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Irrigation for Livelihoods
Improvement

Small Holder Tribal Irrigation in Jharkhand

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IRRIGATION FOR LIVELIHOODS IMPROVEMENT: SMALL HOLDER TRIBAL IRRIGATION IN JHARKHAND

MANAS K SATPATHY



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Contents

<i>Acknowledgement</i>	<u>1</u>
<i>Executive Summary</i>	<u>2</u>
<i>1.0 Introduction</i>	<u>2</u>
<i>2.0 Problem Statement and Objectives</i>	<u>8</u>
<i>3.0 Study Methodology</i>	<u>9</u>
<i>4.0 An Account of the Irrigation Commands</i>	<u>10</u>
4.1 The ‘Good’ Groups	<u>11</u>
4.2 The ‘Average’ groups	<u>14</u>
4.3 The ‘Weak’ groups	<u>15</u>
4.4 Non-PRADAN sites	<u>16</u>
<i>5. Impact in the irrigation Commands</i>	<u>18</u>
5.1 Ownership and management by members	<u>18</u>
5.2 Agricultural performance	<u>19</u>
5.3 Impact at family level	<u>21</u>
<i>6. Problems facing the irrigation villages</i>	<u>21</u>
6.1 Attitude, skill and knowledge gap	<u>21</u>
6.2 The infrastructure constraints	<u>21</u>
6.3 Input side constraints	<u>22</u>
6.4 Operational problems	<u>24</u>
<i>7. Analysis</i>	<u>25</u>
<i>8. Findings and recommendations</i>	<u>29</u>
8.1 Major Findings	<u>29</u>
<i>9. Conclusion</i>	<u>35</u>
<i>References</i>	<u>37</u>
<i>Annexes</i>	<u>38</u>

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This study and the preparation of this report were made possible through a fellowship from the International Water Management Institution (IWMI), India programme office, Vallabh Vidyanagar under the IWMI-TATA Water Policy programme. The study looked at the performance of the small-scale irrigation schemes, primarily those being implemented by Professional Assistance for Development and Networking (PRADAN), an Indian NGO, in three different tribal-dominated regions of Jharkhand. The learnings from the study are captured in the report. First, I would like to acknowledge the immense support received from my colleagues in PRADAN teams for carrying out the fieldwork. The initial drafts of this report were improved up on based on the feedback and comments received from Dr Tushaar Shah, Mr Ved Arya, Ms Mamata Krishna, Ms Nivedita Narain and Mr Anirban Ghose. I would like to express my sincere thanks to all of them. The support from Ms Shaswati Ghosh in compiling the final report was extremely crucial.

Irrigation for livelihoods improvement – Small Holder Tribal Irrigation in Jharkhand

Manas Satpathy

Executive Summary

Tribals, who are among the poorest in the country, inhabit almost all the districts of the newly formed Jharkhand State. Nearly eight lakh hectares of land that they own have poor productivity, though are protected against transfer. Curtailment in income from forests and scanty production from agricultural land had made these people migrate for livelihood. Since water resources are abundant in the region, irrigated agriculture seems to be a sound livelihood strategy for them. However, the minor, medium and major irrigation schemes implemented by the State machinery so far have not addressed the problem of low productivity adequately. The irrigation coverage in the state is as low as 9 % of the net sown area. Again, the tribal areas being located mostly in the upper catchments of medium and major irrigation projects, they hardly benefit them.

In view of the fact that the tradition of taking collective decisions is still strong among the tribals, during the last decade, PRADAN and a few other NGOs have promoted small-scale community-managed lift irrigation schemes in the region to develop agriculture, and to address poverty in the tribal regions. So far there have been no studies on the experience with these schemes, which are important to help devise sound policies for the development of community-managed irrigation systems in the tribal regions of the country.

This study makes an attempt to carefully look at the factors contributing to the success and failure of such schemes promoted by PRADAN. For this purpose, schemes in use as well as those not in use, were chosen. The study was carried out through PRA, covering farming families, promoters and key informants, and visits of the schemes themselves. The study reveals that despite the strengths, small scale, community-managed lift irrigation schemes do not succeed among all sections of tribal communities. The factors, which determine the success of these schemes include adherence of the farmers to agriculture; their farming skills; stimulus from other progressive farmers; and, external support in terms of infrastructure, training and capital. Nevertheless, the functioning schemes have resulted in increased productivity, improved income, employment generation, and food security. The study makes an attempt to come up with an approach to make such schemes more successful among the tribals of Jharkhand.

1.0 Introduction

The mineral rich Jharkhand State in the eastern plateau and hilly region of India was carved out of Bihar on 15 November 2000. A decade-long agitation by local people against skewed development and apathy of the Mother State led to the separation. In terms of per capita income the state is lagging behind other States along with Orissa, Bihar and Tripura (source: mapsofindia.com/maps/india/percapitaincome.htm).

The State has a geographical area of 79,714 sq. km and State's economy is based on agriculture and allied activities. It shares border with Bihar in the north, West Bengal in the East, Orissa in the South and Chhatisgarh and UP in the West (Figure 1).

Figure 1: Location map of Jharkhand (Source: mapsofindia.com)



1.1 Large Tribal Population and High Poverty Ratio

The Jharkhand State has 22 districts (Figure 2) and 32,620 villages. The total population of the State is 2,69,09,428 (as per 2001 provisional Census). The State recorded a decennial growth in population of 23.19 per cent during the past decade. During the period, the population density increased from 274 to 338 persons per sq. km. As per 1991 Census, 28 per cent of the State's population belonged to Scheduled Tribes and 12 per cent belonged to Scheduled Castes. The State is home for 66,16,914 tribals (9.77 per cent of the tribal population of India), the most deprived community in the country. Approximately 75 per cent of the State's population live in rural areas. The population below poverty line is 12.42 million people, accounting for 57 per cent of the total population.

1.2 High Rainfall and Poor Irrigation Facilities

The average annual rainfall in the State is 1326mm. The rainfall is highly erratic. The monsoon rains causes heavy run off and severe soil erosion. Total cultivable land in the State is 38 lakh ha. (48 per cent), whereas the present net sown area is only 18.04 lakh ha (23 per cent). But, the net irrigated area is only 1.57 lakh ha, which accounts for nearly 9 per cent of the net sown area. The irrigation coverage is lowest (2.08 per cent) in Dhanbad district and highest (24.25 per cent) in Palamu district. More than 29 per cent of the land is under forest area. Climatic conditions are largely sub-humid. Nearly, 82 per cent of the annual rainfall occur during the four months of June-September. The climate in the State is quite favourable for cultivation of fruits and vegetables. Presently, around 33,692 ha of land are under fruit trees producing 390 thousand tonnes of fruits every

year. Similarly, vegetable production in the State is 3,395 thousand tonnes per year from 2,23,595 hectares of land.

Figure 2: Administrative Map of Jharkhand State (Source: Jharkhand.nic.in)



1.3 Low Agricultural Productivity and High Migration Rates

The land productivity is Rs 2772/ha GCA¹ and labour productivity is Rs 502/capita. The degraded soils and lack of irrigation facilities particularly hamper agricultural productivity in the undulating terrain of the State. Sixty percent of the land holdings are of less than one-hectare size, and therefore are officially classified as marginal. The average yield of rice, the main food crop of the State, is only 0.8 metric tons per hectare, which is less than half the national average. As there are very few local employment opportunities, many farm labourers migrate to distant states Such as Punjab, West Bengal and Assam on a seasonal basis.

1.4 The Irrigation Potential of the State

Going by the assessment of the Second State Irrigation Commission, the State has enormous un-utilized water resources. The major river basins in the State are North Koel, Sankh, South Koel, Subarnarekha, Damodar, Ajay, More and Gumani. The total water resources of the State have been assessed to be 28,781 million cubic metres (MCM), of which 23,789 MCM (83 per cent) is surface water resources, and 4992 MCM is ground water resources.

The Irrigation Commission has separately identified potential for reservoir schemes, lift irrigation schemes and tanks in the State. Among different types of schemes, the tanks have received least attention by the State so far, while the irrigation potential of tanks, as envisaged by the Commission is 28,340 ha. By and large, the lift irrigation schemes implemented by government agencies are not performing well due to various reasons.

