DFID Natural Resources Systems Programme

# Theme 2

# Practical ways forward for participatory land and water management in canal-irrigated areas



## Background

Two interdisciplinary research projects funded by the UK Department for International Development (DFID) through the High Potential Production Systems Research Portfolio of the Natural Resources Systems Programme (NRSP) are working with the same communities in Bihar and eastern Uttar Pradesh in India.

Project R7830, is managed by the Patna-based institute of the Indian Council of Agricultural Research (ICAR), namely the ICAR Research Complex for the Eastern Region (IRCER) and involves Rothamsted Research (UK) and the International Water Management Institute (IWMI). R7839 is managed by Rothamsted Research and involves several project partners: IRCER, Cirrus Management Services Pvt. Ltd. (Cirrus) based in Bangalore (India), GY Associates Ltd. (UK), CABI Biosciences (UK), the Overseas Development Group, University of East Anglia (UK), and IWMI, Colombo (Sri Lanka). These projects were implemented in the command of RPC-V of the Patna Main Canal under the Sone Canal System in Bihar and the Chapia Distributary of the Gandak Canal System at Maharajganj in eastern Uttar Pradesh.

The projects' experience is presented under three themes:

**Theme 1** Sustainable and scalable institutional arrangements at the community level that facilitate livelihood improvement

**Theme 2** Practical ways forward for participatory land and water management in canal-irrigated areas

**Theme 3** New approaches to participatory technology development.

This report relates to Theme 2 and mainly covers experience at RPC-V.

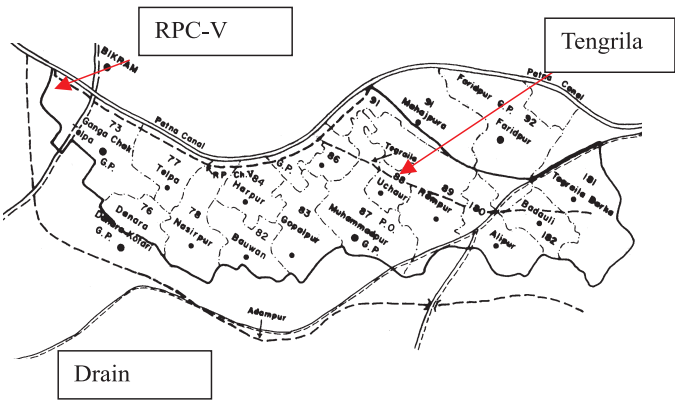
## Introduction

The average cost of canal water in India is even less than 5% of the value of the crop it is used to produce. During 1989/90, the average revenue collected from canal water users was Rs.50/ha whereas the average cost of canal maintenance was Rs.270/ha. Low irrigation rates and increased establishment charges result in neglect of canal maintenance leading to infrastructural deterioration, unreliability, excessive water losses, social conflicts and low agricultural production. A `slow and steady' approach towards participatory irrigation management (PIM) in India has been recommended as a way to improve water management, with a caution that it is not the panacea for all the difficulties. Water conflicts are common in most of the systems, leading to

vandalism and disruption of the physical facilities and degradation of the system. Irrigation problems occur below the outlet with typical 'top-end'–'bottom-end' distribution problems leading to inefficiency and inequity in water use.

DFID project R7830 aimed to facilitate better use of land and water resources through community participation in order to improve land and water productivity and the livelihoods of the poor in a high-potential, low-productivity area of eastern India. In this area average yields of the traditional rice-wheat system are 1.30 t/ha rice and 1.99 t/ha wheat against experimental yields achieved in the same region of 7.21 t/ha rice and 3.96 t/ha wheat. **The basic premise of Theme 2 was to facilitate the formation of land and water management strategies and institutions that are socially acceptable and broadly replicable in this region. Participatory technology development and its dissemination was the main driving force in this endeavour to improve productivity and livelihoods. This project is being implemented in RP Channel-V (RPC-V) a distributary of the Patna Main Canal under the Sone Canal System in Bihar.**

Project members earlier focused on RPC-V and worked with an existing water user association (WUA), consisting mainly of large-scale farmers with large farm holdings.




