrigation systems in 11 countries. The indicator called standardized gross value of production (SGVP) was developed for conducting cross-system comparison[11]. To obtain SGVP, equivalent yield was calculated based on local prices of the crops grown and, compared to the local price of the predominant, locally grown, internationally traded base crop. The second step was to value this equivalent production at world prices. The four basic comparative performance indicators considered are output per cropped area, output per unit command, output per unit irrigation supply and output per unit water consumed. These indicators were applied to 18 irrigation systems located in 11 countries. Measurements of SGVP per unit cropped land indicate that non-rice producing irrigation systems can be more productive than the rice producing irrigation systems by 100–200%. SGVP per unit irrigation supply indicates the lowest value for purely rice-based systems. Irrigation systems which grow rice during rainy

seasons and other crops during the dry season obtain middle-range values. The highest value is obtained by systems which grow orchards, industrial crops and vegetables.

Experience in India

India is the world leader in irrigation development with an increase in irrigation potential from 22.6 M ha in 1950–1951 to about 123 M ha at present, but suffers from low irrigation efficiency (30–35%). As a result of the debate over inefficiency in irrigation system, the PIM and IMT have been advocated as a solution by the National Water Policy of India (1987, 2002). Accordingly, many states in India such as Andhra Pradesh, Tamil Nadu, Maharastra and Odisha have been implementing the PIM programmes and transferring the irrigation management to WUA for which suitable legislation has already been introduced. The concepts finally led to transfer of tertiary irrigation networks to WUA with the responsibility of operation and maintenance of the tertiary systems.

In Andhra Pradesh, the first Indian state to witness farmers' participation in irrigation management, the PIM has resulted in a significant expansion of irrigated area, reduced flooding losses, an early cropping calendar and higher yields of rice crop[12]. Analyses from a sample of 222 WUAs covering 22 districts in Andhra Pradesh indicate that there are differences in the number of irrigations required and actual number of waterings in rice[13]. Productivity of rice has been increased; however, the rate of change is higher in the head and middle reaches than the tail reaches.

By implementing modernization programme in minor irrigation tanks in Tamil Nadu, improvement in conveyance, distribution, application and irrigation efficiencies and increase in rice yield, water productivity and gross income were reported[14]. Conjunctive use of groundwater and tank water is also one of the important factors that influence rice yield in tank command areas. In rainfed tanks, dependency of higher rice production on well water is high. From a detailed survey covering 566 tanks[15], it was found that higher proportion of farms in the tail reaches are found to have more supplemental irrigation from wells than the head reach and rice yield was progressively higher with supplemental irrigation, rather than tank water alone. Thus, the conjunctive use of tank water and groundwater should be considered for improving irrigation efficiency.

WUA has been successful in devising and enforcing the rules for water distribution, fee collection and conflict resolution in Mula irrigation system of Maharashtra[16]. The results of impact assessment in one of the canal systems (Mula minor 7) revealed increase in cultivated area, shift to higher value crops and increased yields[17].

Differential functioning and effectiveness of WUAs are observed under different types of irrigation system in Odisha[18]. Farmers perceived adequacy of irrigation water and overall performance of minor irrigation system relatively better. The impact is found positive with respect to cultivated area, cropping intensity, irrigated area, irrigation intensity, crop diversification and crop productivity in three minor irrigation systems in Odisha rehabilitated with aid from the European Commission and turned over to WUAs during 2005[19]. Rice is the predominant crop in the command areas of all three selected systems; however, there is a major shift in the cropping pattern from paddy to non-paddy crops due to assured water availability. During dry season, pulses, oilseeds and vegetables are grown by the farmers with a reduction in fallow area by 50%. On an average, yield increased by 45% in rice, 57% in pulses, 80% in oilseeds, 40% in sugarcane and 43% in vegetables. Thus, it may be concluded that post-IMT witnessed remarkable increase in yield in almost all the crops due to better irrigation performance.

Conclusion

Water forms the backbone for all the future endeavours to achieve the vision of food security. The projected food requirement in 2050 demands a pronounced role for capacity building through technological upgradation, knowledge dissemination and training in the water and agriculture sectors. The governments of several countries have initiated a major shift in its approach promoting WUA as the most appropriate institute for efficient irrigation management and agricultural development. This reform process has already made a positive impact on irrigation and agricultural performance and further strengthening of institutional linkage mechanisms will pave the way for a creating virtuous circle in irrigation and farming sectors.

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