¹ Gross Cropped Area is the total area covered by crops in all seasons

At the aggregate level, the stage of development of ground water in the State is approximately 27 per cent leaving around 3664 MCM of groundwater un-utilized. Ground water exploitation under the private sector is mainly through dug wells. As per the official estimates, 8-10 lakh additional wells can be constructed in the State, which would help increase the irrigation potential significantly. Physiographically, the State is a plateau where ground water resources are limited. But, with a high surface water potential, irrigation development through tanks and surface lift irrigation schemes hold great promise.

1.5 Agriculture in the Tribal Region: Rain-fed, Mono-cropped and Subsistence Driven

An average tribal family in Jharkhand still holds 2-3 acres of land. Nearly 30% of the families have more than five acres of land. Agriculture is predominantly rain-fed and, mainly mono-cropping is practised. Paddy is the main crop accounting for about 60 to 70 per cent of the cultivated land during the *Kharif* season. The productivity of rain-fed paddy ranges from **1000 kg to 2500 kg/ha**. The other crops are maize, finger millet, wheat, pulses and oil seeds. Food grains occupy about 95 per cent of the cropped area. Even though hard empirical data are not available, irrigation in tribal areas is extremely poor.

Living mostly in the upper catchments of the basins, the tribals of the State are generally not benefited by the State's large irrigation projects. Wells, either private or those constructed under the poverty alleviation programmes of the government, are the chief sources of irrigation for them. Due to highly undulating terrain, the moisture holding capacity and productivity of the land varies widely from holding to holding in the region. So when the land get divided among the brothers of a family each plot is shared. As a result, everybody's holding is quite fragmented. Therefore, it is difficult to bring all the holdings of a family under irrigation.

The main crops grown in the *rabi* season are wheat, oilseeds (rapeseed, mustard, linseed and groundnut), pulses (pea and gram), and vegetables. Vegetable cultivation is picking up very fast due to the favourable climate. These are preferably grown on the homestead. Women participate in all agricultural operations except ploughing and sowing of paddy seeds (taboo). They contribute between 70 to 80 per cent of the total farm labour.

1.6 Poor Infrastructure

Rural infrastructure in the State, that is the back bone of the developmental activities, is quite poor. This is evident from the fact that only 45 per cent of the villages are electrified, and 26 per cent of the villages connected by roads. Road density is as low as six kilometres per 100 square kilometres, compared to the national average of 46 kilometres. Many rural areas remain inaccessible, particularly during the monsoon season. Arrangements for marketing of agricultural produce as well as post harvest storage and processing are grossly inadequate, causing wastage and low returns to farmers. Health and sanitation facilities are minimal, and access to safe drinking water is an urgent priority.

1.7 The State Interventions for Irrigation Development

The Government of Jharkhand (GOJ) has recognized the role of irrigation development in poverty alleviation and enhancing agricultural production and has bestowed due priority to it in the annual plan of 2001-2002. A sum of Rs 60.84 crore is allocated for minor irrigation development and Rs 288.60 crore is allocated for development of medium and major irrigation schemes. However, resource allocation across sub-sectors is not based on any appraisal of ground reality. For example, in minor irrigation sector, resources are allocated year after year for the revitalisation of the schemes without a commensurate effect. Table 1 shows the expansion in irrigation in the State during the past two decades.

Table 1: Irrigation (in '000 ha) development in Jharkhand (Source: ARPU² Report)

Year	Surface water sources				Ground water sources			Total
	Canal	Tank	Others	Share (%)	Tube wells	Other wells	Share (%)	
1981	50	24	44	66	13	49	34	180
1985	36	24	42	65	10	45	35	157
1991	21	25	51	62	18	42	38	157
1995	28	32	44	58	15	60	42	179

From Table 1 it is clear that irrigation development in the State has been quite poor. The share of ground water has consistently increased from 34 per cent to 42 per cent when that of surface water has declined. The primary reason for this may be that the ground water sources by and large are privately owned and the surface water irrigation sources are generally government owned.

1.8 PRADAN's Intervention in Small-scale Irrigation

Considering the facts that the surface water resources are abundant in the State and government-owned irrigation schemes are performing poorly, means to develop user-owned irrigation schemes based on surface water need more attention. The development of people owned small-scale lift irrigation schemes is one promising method. With the below average performance of the State-owned surface lift irrigation schemes³, in the year 1989 the Ranchi district administration invited PRADAN, a well-known NGO active in Bihar, to promote community-owned lift irrigation schemes in the district with funds from various poverty alleviation schemes of the government.

These schemes involve lifting water from streams, tanks or reservoirs using diesel pumps and taking water to the fields through buried pipelines. Seeing its initial success the state planned its expansion under Bihar Plateau Development Project (BPDP⁴) for the progress of tribal community. During the expansion phase, many NGOs and government agencies were involved, apart from PRADAN.

Small-scale, community-managed lift irrigation schemes are relatively recent and there is no adequate information on the impact of such schemes anywhere in the country.

² Agro-climatic Regional Planning Unit, set up by Planning Commission of India in Ahmedabad

³ Only 60 out of 394 schemes implemented by Bihar Hilly Area Lift Irrigation Corporation (BHALCO) are reported to be functioning and a sum of Rs 6 crores is allocated during 2001-2002 financial year by GOJ to revive some of them.

⁴ BPDP was a World Bank funded project implemented in 67 tribal dominated blocks of Jharkhand during 1993-2000. The main components of the project were agricultural development, construction of minor irrigation works and rural roads, provision of safe drinking water, and implementation support.

Learning from past experiences could help devise effective interventions by improving the criteria for designing the irrigation systems and their commands, and institutional processes for evolving sound local, community-based management systems. The present was undertaken to have a deeper understanding of the performance of community-based lift irrigation schemes.

1.9 Present Coverage and Future Potential

PRADAN primarily has promoted small-scale schemes, each irrigating around 12-20 hectares of land belonging to 30-35 families, in the poverty stricken pockets of the State. The plot size and also the holding in the command area vary widely from 0.1 acre to 1.5 acre or more. More than 90 per cent of the user families are scheduled tribes. They contribute labour for putting the schemes into operation. They run the schemes through an informal water users' association. Due to precarious condition of electricity supply in the State, diesel engines have, invariably, been used to lift water. Since large-sized diesel engines are difficult to manage for the community, 5-8 hp diesel engines are used in the schemes. This limits the height to which water can be pumped and the command area. PVC pipes, 600-1000 m long, are used to pump water to the fields at an average elevation of 25m from the water source. The sources are mostly rivulets with a very low dry weather flow, due to which they are generally deemed unfit for minor irrigation schemes. The average cost of each such scheme comes to nearly Rs 2 lakhs and cost of irrigation per hectare of land is roughly Rs 12500/- at current prices.

Table 2: Irrigation coverage by PRADAN in Jharkhand (Source: PRADAN's annual report 2001)

District	No of projects by March 2001	No. of families involved	Command area (ha)	Million of Rs invested
Ranchi	108	3,609	1394	10.82
Lohardaga	121	4,429	2234	13.637
Gumla	65	2,170	1130	10.226
W. Singhbhum	124	4,105	2010	15.17
E. Singhbhum	3	100	36	0.5
Hazaribagh	94	3,365	1440	11.8
Godda	45	850	400	4.5
Dumka	15	464	201	2.0
TOTAL	575	19,092	8845	68.653

By March 2001, PRADAN implemented 575 such lift irrigation schemes in Jharkhand (**Table 2**) using various sources of water such as rivers, tanks, canals and wells. As Table 2 shows, the average cost of a scheme is Rs 1.2 lakh, and the cost of irrigation per hectare of land is Rs 7,762.

Assuming an equal number of such schemes being implemented by other NGOs and government agencies a total of 17690 hectares (11% of NIA) of land must be under such irrigation schemes in Jharkhand. Based on the available water resources in the state, it is estimated by PRADAN that around 100000 ha of additional land can be brought under such schemes.

2.0 Problem Statement and Objectives

Agriculture being the mainstay of the people in rural Jharkhand, PRADAN, in its endeavour to provide a sustainable source of livelihood to the rural tribal communities, started building micro-lift irrigation schemes. Usually PRADAN approaches a poor village having a potential source of irrigation for such schemes. The selection of farmers is done through wealth ranking and the commands are chosen in such a way that maximum numbers of holdings is covered.

With exposure and orientation, the farmer-users are prepared to accept the service before securing government permission. In all the schemes implemented by PRADAN the farmers are involved right from the time of planning of the scheme. The users implement the schemes using the funds received directly from the sanctioning authority and with labour contributions from members. Following initial demonstration in a location, many times, the villagers themselves come up with the request for providing irrigation facility, and in such situations, if found suitable PRADAN team pursues it. Here, the better-off farmers often do not get the facility even when they approach PRADAN.