A key difference in this project has been the identification and elaboration of possibilities of bringing improvement through dialogue with poor and marginal stakeholders empowered in relation to the larger-scale farmers who traditionally dominate the on-farm water management approach (OFWM) through self-help groups (SHGs). Dialogues were initiated between experts, local communities, and other key stakeholders such as the Irrigation Department.

## Participatory process: Approach, experiences and lessons learned

Initially the project partners of each theme followed their own routes toward their respective goals. The earlier work of Theme 2 researchers was based on scientific diagnosis and interacting with WUAs and individual farmers, while Theme 1 staff focused on the formation of SHGs that incorporated poor and marginal farmers.

Over the course of the project – but mainly towards its end, i.e., after some 2 years' work – possibilities to improve productivity and livelihoods in the designated command area that is characterised by wide gaps between water availability in the canal and the requirements for water in the areas commanded were identified through interaction between experts, the SHGs, the WUA and other stakeholders.

Basic information was generated from published sources, socio-economic surveys, cadastral mapping and GIS, and dialogue with the community. This helped in identifying the following constraints and problems that are specific to water management.

### Technical

- Lack of awareness about recent water management technologies and advanced agricultural practices

### Social

- Dominance of rich over poor
- Small and fragmented landholdings
- Superstitions
- Low interaction level

### Managerial and hydraulic

- Release of water from canals at inappropriate times
- Lack of communication between canal managers and farmers
- Lack of timely operation and maintenance (O&M) of canals
- Unauthorised, ungated outlets that are not proportional to the command
- Obstructions in canal flow causing breaches in canal banks

### Institutional and financial

- No timely availability, release and utilisation of funds for O&M
- Lack of efficient and trained manpower
- Lack of linkage among stakeholders and financial institutions

### Administrative

- Insecurity
- No crop insurance
- No reward or punishment for canal management
- Poor communication, transport and infrastructural facilities.

To provide solutions based on people's capacity, need and priorities, the challenge was to develop a sustainable participatory process that not only helps in establishing dialogue within the community leading to enhanced land and water productivity, but also to provide opportunities for better interface within the communities for sustainable livelihood improvement.

The preliminary appraisal helped to establish dialogue with the members of WUAs, individual farmers, and members of SHGs, who were made aware of the status and constraints of the area as diagnosed from earlier studies. Frequent interactions with the Distributary Level Committees (DLCs) and Village Level Committees (VLCs) that form the two tiers of the local WUAs resulted in some serious thoughts about canal management options:

- The WUAs took a major step in forming outlet management groups (OMGs) at each outlet because it was realised that the existing two-tier system in WUAs did not provide fair representation to members and may be one of the causes for the WUA's lack of credibility among members
- OMG formation resulted in members having more say in canal water distribution through wider participation in canal management. This act of the WUA supports the Government of India policy guidelines of **Command Area Development (CAD) on Participatory Irrigation Management (PIM).**

### Process and target groups

Three target groups that needed to be involved in the project were identified:

1. SHGs, WUAs, OMGs
2. Individual members of the community
3. Canal managers and developmental agencies.

A conflict emerged within the management group of the project team about working with the three identified target groups. This was resolved through joint meetings of project partners, who decided to only involve SHGs, since they represent a wider constituency of stakeholders in management of land and water and are focused on the poorest of the poor in the community.

### Participatory actions

The following methods were used to broadcast identified ideas about groundwater use, greater participation in canal management, land and crop planning for the efficient use of rainfall, and alternate uses of water and land in pockets facing seasonal water congestion (waterlogging):

1. Discussion of ideas amongst Theme 2 scientists, Cirrus and SHG volunteers were transmitted to SHG members through SHG volunteers. The responses received by SHG volunteers were forwarded to Theme 2 scientists through Cirrus
2. Theme 2 scientists together with Cirrus broadcast ideas directly to SHG volunteers for transmission to SHG members. Responses from SHG members received by volunteers were relayed to Theme 2 scientists during SHG meetings
3. Theme 2 scientists, Cirrus staff, and SHG volunteers broadcast ideas at SHG meetings where they directly received responses.

It was realised that although the first step was not so fruitful in terms of SHG members' responses it provided much-needed awareness amongst SHG members about ideas for improved land and water management. This resulted in more responses from SHGs during the third step of executing the process.