Even though the users report significant impact of the schemes on their livelihoods in terms of food sufficiency, living standard and surplus income, even the promoters amongst others have occasionally questioned the sustainability of these schemes, notwithstanding the rewards of such schemes, such as:

- Being easily executable by the community;
- Short period of execution;
- No external interference;
- One person to irrigate at any given time;
- Hundred per cent grant as well as use of amount saved by labour contribution as working capital and
- Free training on pump maintenance and appropriate agricultural practices on top of ongoing assistance

The overall response is not overwhelming. The percentage of potential users benefiting from such schemes is in the range of 50-60 per cent only. The command area utilization is even lesser. In a few pockets it has even failed to motivate the farmers to shift from rain-fed to irrigated agriculture. Those farmers use it only during emergency. The increase in productivity of crops with assured irrigation sometimes falls far short of the expectation.

This study was conducted to know the critical issues facing the use of these schemes, and to explore whether it is worthwhile to develop more such schemes. The specific objectives of the study were to:

- Review the overall performance of selected functioning and non-functioning schemes.

- Identify the constraints and opportunities for the utilization of such schemes.
- Find the distinction between users and nonusers.
- Ascertain the production and income level that have made the users sustain them.
- Suggest future strategies for development of such schemes in Jharkhand, particularly for the poor tribal communities.

3.0 Study Methodology

The study was designed to compare tribal groups using the irrigation facilities with those in the same area having similar socio-economic profile and not using the irrigation facilities. Participatory Rural Appraisal (PRA) techniques such as focus group discussions, preference ranking, wealth ranking and seasonal and historical diagramming were used in collecting primary data on the performance of schemes. Information was collected on the following attributes: the interest of farmers in irrigation; quality of present irrigation services in terms of cost and ease; returns from irrigated agriculture; problems encountered; and alternate/additional employment opportunities available. This was aimed at identifying the factors that lead to the emergence of successful schemes. A semi-structured questionnaire was used for collection of primary data from the field, and is given in Annex A. During group discussions attempt was made particularly to understand the reasons for intra group variations. Secondary data on materials used and investments made were collected from PRADAN's records.

Informal interviews were carried out with some key informants like progressive tribal and non-tribal farmers, seed dealers, professionals from PRADAN, NGOs and extension officials. The idea was to get more insight in to the factors influencing the utilisation of the schemes. These informal interviews not only helped formulating the queries for PRA, but also throwing more light on information gained through PRA.

Ho, Oraon and Santhal tribes dominate the South, Central and Northern regions of Jharkhand, respectively. PRADAN schemes, including those, which have become defunct, were selected in consultation with the team members in all the three regions to adequately explore the factors affecting performance. Newly implemented (less than three years old) schemes were not reckoned for the study, as they are likely to fail in providing adequate basis for drawing inferences.

When the PRADAN-sponsored schemes performed better than the State-owned lift irrigation schemes, a few district administrations started involving other actors to follow the same approach to increase the reach of the programme. A few such schemes implemented by the State government and NGOs were also visited as part of the study to examine whether significant differences exist. The schemes promoted by two other NGOs, namely, World Vision and People's Science Institute (PSI), were also visited for understanding its effect. Tribal and non-tribal villages engaged in improved irrigated agricultural practices without much external assistance were also visited in all the regions.

In addition one lift irrigation and two flow irrigation sites implemented by government departments were visited in the northern region to see their utility. Table 3 summarises the different types of villages visited during the study in different regions and the list of 40 villages visited is given in Annex B.

Table 3: Summary of different types of sites visited

Regions	PRADAN schemes		Others similar schemes		Other NGOs	Good IA sites		Govt. sites	
	Functioning	Out of use	Govt.	NGO		Tribal	Non-tribal	Flow	Lift
Central	7+1*	3	2		2	2	1		
South	5	3		2			1		
North	3	1		1		1	2	2	1
Total	16	7	2	3	2	3	4	2	1

- Only loan financed scheme implemented by PRADAN in Jharkhand

4.0 An Account of the Irrigation Commands

A summary of the 23 PRADAN sponsored lift irrigation commands studied is given in Table 4 and the detail information is given in Table 5. This is followed by a narration of all the irrigation commands covered by the study.

Table 4: Summary of 23 PRADAN-Sponsored Irrigation Schemes Visited

Location	22 sites in Lohardaga, Hazaribagh, Gumla, Ranchi, West Singhbhum, Godda and Dumka districts of Jharkhand and 1 in Banka district of Bihar ⁵
Membership	Range: 18-49, Average: 32
Actual users	Range: 8-40, Average: 22
Age	Range: 3-8, Average: 5
Size of diesel pump set	8 hp everywhere except Masiyatu where it is 5 hp
Length of pipeline	Range: 200-730m, Average: 517m
Command area	Range: 30-55 acres, Average: 43 acres
Actual command area	Range: 3-45 acres (7-100%), Average: 18 acres (43%)

⁵ Albeit the village Beltikri is in Banka district of Bihar, for all practical purposes, its residents are linked to the small town Hansdiha in Sareiyahat block of Godda and the PRADAN team in Godda has implemented the irrigation scheme there.

Since the study was carried out during the monsoon (July-August 2001) only the villages connected by all weather roads were visited. Except Kustuiya and Banamgutu all other villages are within a distance of 15 kilometres from the block headquarters.

The irrigation groups have been rated according to their agricultural maturity and overall performance in a 1-5 scale (one being lowest and five being the highest) and are tabulated (see Table 5). Agricultural maturity is rated based on the quality of inputs used, practice followed and yields obtained. It was observed during the study that out of the norms or practices encouraged by PRADAN, operation and maintenance of pump set by the operator, coupon system (modified) for water distribution and introduction of appropriate crops have largely been helpful for the irrigation groups. Whereas these groups could not sustain collective purchasing, accounts keeping, regular meeting, and revolving fund for crop loans. Therefore, instead of using the above criteria to judge performance, the attributes such as “percentage of families using the schemes” and “overall management of the schemes” were considered to rate the groups. Based on the assessment of these attributes, the schemes were classified as ‘good’, ‘average’ and ‘weak’.

4.1 The ‘Good’ Groups

Among the functioning groups, five (namely Danru Pahantoli, Danru Pujartoli, Butgorwa, Kurag and Banjhikusum) were found to be good groups. The members of these groups follow comparatively better agricultural practices. All of them are rated either 4 or 5 as far as agricultural maturity is concerned. Even though there are many differences in the practices followed among the members, all of them are in a growth path. Another common thing, observed in these groups, is that they had approached PRADAN to get the facility. An exploration into the past reveals its bearing on the present status.

In the twin schemes in village Danru around 10-15 young men, who are having formal education or having good social outlook due to exposure to distant towns, took the initiative and approached PRADAN for the irrigation schemes in 1994. Due to poor landholding and rising pressure to meet food sufficiency they opted for irrigated agriculture. Other fellow villagers, who were not migrating and dependent upon local wage apart from agriculture, were next to join them in the venture. Last to join are the people who were migrating to distant towns for employment. Now, most of the families having land in the command area take irrigated crops, but agricultural practices vary widely among the members. The late adopters still take more food crops whereas the early adopters have shifted to vegetable cultivation. The initiators are the best farmers who introduce more remunerative crops every year with hints from the market and when others start producing them they shift to new crops. They also look after the overall management of the schemes quite well and the pump sets in both the commands have been overhauled last year with group funds. They are the source of inspiration even for nearby irrigation commands in Chitri and Jhaljamira. The leaders have even formed a registered society to implement developmental activities in the district with funds from government.

The group of 7-8 farmers, which initiated the Kurag irrigation scheme in 1994, is growing vegetables near their wells for many years now. However, the opportunity was

limited by the limited capacity of the wells. Now they are taking crops both near the wells as well as in the lift irrigation command area. Seeing them a few others who were wage dependent are also taking crops. Even though number of user wise the growth is less in this command, the growth is from 8 to 15; increase in command area is substantial. The group of 15 farmers, which is using the facility now, covers all the land (more than 30 acres) in the command area with crops, namely, wheat, potato, tomato, ginger and banana.

The PRADAN team had introduced ginger and banana cultivation in the area. But, only eight progressive farmers have accepted it in the beginning. This is the only group found during the study, which is maintaining the revolving fund for giving crop loans to its members. This was provided to them at the time of installation of the scheme against their labour contribution. People who have less than 25 decimal (a quarter of an acre) of land in the command area or lacking family labour are yet to utilise the facility. The farmers, who have enough land and can get enough paddy for domestic consumption, are also not interested in irrigation.

In Banjhikusum mainly four progressive farmers initiated the scheme. Of these four, two had an opportunity to try irrigated farming in as early as 1972 to be selected as the key farmers, by the block administration for receiving intensive support. The village level worker (VLW) whom they can never forget had provided them training, exposure and improved inputs for a few years consecutively. Starting with five farmers in 1997, now there are around 15 farmers taking wheat, potato and vegetables in the command area; vegetable cultivation being particularly picked up due to intensive support from the PRADAN team. Due to high capital requirement only 5-6 farmers presently go for summer vegetables. People, who are used to regular wage labour and who do not own bullocks and capital, are yet to start taking crops in the command area of the scheme.

The scheme in Butgorwa is the only loan-financed scheme implemented by PRADAN in Jharkhand. The group in this village had approached PRADAN to get a lift irrigation scheme on grant. As grants were not available at that juncture, the group was advised to take a loan and use the remnants of an old government scheme to have an irrigation scheme. It took around a year for the group to agree to take a loan. In the mean time, PRADAN team helped them improve their existing agricultural practices, by providing exposure to other successful schemes and conducting puppet shows and motivational camps, which boosted their confidence. In 1998, nearly 40 farmers took a loan of Rs 45000 and completed the scheme to irrigate 30 acres of land. The land holding by members in the command area varies from 30 decimal to 2 acres and the loan got divided among them in proportion to the land holding size. The villagers earlier were mostly wage earners. The *Mahato* community leaving in the surrounding area has influenced their agriculture significantly. The villagers picked up the skill for vegetable cultivation while working in the fields of *Mohato* farmers and started taking vegetables in the homestead with well irrigation. Now all forty families take crops in full command area and repay the loan instalments on time. They get reading material and required information from the seed dealer in Gola.

The next best groups are Salgi Chhapartoli, Dumerdiha, Landupada, Baghakol and Beltikri. Their rating in agricultural maturity is in the range of 3-4. In Salgi Chhapartoli mainly five farmers who cultivate in more than half of the command area during *rabi* hold the group together. In addition they also take summer crops. The rest 20 farmers go for only *rabi* crop that too on average in half an acre of land each. The source here is a pond that can not irrigate more land than what is irrigated presently. So while initial adopters have been able to take crops in all their lands, other 20 families are neither able to expand their area under irrigation nor able to take a major shift from food grains to cash crops. The recovery of irrigation charges is quite irregular and last time when the machine required major repair money was arranged by selling tamarind from the village common property. An SHG of women has been of help to farmers to avail of timely credit to go for irrigated agriculture. Introduction of ginger crop also has generated interest among the farmers.

In Dumerdiha, farmers are using the irrigation facility to take crops for two years now. After the initiation by 15 farmers in the first year, the rest joined in the second year and area under vegetable cultivation increased considerably. But the rivulet from where water is lifted dried up in summer. Even though the cropping practice is quite poor here their moral is high with backing from their relatives in village Laxmiposhi where one PRADAN member helped them improve their agricultural practice with systematic follow up.

Some non-tribal villages practising good agriculture surround the village Landupoda. With canal irrigation villagers here were getting higher *khraif* yields and were also growing vegetables. Only five farmers used the lift irrigation scheme in the first year, 15 more joined in the second year and in the last season 30 farmers used the facility. Even the farmers who are having good level of awareness had no irrigation facility. This had compelled them to go for *bidi* making or waged labour. Two to three leaders from the group including the operator manage the scheme and the rest of the members know little about the group's accounts.

In village Baghakol, of the 33 families that are member of the scheme, 16 families belong to *Santhal* tribe, one Pahadia tribe and the rest 16 are nontribals. In the second year all the families had taken crops whereas in the last season only 15 families including only one tribal used the facility. The following was the reason. The river dries up towards April and the tribals who had sown late following the nontribals got very poor yield in the previous season. This discouraged them from using the service next time and then resorted to migration to West Bengal for harvesting crops as farmer labourers. Among the nontribals except 2 *Sahu* families rest belong to *Ghatwar* community who are quite indistinguishable from tribals. They are comparatively good in agriculture, made use of PRADAN's training programmes and are managing the scheme well.

In Beltikri 37 tribal families are using the lift irrigation service since 1992. Nontribal community staying around the village have influenced the cropping practices here to a great extent. So as soon as the irrigation facility was made available to them, all of them started using the service from the first year itself. As the water is scarce in the source no one has shifted to high water requiring crops such as wheat, maize and mustard. They are

quite happy with the impacts, like, they do not consume millets now, no one goes to moneylenders and 2-3 of them purchased land. Agricultural practice over these years in all the seasons also has developed appreciably. However, their struggle to manage the operator seems unending. Whoever gets selected as the operator misuses group fund and group changes the operator. The third operator, who is in charge, now also faces similar corruption charges.

In a nutshell, good groups seem to be the consequence of inclusion of farmers having more involvement in agriculture in preference to waged labour. Such farmers possessing prior experience in irrigated agriculture, albeit in a small-scale, have led the way for other less enthusiastic ones to join the enterprise subsequently. Presence of progressive farmers in adjoining area's seems to have definite influence on such groups to show better inclination for using the irrigation facility.

4.2 The 'Average' groups

The groups in Masiyatu, Tengria Nawatoli, Sehal Bansitoli, Kokrobaru, Kundubera and Bariyarpur are average. Their agricultural maturity levels range from 1-3. The village Masiyatu is a mixed village of *Oraon* and *Turi* community; *Oraon* being a little better in agriculture than *Turi*. *Turi* community is known for its bamboo basket making activity; each family sells around Rs 7000/- worth bamboo products in a year. Initial response from the group was very poor. Due to conflict between the two communities, they were not using the irrigation facility. PRADAN team's pursuit together with influence from nearby irrigation commands made at least 13 farmers use the irrigation facility for growing wheat, pea, potato and vegetables. The source again is a pond that can not support more command area once farmers go for high water consuming vegetables. The group has rejuvenated with young people taking over the responsibility of operating and maintaining the scheme.

In Tengria Nawatoli the irrigation water utilisation reduced after initial two years due to poor yield. Presently only 18 farmers are using the facility against 30 who had started. Half of them again are nontribals whose agriculture is a little better than the tribals. PRADAN team is still involved in influencing their cropping practices. A Self Help Group of women also is formed in this village to help access required credit. In Sehal Bansitoli people are used to vegetable cultivation in small patches by the side of the river. Many people are not interested in the irrigation scheme since they are allowed to grow only wheat in the low lying land. Wheat yield again can be sustained in these lands only with appropriate dose of chemical fertilisers. People have apprehension that the use of chemical fertilisers will make their land unfit for paddy that is grown without using chemical fertilisers. Presently only 14 farmers are using the scheme to grow wheat, potato and vegetables. Water source also is unreliable.

In Kokrobaru only eight farmers use the scheme to grow vegetables. These are mostly from the middle category and used to grow *Kharif* vegetables before. Members of very poor families who go out for wage earning and the families having food sufficiency are yet to take benefit of the scheme. Being in the fringe areas of forest, farmers take wheat and varieties of pulses without irrigation. They lack knowledge on the use of chemical fertilisers and pesticides and are scared of taking up input-intensive agriculture. In

Kundubera with PRADAN's training and crop input support around 30 farmers took a good harvest of vegetables. However, subsequently they could not sustain the high investment agriculture and incurred losses. Even the leaders are not interested in agriculture now. Only 10 farmers who do not go out for wage earning used the scheme to grow vegetables in half acre each that fetched a net benefit of Rs 2000. Bariyarpur is a forest dependent village where people lack skills in agriculture. After the provision of irrigation only 3-4 farmers showed interest. Last year, PRADAN team's training and support made 20 farmers from the middle category to grow wheat, maize and vegetables. However, the yields that they have obtained are not at all impressive. On top of this their machine gives problem regularly. A few more interested farmers who have fields away from the pump outlets take irrigated crops as they could not afford to dig the field channels all-alone.

On the whole, lack of skills in agriculture appears to be the crucial factor affecting the performance of these groups. A large proportion of farmers here are either forest or wage-labour dependent. A few, who have been influenced by PRADAN's follow up, are using the schemes. However, their returns from existing practice are quite low.