### Lessons learned

1. SHGs cannot tackle water and land management related issues on their own; there is a need to involve such local bodies as WUAs, OMGs, and individual farmers in the process.
2. Direct but informal contact with the members of the community was the right initial approach to understanding peoples' needs, priorities and capabilities.
3. Lack of dialogue within the community is one of the major causes of the lack of better interfaces.
4. Landless, sharecroppers or small-scale and marginal farmers do not consider development or incurring heavy expenditure on creating infrastructure for improved water management practices as their prime priority.

5. Land consolidation is widely perceived as a major drawback to the adoption of water management practices, but it should be noted that land fragmentation has not been an obstacle to water market development in other areas such as North Bihar, West Bengal or Bangladesh.
6. Improvements in the poor financial capacity of SHG members require strong linkages with financial institutions.

## Turning point

The lessons learned led Theme 2 to revisit the participatory process and redefine their strategies, which included:

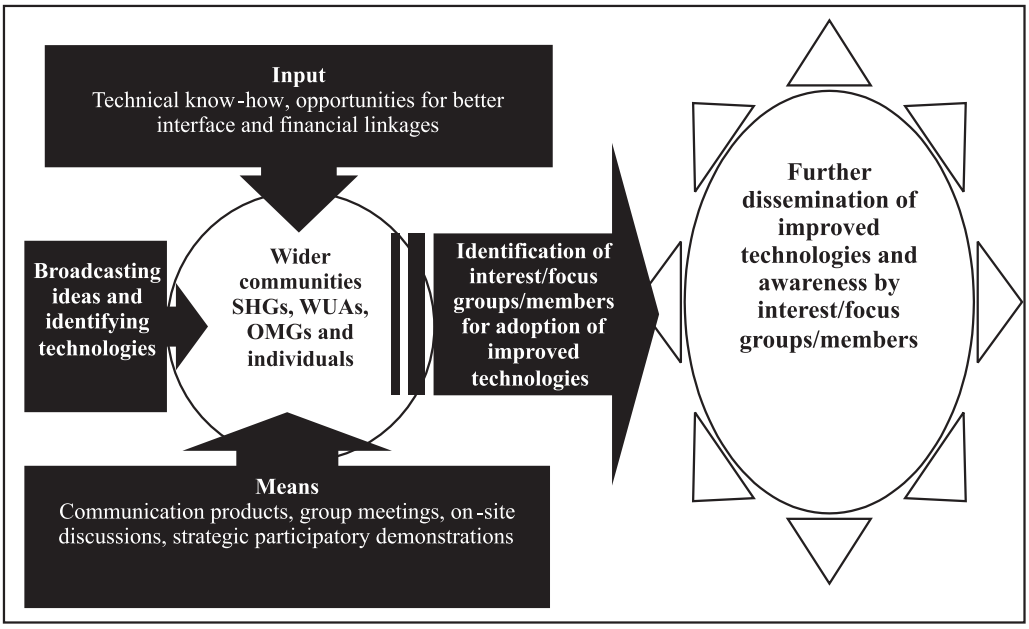
- Involving wider groups of communities as target groups (WUAs, SHGs, OMGs and the local community) to identify the members/interest groups/focus groups
- Broadcasting ideas about improved water management practices to identified groups
- Identifying appropriate technologies in group meetings based on groups'/members' responses
- Preparation and distribution of communication products (in the form of leaflets, strategic field demonstrations etc.), through group meetings and on-site discussions with SHGs, WUAs or individual members
- Providing motivation for adoption and opportunities for better interface amongst different communities/groups
- Providing technical knowledge to members/ groups interested in adopting technologies
- Creating opportunities for linkages to financial institutions.

## Process revisited and modified

The participatory process was revisited and modified with a view to developing a mechanism that involves a wider constituency in land and water management for effective PIM. The result was a participatory process model.