4.3 The 'Weak' groups

A review of the seven commands not presently in use showed that five of them that have a rating of two might be used in future. But two of them, which are rated one, do not look to be using the schemes again on their own. Except Chhota Danru rest are rated either one or two in agricultural maturity. In Chhota Danru one and two, after the inception year, they did not use the schemes. One of the pumpsets was stolen and the other went out of order. At the same time one of their persuasive leaders died and another had mental illness. The operator failed to persuade the members to contribute for the repairing of the pumpset. However, afterwards it has been repaired and the members plan to use it this year. There is a lack of interest in some farmers as the scheme irrigates low lands where only wheat can be taken and wheat yield gradually has been reducing from those lands. Now a number of them have wells in the homestead where they grow vegetables round the year. People having more than 2 acres of land in the command area are more interested in the schemes as even wheat cultivation in a large chunk of land is viable.

In Drankel Mahuatoli, all the farmers took crops by using the facility till PRADAN team was associated with them. After PRADAN's withdrawal, they discontinued using the facility due to the poor yields. Here every year people need to construct earthen barrier to store water for lifting. The better off farmers wanted to use the facility, but they too withdrew as every year they get lat in constructing the earthen bonds and mobilizing the farmers for sowing operations. Others in the village are mostly wage earners who were not willing to control for construction of the bonds. They think that now the only solution is to get a masonry structure constructed. They are trying hard to get it constructed by the block administration. In Ulijhiri, farmers discontinued using the scheme after three years mainly because of damage to crops by elephants, as reported by the farmers. However, an analysis of their crop yields show that initially the yields were good as the inputs were provided by PRADAN free of cost and subsequently the yield reduced considerably when they invested less for inputs. A few farmers who do not opt for wage earning and are a little better in agriculture are thinking of using the scheme in the coming season. In

Daldali again farmers did not use the scheme during last season although thirteen of them took crops in first two years, due to lack of capital, problematic machine and difficulty in protecting crop against grazing. Actually poor yield discouraged the farmers from going in for irrigation. Even in the first year when PRADAN provided the capital they procured the inputs late and the yield was less. Most of the farmers here were dependent on wage labour that migrates to West Bengal four times a year for farm labour. Five farmers wanted to use it last year, but one person fell ill and one of the family members of another person died. Rest three could not dare to go for cropping, as they were not confident of guarding the crop and machinery. However, the pumpset is repaired and this year they plan to use the scheme.

In Kustuiya the main problem for not using the scheme after using it for a year was told to be the light soils clay in the area that causes severe heavy losses during conveyance through field channels. The yield of wheat that they obtained was extremely low. Farmers here still purchase their daily requirements of wheat in exchange for paddy. There are a few nontribal (Maharana) families in the village who are good at vegetable cultivation. Being motivated by them, the tribal family now take kharif vegetables, but with very low investment. They wanted to take summer vegetables in the command area but the river dries up by that time. In Banamgutu, the farmers stopped using the scheme after one year of experiment as crops were damaged by elephants. Actually most of the economically better off families here have one or more of their members holding jobs. The poor farmers whose agricultural practices are still not forward are afraid of input-intensive agriculture and have resorted to either wage earning or vegetable cultivation beside the canal from which the water is lifted.

As far as agricultural practice is concerned, there is not much difference between the average and weak groups except for Chhota Danru. The reasons for not using the schemes are village specific. Presence of skilful farmers is generally very few in these groups and those few find it difficult to run the schemes by themselves for various reasons explained above.

4.4 Non-PRADAN sites

Out of the five PRADAN model schemes implemented by others, those implemented by the government are performing well. Both are in the same village Senha Barwatoli of Lohardaga, one belonging to nontribal vegetable growers and the other belonging to tribals. Basically the schemes are located in an area having a mixed population of tribal and nontribals who are skilled in agricultural practices. Whereas the schemes implemented by NGOs (in Pandubadi of West Singhbhum and Murbhanga of Dumka) are in the hands of very poor tribal community. But they are performing quite poorly in spite of a lot of free agricultural inputs in the beginning. The nonusers cited problems of crop failure due to diseases, cattle grazing, and lack of capital for inputs. In Pandubadi the scheme became defunct due to the drying up of river.

Two villages, namely, Guyu (Ranchi) and Rud Hargara (Palamu) were visited. In these villages, the scheme were implemented by two different NGOs who adopted different approaches to promote irrigated agriculture. In the first village the tribal farmers working in the lands of nontribal agriculture community have been supported with tanks,

pumpsets and pipes to take similar crops in their own lands. Here, the impact is significant in terms of increased yields. The support for agriculture was received from the seed dealers in nearby towns of Lodhma and Ranchi. Now, government has adopted the village for intensive agricultural support. In Rud Hargara a tank is constructed to harvest runoff in the land of a progressive tribal farmer who uses it to grow crops round the year with his own pumpset. However, contrary to the norms set the NGO, owner is not allowing others to take water from the tank. Many such tanks have been constructed by the NGO in the area for such purpose.

In Badla Mahadevtola, Bodeiya and Madhuban, tribal farmers who have individual ownership of private dug-wells were found to be very useful for agriculture and could be compared successful in doing irrigated agriculture. Nontribal agriculture community who stay near all these villages have influenced them a great deal. The village Madhuban is particularly benefited by government when around 50 wells were constructed in the village and rigorous follow up with crop inputs was initiated. Around 30 of the users have stopped migrating and taken to irrigated agriculture one after another.

Among the nontribal villages practising excellent agriculture, in the case of Chainpur, then the relatives living in Sos Patratu and Bero where each family is having two or more dugwells for irrigation influenced the farmers in Chainpur. According to them, arrival of hybrid seeds and small machines brought significant improvement in agriculture. Nipania Koiritoli people also use well irrigation to grow vegetables. They had started with potato and while scouting potato seeds in distant towns they picked up vegetable cultivation. In Pathalgama farmers are favoured by good ground water condition and with private shallow bore wells, costing only Rs 5000/- each that supports 5HP pumpsets, go for large-scale food grain production. Otar farmers are not very progressive. The flow irrigation from a tank was supporting wheat only in a small area. Of late, they have got a deep borewell as grant and pumpset on loan from government. Thus they could go for winter cultivation in a big way. In all these commands the farmers said that they also had taken time to accept HYV seeds and chemical fertilisers when popularised by block officials long back. The highly motivated and skilled block staff at that point of time worked hard to get the agricultural community used to these improved practices. Similar massive effort is now required to influence tribal farmers but the government seems fall short of such officials now.

The flow irrigation commands visited in Mahulbana Nijhartoli and Sulanga, however, showed that response of tribal farmers to provision of irrigation facility is better when water is made available free of charge. Due to regular migration to West Bengal to work as agricultural labourers, they picked up improved paddy cultivation practices and with assured irrigation dared investing more in paddy cultivation. Now, they even take winter crops in limited area depending on the capacity of the tanks. Young men here are even interested in availing of loans to purchase pump sets and expand area under irrigation. The lift irrigation scheme implemented by the government in the non-tribal village, named, Bhurkunda is damaged beyond repair. The ownership of the scheme was the main issue here. The people had little role in the management of the scheme. When asked whether they could manage the scheme once revived and transferred to them, they said

that with the existing group it would be difficult. They wanted the scheme to be owned by a small, homogeneous group of farmers interested in irrigation.

The region-wise differences noticed are that due to exposure to West Bengal. The Santhal tribes in Northern region are more aware of the cultivation of high yielding variety of paddy with the use of chemical fertilisers, where as both in central and southern regions, a large number of tribal villages are still unaware of this. Since dug wells are not at all feasible, rivers and canals are the main sources of irrigation in the southern region. The local production of vegetables being lower than the local demand, farmers with irrigation facility largely go for growing vegetables. The income from sale of vegetables takes care of their day-to-day cash requirements. However, the Ho tribes here were found to be practising very backward agricultural practices. The central region, where the state capital is located, was found to be better linked to distant markets, which makes it easy for selling the agricultural produce.

5. Impact in the irrigation Commands

5.1 Ownership and management by members

In almost all the commands, the water users knew that the schemes belonged to them. The sense of ownership over the schemes is evident from the fact that all the groups have established systems to guard the assets even when not in use. Such sense of ownership is lacking in government-owned schemes. In one of the government schemes in Bhurkunda village, which was visited during the study, the assets got stolen and farmers are now deprived of irrigation service after 15 years of use. As the irrigation infrastructure belongs to government, they are waiting for its revival instead of purchasing a new pump-set with contribution from users. Similar attitude was observed with regard to the maintenance of flow irrigation sites too. In fact the sense of ownership among the members even was observed in the PRADAN type of schemes being implemented by both government and NGOs. Seemingly, the approach, in which external promoter's role virtually ends after implementation, has been able to address the ownership issue.