The process was initiated with wider communities involving individual members, SHGs and WUAs in different reaches of the canal command. This facilitated a wide range of discussions between project team and group members and also among the members of different communities. Such discussions provided the much-needed sensitisation amongst members of the community that resulted in further invitations from members for the Theme 2 team to visit their areas and to explain concepts and strengthen their knowledge through group meetings. As a result, individual members and groups with genuine interest in adopting improved technologies came forward. Further group meetings helped to identify technologies and match them to members' capabilities. These technologies included:

- Selection of pumps for groundwater exploitation
- Water management in rice
- Multiple water use
- Canal water management
- Efficient use of rainwater
- Water management in wheat
- Advantages of irrigation through field channels and the importance of gates on outlets
- Optimisation of rice transplanting.



Leaflets were developed and distributed. The advantages and disadvantages of the technologies were discussed in meetings between Theme 2 staff and various groups in different canal reaches among SHGs/WUAs and even individual farmers. This provided a better understanding amongst the members that resulted in the identification of interest/focus groups and individual members, who are and will be disseminating the technical knowledge and sharing their experiences with a wider community for scaling up with technical support from the project team as needed.

### Response analysis of process and products

People's perception and their responses were collected through discussions and questionnaires, 273 of them were analysed for their views and feedback. Responses from SHG, WUA, and OMG members or individual farmers included:

- Members experienced this type of approach for the first time and found it very interesting
- Members suggested the process should be repeated at frequent intervals along with updated communication products
- Leaflets should be distributed amongst the communities on a large scale
- The participatory process has no direct benefits to members, but seems more sustainable in terms of increased awareness
- The processes of increasing awareness among community members should be continued and should focus on wider participation of communities in various activities.

### Responses to interventions/ideas suggested in leaflets

- 27% were attracted by multiple water use, showing they want to improve their livelihoods by generating income
- 20% made suggestions related to the selection of pumps indicating their inclination to use water conjunctively
- 19% wanted to be involved in canal water management and 18% in the use of rainfall and water management in rice, indicating their concern for efficient and appropriate use of water to enhance its productivity.

## Adoption of technologies

### Efficient rainwater use

Under this concept two interventions were adopted:

- 75 members raised their field bund heights (from 7.5–15 cm to 25–30 cm) to conserve rainwater in their rice fields. This resulted in more moisture being available in rice fields for longer periods, and reports of 1 or 2 fewer irrigations to rice crops from canal water
- Advancing rice transplanting by 15–30 days by raising nurseries in the last week of May to the middle of June and transplanting the crop between the last week of June and the middle of July. This resulted in the efficient use of rainfall and early vacation of rice fields to allow timely sowing of the following crop
- Farmers reported reduction in seeding rate, more efficient use of rainfall, enhanced crop yields, conjunctive water use, employment generation and increased production of rice and other crops.

### Water management of rice and groundwater use

- 27 farmers adopted improved water management practices for rice
- 11 farmers purchased pumpsets enabling them to make conjunctive use of groundwater.

### Canal water management

- According to the survey results, canal water management was not of interest to landless, sharecroppers, and marginal farmers, but the enthusiasm of WUAs and the newly formed OMGs was encouraging. The OMG at outlet no.4 of RPC-V took a historic step in deciding to regulate the flow from their outlet by installing a low-cost wooden gate (Rs.20 for the gate and Rs.80 for associated brickwork)
- The installation of this gate inspired two more OMGs to install similar gates at their outlets. During the whole season these were used to regulate the canal water for irrigation. To date 6 OMGs have installed gates.

### Multiple uses of land and water

Excessive water flow from outlets, canal seepage and the accumulation of runoff in low-lying areas, all cause seasonally waterlogged land and result in livelihood-threatening problems for

farmers. Fish production as a remunerative enterprise under such conditions attracted the maximum response. The possible techniques discussed were: growing fish with rice (if the water level in the field remains more than 10 cm deep for sufficient time); growing fish in nylon net pens; growing fish in abandoned pits; and multiple uses of water using secondary reservoirs.

- 2 SHGs have started to make multiple use of land and water by hiring land from other farmers in the area
- 7 farmers have started to produce rice and fish or fish alone on land that is seasonally waterlogged or in abandoned pits
- 1 farmer producing rice and fish with tubewell irrigation harvested over 500 kg fish, the sales of which gave him additional income.

Preliminary fish harvesting at all the locations created overwhelming responses in the community. People are looking at fish culture as an alternative to traditional rice–wheat cropping and as a way to diversify or integrate aquaculture into their present system and thus improve their livelihoods.