In the case of schemes promoted by PRADAN the operators trained by the agency operate the machinery mostly. In Masiyatu after the trained operator left the village another person was trained by the cluster mechanic⁶ to take care of the operation and maintenance of the machine. The idea of promoting "cluster mechanics" worked very well in terms of providing back up to the individual operators. Two of the cluster mechanics in Salgi Chhapartoli and Chhota Danru, respectively, interviewed during the study, were found to be quite satisfied with the level of income they get by providing this service. In the government-implemented schemes in village Senha Barwatoli, absence of a trained operator causes major problems as the machine breaks down very often due to rough handling by members.

⁶ A cluster mechanic is a person who has been specially trained by PRADAN to provide technical support all the operators in his locality when required. The most skilled and interested person among the operators is selected for this. They are not promoted in all PRADAN locations.

Contrary to the expectations, all the members of the irrigation groups are not involved in decision-making and management of schemes. The responsibility of managing the schemes was found to be vested with a small group of 2-5 persons in every scheme. These small groups of farmers in most places are the progressive farmers having higher stakes in the schemes, as compared to the rest of the members of the scheme. Their improved agricultural practices have really motivated the less skilled farmers to get used to irrigated agriculture. The rest of the members were only concerned with availing of irrigation services at reasonable rates. The irrigation charges, excluding the cost of diesel varies from Rs 7-10 per hour in the case of the PRADAN-promoted schemes. From these charges, the operators on an average get Rs 3 per hour. Rest is used for maintenance of the pump sets. One of the leaders keeps the accounts. Only in the case of two schemes, namely, Chhapartoli and Masiyatu, the accountants are paid at the rate of Rs 0.5 and Rs 1, respectively, for every one-hour of use of the pump set. In most of the well-performing groups, there are no separate accountants. The operators provide irrigation after collecting the charges and keep the accounts. The leaders check the accounts at regular intervals. For major repairs, when the group fund falls short of the requirements, one of the leaders pays for it and subsequently the money is collected from the other members. This ensures timely repair of pump-set.

Overall, the general impression on this type of irrigation service, which caters to a small group of people, is positive. They found it to be better than the wells as their lands are scattered and well can irrigate only one of their plots. Even small pump sets installed on wells take much more time than the time taken by these irrigation systems to irrigate the same plot.

5.2 Agricultural performance

The farmers across the region grow a variety of crops, and their yields vary widely. The choice of crops was influenced more by the considerations of domestic food grain requirements rather than profitability during the initial days. The tribal farmers, who were not getting adequate amount of paddy from their land with provision of irrigation, mostly also grow wheat after the kharif season to meet the deficit. In older commands, the experienced farmers are growing a variety of vegetables in order to increase their cash returns from farming. Reduction in wheat yield, which had happened over the years, also pushed the farmers to grow crops like pea, potato and mustard. Land and soil type also determines the choice of crops. In West Singhbhum, for instance, the farmers have gone for vegetables right from the beginning in small patches of land with very low investment. The consideration was to meet regular cash needs as well as generate enough capital to grow the main paddy crop. The vegetable cultivation practised is backward and yields are very less.

Among the non-PRADAN villages, high crop yields were reported at the villages, namely, Guyu, Madhuban, Bodeiya, Badla Mahadevtola and Senha Barwatoli. These are tribal hamlets located near the hamlets of non-tribes, who are engaged in vegetable growing. The high yields are due to the use of high level of inputs and improved practice. They learnt these from the non-tribal community while working as labourers earlier in their fields. Among the PRADAN promoted groups, all the well-performing groups have got reasonably good yields. Farmers in average groups, who are either forest dependent

or wage earners, have taken up irrigated agriculture to supplement their income and the yields are showing a positive trend. Intensive training and follow up has resulted in this.

Most of the farmers practising irrigated agriculture for more than five years have adopted some sound farm management practices, such as land-levelling and timely sowing, which help derive maximum returns from irrigation. The high levels of inputs used in most of the successful schemes also indicate that the farmers have developed a commercial mentality.

In the case of a well-performing scheme, an average tribal farmer, who takes wheat in an acre of land and vegetables in quarter acre of land, gets a net income of around Rs. 8000-10000 in the six months of the irrigation season with an investment of roughly Rs. 3000. This is at par with the minimum wage rate of the state. This is also higher than the amount that an individual brings home after six months of migration. A few, who are the prime motivators for others in their respective villages, make a net income of Rs 20,000 or more during the season. Information on the agricultural practices for the main irrigated crops was collected during the study in each village. The village-wise figures of investments and returns are given in **Annex C**. For calculating the village wise figures, the average values of the investments and yields are taken. The summary is presented below in **Table 7** for different categories of villages.

Table 7: Investment and average yield of selected crops in various categories of villages

Group type	Wheat			Pea			Potato		
	Inv. (Rs/ha)	Yield (t/ha)	Return (Rs/ha)	Inv. (Rs/ha)	Yield (t/ha)	Return (Rs/ha)	Inv. (Rs/ha)	Yield (t/ha)	Return (Rs/ha)
Good PRADAN groups	4275	2.43	15763	9417	7	35000	18000	16.9	50700
Average PRADAN groups	2375	1.56	10156	7500	5	25000	9000	8.25	24750
Weak PRADAN groups	2264	1.54	9982	7417	4	20000	12083	12.7	38000
Non PRADAN tribal groups outstanding in agriculture	4958	2.67	17333	8500	6.4	32188	19125	17.5	52500
Non PRADAN tribal groups average in agriculture	2563	1.63	10563	-	-	-	17500	15	45000
Non-PRADAN non-tribal groups	5650	3.1	20150	12000	8.8	43750	26250	21	63000

As Table 7 shows, investments as well as yields of various crops in the well-run PRADAN schemes, are quite impressive, though less than what the non-tribal farmers obtain. There is not much difference in the yield between average and weak groups. The average groups continue taking crops either due to regular support from PRADAN teams or influence from nearby progressive farmers. The investment made by farmers increase with the increase in their level confidence. In many villages, wage earners, who used to migrate in the past, have started taking irrigated crops after seeing their fellow villagers taking irrigated crops successfully. The farmers, who are used to cultivation of high yielding varieties of paddy with application of chemical fertilisers, have shown better inclination towards irrigated agriculture.

5.3 Impact at family level

All the families involved in irrigated agriculture talked about concrete benefits from irrigation. Some women interviewed during the study articulated that food security at the household level was the major contribution of irrigation. There is a shift in food habits from millets to cereals and vegetables. Farmers engaged in vegetable cultivation have surplus income with which they have acquired various assets like bicycle, farm implements and cattle. A few farmers have purchased land and a number of farmers have repaired their houses. The farmers, who are now used to irrigation, said that their dependency on the rich people in the village at the time of crisis had really reduced. Investments for the education of children were found to have increased in many families. Educated young men in the villages, who did not get jobs, are generating significant income from practicing forward agriculture. They display a lot of entrepreneurial skills too in searching market information, organizing cropping practices accordingly and arranging transport to such markets. All the families who were previously migrating and have got a feel of irrigated agriculture currently find it more remunerative and less taxing. The conclusion that can be drawn from these observations is that the socio-economic condition of the families using irrigation water is much better than that of the wage dependent families.

6. Problems facing the irrigation villages

The major problems facing the irrigation villages are:

6.1 Attitude, skill and knowledge gap

In almost all the sites, where farmers were found to be less excited to go for irrigated agriculture despite having irrigation facility, the primary reason is poor yield from agriculture and period crop failure. Correspondingly, wherever the farmers have got reasonable yields, they have gone for irrigated agriculture against all odds. So this is a crucial motivating factor for farmers to use irrigation facility. Most of the tribal farmers were used to rain-fed paddy cultivation with little or no fertilizer use. Being influenced by other agrarian community, gradually they are adopting high yielding variety of paddy along with chemical fertilizers. Whereas an assured yield from irrigated agriculture demands knowledge of field preparation, appropriate crop selection, improved varieties of seeds, right spacing between plants, suitable application of water, proper doses of fertilizer, plant protection and so on. The farmers have incurred huge losses in the absence of the required knowledge and skills. The families engaged in improved farming practices have mostly acquired them from the neighbouring non-tribal families, relatives, the seed dealers and the distant locations to which they migrate.