### Future adoption scenario

There is strong inclination to increasing multiple uses of land and water. In spite of various constraints, farmers are keen to adopt such activities to improve their livelihoods.

## Participatory GIS mapping

Some 22,000 plots under RPC-V distributary were surveyed with the assistance of key informants of the villages, using a differential global positioning system (DGPS) and LaserAce range finder coupled to pocket GIS software running on Windows CE handheld computers (Huskey Fe20x and iPaq 3600). Direct observation of observable characteristics of farmers' plots were recorded on Palm IIIxe handheld computers using the satellite forms, survey forms and database application. The direct observation data in the Palm were integrated with the maps in a desktop GIS. Paper maps and an interactive database were prepared to explore and diagnose land and water management problems and possible solutions. These maps facilitated dialogue among experts and local people:

- Thematic maps of land type, land use, soil texture, drainage direction, rainy- and postrainy-season crops were produced in soft copy. Dates of crop sowing, tillage practices, source of irrigation and methods of irrigation, location of outlets, outlet commands, tubewells and the location of different SHGs in the villages were recorded for each plot
- Information on outlet boundaries, area and dates of sowing rice crops are being used as inputs to the water balance model to map and illustrate different options
- Thematic maps and the GIS database have been used in dialogues with different SHGs and farmers about agriculture-based livelihood-related activities and as an aid to participatory resource management decisions following personal discussions with representatives of Cirrus, SHG volunteers and members, WUAs, and members of the communities
- Farmers' responses to the maps have been collected and it is noted that they found them very useful in solving land dispute related problems, planning agricultural activities, judging the accessibility of their fields to irrigation water, land consolidation, and making field channels
- Dialogue has started among Theme 2 team members and Irrigation Department stakeholders, using this tool to analyse problems and find solutions at a workshop meeting.

## Decision-support tools

WUA and other community members and canal managers were consulted about how day-to-day decisions on canal management were made during the development of a water balance model in order to generate information on water availability and use under different scenarios. Two decision support tools were developed.

### Water balance decision-support

- Development was based on an interactive spreadsheet tool
- This system uses simple engineering procedures to estimate temporal and spatial water requirements and different components of the water balance in outlet command, e.g. seepage from distributary channels and water courses, surplus flow from the end of the

distributary and its minor, excess flow from outlets, and water delivered to fields for crop production

- The tool provides information on the effect of different water management options on the overall water distribution scenario, e.g., discharge release in distributary, discharge bifurcation between its minor and the rest of the distributary, outlet operation and irrigation schedules, staggering rice transplanting, etc.
- The decision-support system was linked to GIS in such a way that the crop/areas planted become inputs to the spreadsheet model and the results of the estimations can be shown in the form of graphics and maps. Different scenarios were generated to consider different options (real as well as hypothetical) and these provided good communication material to illustrate the effect of different water management practices to potential users.

### Tool to study the option for conjunctive use

In order to explore and popularise the concept of conjunctive water use in the canal command area an interactive tool in Visual Basic was developed in English and Hindi versions. This tool calculates:

- Annual fixed and operational costs of irrigation from tubewells and canal
- Yield and total cost of produce
- Excess expenditure incurred in tubewell irrigation over and above the canal water charges
- The required yield increase needed to compensate for the additional cost of irrigation from tubewells.

The tool was demonstrated to water users; it was found capable of making the required analyses and of convincing them to use it to make decisions about groundwater use under the prevailing constraints they face. Along with canal irrigation the economic viability of tubewell irrigation under three situations were also analysed to understand why conjunctive use is not so popular in this region:

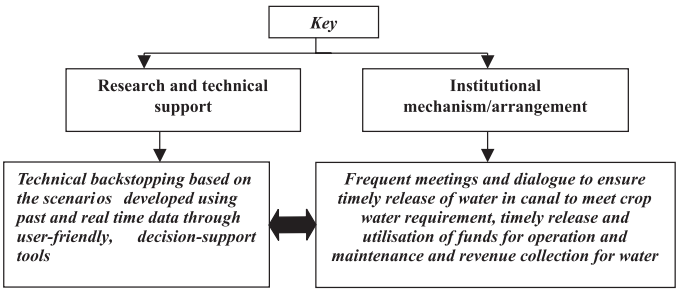
- Own tubewell
- Renting pumpsets to run tubewells for irrigation
- Purchasing water from tubewell owners.

### On farm water management (OFWM) needs linkages to main canal management

Surprisingly, it was observed that there was hardly any response to the need for canal management on the future agenda of community members, even though they are highly dependant on canal water. This reflects the lack of confidence amongst high-volume water users about canal water supply and canal managers. Some of the members reported that to achieve the objectives of OFWM the supply of water from the canal must be ensured. This indicates a valid and strong reason for OFWM linkages to main canal management.

This led Theme 2 members to explore the possibilities of balancing the expectations of water users and canal managers. The project team interacted with both groups in several group meetings. Canal managers agreed that in order to correct or reduce the mismatch between canal water supply and demand, a strong linkage between OFWM and canal operation and management is needed. OFWM alone cannot improve water productivity and livelihood. The discussions highlighted the two important key factors for efficient use of canal water.

## Key findings




- Participatory processes that involve a wider constituency of stakeholders including WUAs, SHGs, OMGs and other interest groups provide good opportunities for the adoption of need-based OFWM technologies, leading to more effective PIM. This could be helpful in the effective implementation of PIM in irrigation projects
- The convergence of parallel approaches and ideas of teams from Themes 1 and 2 was a notable achievement in forging better working partnerships so the work moved forward in better understanding. This learning is expected to feed into the development of similar projects focusing on integrated land and water management issues

- Optimising rice-transplanting time has encouraged the conjunctive use of groundwater and enhanced rice–wheat productivity
- A simple interactive operational tool developed and demonstrated amongst water users to analyse options for conjunctive use of canal and groundwater has provided a 'window of opportunity' to engage the rural poor through social mobilisation, awareness and capacity building, knowledge-sharing and improvement
- OFWM approaches that ignore (while widely acknowledging) the problems caused by erratic and unpredictable main canal system management can only have limited success. A broader framework to establish linkage and dialogue between water users and canal managers was developed by: firstly, providing an institutional mechanism for dialogue and secondly, need-based technical backstopping
- A combination of new technologies used to construct cadastral maps and to capture directly observable characteristics of plots facilitated scientific diagnosis, and dialogue among experts and local community to solve land and water management related problems and interventions
- The interactive decision-support tool based on a water balance approach and linked with GIS at distributary command level illustrates various water management options and their effect on spatial and temporal water availability in the command. This will serve as a tool to facilitate dialogue amongst various stakeholders and will help in decision-making
- Continuous dialogue between Theme 2 scientists and with canal managers resulted in timely release of water to optimise rice transplanting
- Need-based, low-cost interventions such as selection of pumps for groundwater exploration, water management in rice, optimisation of rice transplanting time, multiple water use, canal water management, and efficient use of rainwater, undertaken by the farmers using their own resources have shown encouraging response and similar interventions are expected to be taken up by large number of members. This is a testimony to the success of the participatory process and its sustainability.

## Policy implications

- Participatory process developed and demonstrated by the project involving a wider constituency of stakeholders (such as WUAs, SHGs and other interest groups) can be used to support/strengthen effective implementation of PIM through the CAD guidelines
- Institutions and mechanisms for improved linkage between the main canal and OFWM issues need to be addressed by the concerned authorities at appropriate levels and facilitated through sensitisation workshop meetings and consultative workshops, and supported by the appropriate dialogic decision-support tools
- Subsidies and incentives are not necessarily essential for the adoption of effective OFWM interventions in the command when such interventions are supported with effective communication, dialogue and the process of participation
- Multiple use of seasonally waterlogged areas to enhance water productivity, including such areas that are near the canals, will require a definitive policy from the Canal Department to lease such lands to SHGs or other interest groups
- The dialogic tools developed by the project require a GIS component to be effective. A key issue is to develop ways to produce these resources that can be supported by their potential clients.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This document is an output from Projects R7830 and R7839 that received funding from the UK Department for International Development (DFID), through the High Potential Production Systems Research Portfolio of the Natural Resources Systems Programme (NRSP). The views expressed are not necessarily those of DFID and/or the Indian Council of Agricultural Research (ICAR).