6.2 The infrastructure constraints

Poor quality of the irrigation infrastructure was a major concern for farmers in the case of schemes implemented by the government. The farmers complained about leakages in the fittings, frequent break down of the pump sets and reduced discharge. In the absence of trained operators, a lot of time is spent in repairing the pump sets. The remote irrigation group of PRADAN in Daldali village of Dumka, whose operator has not picked up the skills during the training, has similar problems.

Some farmers, on the other hand, find the usage of the irrigation systems quite labour intensive as long earthen field channels are to be made every year for conveyance of water. The use of earthen channels causes heavy seepage losses, which ultimately increases the cost of irrigation. The heavy clayey soils that develop cracks in summer due to moisture stresses cause maximum losses. The farmers had made the logical suggestion in such cases of delivering water through pipelines or masonry channel as close to their fields as possible.

Absence of basic amenities such as roads and transport facilities to the markets seems to be a problem for several of the villages where vegetable production is increasing. Due to poor quality roads it is difficult to get vehicles in the villages to transport the agricultural produce. For poor roads, the transporters charge a very high price. This also increases the cost of procurement of inputs such as compost. In the absence of transport facility villagers carry their vegetables to nearby (up to 15km) markets on bicycles. But, the bicycles are only capable of carrying a maximum one-quintal of vegetables. Using bicycles for transport also causes loss of vegetables.

In the absence of any organized marketing strategies and structures, the farmers have incurred losses a number of times. Some farmers are scared of growing vegetables as it demands a lot of labour and at times the marketing of produce is also not easy. Vegetables are mostly sold through existing channels in which producer normally gets less than 50% of the price. In Lohardaga, there is a commission agent who transports farmers' vegetables to distant markets. He is well informed of the conditions in the nearby markets and judiciously decides about the market for sending the collected vegetables. So the vegetable growers do not face any marketing problems. However, some farmers complained that the prices obtained after deduction of various commissions were too low. When some farmers wanted to introduce commission agents from Calcutta to ensure competition, they faced resistance from the present agent. Vegetable cultivation has grown tremendously during the last decade in a few non-tribal villages near Ranchi, like Pithoria and Patratu, where the growers have been able to hire transport collectively and send vegetables to the distant markets.

6.3 Input side constraints

Lack of capital for purchasing agricultural inputs was expressed a major constraint by all sections of community. As per the calculation showed by a farmer, the cost of inputs for growing wheat in one acre of land has increased by Rs. 800 after the irrigation scheme was installed in their village in 1995. However, there was no appreciation in the price of wheat during these years. So the farmers, who could sustain yield increases that can commensurate with the investments, only continued taking the crops. Those farmers with hand-to-mouth existence are not able to make such high investments.

Agriculture being subjected to varieties of natural hazards such as droughts and floods, a number of farmers have been forced to migrate after incurring losses to bring capital to again invest in agriculture. Had there been easy access to credit, they might have rather

preferred it than migration. Wherever women's SHGs⁷ existed along side the irrigation schemes, they were found to have made definite contribution. Some farmers who have utilised the facility of Kisan Credit Card⁸ appreciated the system a lot. The awareness of this or any other credit facilities provided by mainstream institutions is largely absent among the tribal people of the region. A significant proportion of the tribal families being defaulters due to faulty system of government in past are anyway not eligible for such credit facilities.

Farmers, especially the tribals in the interior area, have problems of getting good quality seeds. They normally purchase the seeds from the local markets where timely availability is a problem. Due to lack of literacy they are not able to check the authenticity of the commodities they purchase. Even the small dealers do not have any idea of storing fertilizers. In the market they were seen to be keeping urea in open bags kept under the sun, which is not a good practice. In West Singhbhum particularly it was observed that the dealers in the towns do not have any interest in educating the tribal farmers who approach them. The farmers in the villages told that the dealers scoffed at them when they asked about some medicines to save their crops affected by disease. Even the prices of agricultural commodities were found not to be authentic. Everywhere, the farmers were found purchasing diesel and fertilisers at prices higher than the prices fixed by government.

Lack of timely information is another important bottleneck. The illiterate farmers forget most of the information shared with them by PRADAN during the training programmes they organise. So the farmers should get the right kind of information on agriculture as and when they want it. In most of the areas, the dealers were found to be an important source of information for farmers. Two dealers, one in Kating near Jamshedpur and the other in Bodeiya near Ranchi, are doing excellent extension activities in their areas. They keep track of the yield of various crop varieties they promote. In Pithoria, the pocket of non-tribal vegetable growers in Ranchi, the dealers supply all the inputs on credit to the farmers. The farmers make payments without interests after they sell the produce. During a discussion with the Ranchi distributor of seeds and pesticides, it was opined that the dealers could play an important role in educating of farmers. Due to abundant flow of grants to the tribal areas in the form of a variety of schemes, the tribal farmers are hardly coming to the dealers. They were mostly interested in the free or subsidised commodities supplied by the government.

He observed that during the past 2-3 years, when the BPDP project slowed down, there was a tremendous growth in the interest of the dealers to acquire good quality products, and the total sale of agricultural inputs increased. He said that the dealers of farm inputs

⁷ SHGs (Self Help Groups) are informal groups of 10-20 women having similar socio-economic status engaged in providing saving and credit services to their members

⁸ Kisan Credit Card, offered to farmers under short-term credit introduced as per RBI/NABARD guidelines, provides a running account facility to farmers for meeting their production credit need and contingency needs. The scheme follows simplified procedures to enable the borrowers to avail the crop loans as and when they need. Minimum credit limit is Rs 3000/-. Credit limit is based on operational land holding, cropping pattern and scale of finance. Withdrawals can be made using easy and convenient withdrawal slips. It is valid for three years, subject to annual review.

should have appropriate know-how about various developmental efforts and schemes. In that case they would have been better strategy to educate farmers. He said that in his recent attempt to educate all his dealers in the use of latest pesticides, he had received overwhelming response. According to him the dealers will know more about the most cost-effective pesticides than the agricultural scientists. This is because of the reason that the scientists know only about those pesticides, which are approved by Indian government for sale in India. These pesticides are old. Now with the increasing control of multinational companies in research on global research on seeds and pesticides, research on pesticides is becoming very competitive. The companies are coming out with new products and are directly approaching the distributors for popularising the latest products, as getting approval from government takes a longer time. By the time approval comes the product becomes obsolete.

Many schemes face water shortages towards the later part of the winter season. Since there is sufficient water in the source in the beginning of the rabi season (water availability in the sources declines towards the end of the season), people sow crops in a larger area of land than what can be actually irrigated by the source over the entire season. So crop yield reduces due to water stress at the time of maturity of the crop. Again the response of the source depends heavily on the pattern of the rainfall, whether it is uniform and even or erratic over the years. It is very difficult to predict whether in a particular year the source would have enough water in March, as this would depend on the amount of winter rains. Low yield of crops caused by water scarcity further discourages farmers to use the irrigation facility.

6.4 Operational problems

The greatest weakness, observed in the schemes, was lack of transparency in the maintaining of accounts. In most of the schemes, the members are unhappy with the functioning of the accounts keeper. This has led to disputes. In Beltikri the members have changed the person thrice in 8 years for financial misappropriation. The members think that the accountant had spent the fund for his personal purpose, whereas the accountant says that the members do not conduct regular meetings for checking the accounts and ask for it only when a large sum of money is required for the maintenance. This has affected timely maintenance of pumpsets in many places. At times, the pumpset is run without regular maintenance. This reduces the discharge and increases the cost of repairing on a later date. In the case of schemes controlled by a few progressive farmers, the problems are less. The Senha Barwatoli nontribal group has come up with a very unique idea to avoid the problem of fund misappropriation. They have stopped collecting the water charges hourly. It is collected as and when required. However, this may not be feasible for the poorer groups.

Since the irrigation coverage is quite low in Jharkhand the practice of **free grazing** after the *kharif* season is quite prevalent. Though the farmers take the benefit of irrigation change the practice to controlled grazing, the neighbours do not find any incentive to do so. This is a demotivating factor for tribal communities to go for irrigated agriculture. In Landupoda village, the people reported that when they seized the cattle of the upper caste community for grazing their crops, the later took their cattle back forcibly without any subsequent change in their irrigated practice. Moreover, in West Singhbhum six irrigation

villages have stopped taking crops in their fields, due to severe damage of the crops caused by elephants. In spite of their continuous complaints the forest department has not taken any preventive measures. Where more farmers take crops, the burden of guarding crops is shared among themselves. The influential communities in the locality, however, have been able to pressurize the adjoining villages against such practice.

On the whole it was observed that the problems of the well performing schemes/groups performers are totally different from those of the non-performers schemes. While non-performers complain about increased price of and cattle inputs grazing, performers demand better infrastructural support.

7. Analysis

From the above discussion, amongst the various factors favourable for irrigation, personal traits and exposures look important ones. People having a flair for working in their own locality as against emerge as the most migrating have, over the years, improved their performance. They also have developed their capacity to assess risk before experimenting with and investing in irrigated agriculture. The other and perhaps the strongest influencing factor for tribals is the presence of innovative farmers in the family or among the relatives as was revealed in case of village Dumerdiha and interaction with a progressive farmer, named, Mr Charo Bhagat. Mr. Bhagat himself is a good farmer and has helped all his brothers to do well in agriculture. In Chainpur village, it was a single women who came from a very progressive village who changed the agricultural practice in the whole village . Factors constraining high performers from even doing better are lack of easy accountability of credit, transport problems and increase the area under irrigation.

Among the different categories of irrigation groups, the poor performers are those who cultivate the *kharif* crops with very little investment. They are dependent on earnings from waged labour and migration for a living. They are those who have failed once or twice when tried in irrigated farming and hence wary of investing in inputs. They are traditionally not agriculturists and used to have other sources of livelihood. People, who are obsessed with alcohol, prefer wage earnings to agriculture for a regular cash flow. Lack of exposure to good irrigated agricultural practices, ignorance of suitable crop inputs, insufficient use of organic manure (not enough bio-mass available), insufficient family labour, poor leadership in the village or more powerful neighbouring villages that makes grazing problem difficult to handle are the key hurdles before the farmers in transition.

Based on the above analysis, factors that contribute to a successful irrigation scheme can be summarised as:

- At least 5-10 educated farmers who are either educated or having high level of awareness, as central, who are preferably youths, committed to agriculture and having lands in the command area
- Assured water source

- The command is in medium upland and upland rather than lowlands, and has clayey soil
- High stake since the beginning as in case of a loan financed scheme
- Appropriate crop introduction with a package of practice, agriculture training and exposure and motivational camp;
- Access to timely credit;
- Access to information on agriculture;
- Good backing by good farmers around;
- Sound infrastructure with proper water storage, machine installation and distribution channel
- Reliable irrigation service

Similarly, the *characteristics of users* may be summed up as:

- High to moderate dependency on agriculture as opposed to wage earning
- Educated youths (30-40 age group);
- Aware youths in the age group of 30-40;
- Previous knowledge/exposure to improved agricultural practices;
- Sufficient (3 or more) family labour;
- More than an acre of holding in the command area per family;
- Little surplus from existing rainfall farming production and under stress to meet the increasing needs of the family
- Has somebody in the family or among the relatives who is good in agriculture
- No secured jobs

Wherever irrigation facilities were provided, it was noticed that different sections of community exhibited different levels of interest in irrigated agriculture. The response is substantially linked to the existing livelihood patterns. Based on the analysis of the characteristics of users and nonusers of irrigation facility the following *classification of tribal population along a continuum* can be made.

1. Forest, local wage and agriculture dependent: They are located near the forests and NTFPs are an important source of livelihoods for them. Each family earns a cash income of Rs 2000-5000 a year from the sale of NTFPs apart from using it for household needs. Their agricultural practice is quite poor and use of chemical fertilisers is almost absent. They take rabi crops like wheat, lentil, black gram and the like without irrigation. Even though on an average they own two acres of land due to low productivity they get around 4 months' food from own land. The balance is met from wages. Middlemen use them for NTFP collection and bidi making. Their response to irrigation, mainly lift that needs capital on a regular basis, is generally poor. In West Singhbhum villages (Kokrobaru, Indrua, Banamgutu, Kansara and Kustuiya) lift irrigation schemes implemented for such community are hardly in use. Though the schemes of Masiyatu and Bariyarpur are continuing due to regular influence from PRADAN, still yields are extremely low. In each such village, however, a few families are always found to be better agriculture than others and are interested in irrigation facilities. Then holdings are often too fragmented to plan a single scheme for the irrigation for the entire family. In village Rud Hargara the farmers with fragment holding use the tanks with personal pumpsets to irrigate their fields.

2. Agriculture and migration dependent: They have been migrating seasonally for around six months every year to distant places in West Bengal, UP and North Eastern states for many years now. They mainly work in brick kilns and construction sites. The middlemen spread over the entire area "book" them in advance by providing cash during the stressful *kharif* season. They return just before the rainy season primarily for shelter, with around Rs 5000/- per person, and take *kharif* crop without much investment. They neither use high yielding varieties nor chemical fertilisers. Some of them, who migrate with entire family, do not even own bullocks. Due to the pressure of children education of children and maintenance of family assets, women members are left behind now a days. These women do not take up agriculture even if they have holdings in the command area as they lack capital. They rather work in others to earn wages to take care of the regular cash ___ buying oil and spices. Such families are found in almost all tribal villages and they seriously lack agricultural skills. Very low level of literacy is also quite common among them.

3. Agriculture, local wage and migration dependent: They are the communities in transition to settled agriculture. Some of the families who migrated to work in the agricultural fields of UP, West Bengal and Punjab picked up certain skills and tried to accumulate capital for investment in their own fields. Some of them were influenced by the improved practices followed by the fellow village men. Lack of experience and capital coupled with ignorance has several times led to failure in securing remunerative returns. As a result, they are still unpredictable. However, they have started using HYVs with some chemical fertilisers. The youths from such families still migrate to bring more cash for agriculture. But, of late, due to spread of venereal diseases, the villagers are discouraging the young men from migrating. In Danru village of Lohardaga, in one of the meetings the villagers pressurised the middlemen in a meeting to take only the aged with them. Even though they are not the first to use the irrigation facility, they go for irrigated agriculture after seeing others benefiting from it. They also work as farm labourers for others while taking crops in their own land that brings around Rs 3000/- to each family. Local wage earners many times are addicted to alcohol.

4. Agriculture dependent: Historically they have never migrated and were fully dependent on agriculture as the main source of livelihood. In the past they were leasing in others land which were lying fallow, to grow more grains. So when the land base reduced they constantly struggled to grow more in every piece of land. Migration is not an option for them as they hardly can do the hard labour involved in the activities engaging migrants. They have gone for the use of improved varieties and cultivation practices. Wherever feasible, they have gone manual irrigation from the existing sources. Mainly they grow vegetables to meet the regular expenses on groceries. Irrigation largely lures this category of people. There is a lot of scope for improvement even now in their agricultural practice.

Amongst these agricultural dependent communities there is a subcategory, which has large land holdings. They are able to raise enough to meet their grain and cash requirement by low labour intensive practices like broadcasting and low level of use of chemical fertilizers. They are least interested in irrigation. They mostly belong to the

families of traditional tribal leaders and do not believe external input in the use of chemical fertilisers and irrigation.

5. Agriculture dependent with improved practices: They mostly stay near the towns and other agriculturally advanced communities. They have improved their lands and gone for round the year agriculture with wells in the homestead. They have a much greater market orientation. They are used to quality seeds, fertilisers and pesticides. Their return from agriculture is quite comparable with that of nontribal agriculturists. They are usually educated and have been able to take advantage of the government schemes. The demand for irrigation among them is highest. A number of them own pump sets of varying capacities. These communities are rarely benefited by the schemes promoted by PRADAN. They were found in the villages Badla Mahadevtola of Lohardaga, Kaimba of Gumla, Madhuban of Dumka and Bodeiya of Ranchi.

The table below describes each kind of performer.

Table 6: Cropping practices, yields, income and needs of different categories of farmers

Category	%age of population in this category	Agricultural practices	Paddy Yield (t/ha)	Annual Income (Rs)	Needs for better agriculture
1. Forest, local wage and agriculture dependent	Location specific	No use of chemical fertiliser, poor husbandry of land	1	<12000	Land development, irrigation sources, better seeds
2. Agriculture and migration dependent	35	Only kharif crop with very little fertilizer	2	12000-15000	Protection of paddy, local employment, quality agricultural inputs,
3. Agriculture, local waged labour and migration dependent	50	Use fertilisers, lack knowledge of pesticides, grow vegetables	3	15000-20000	Capital, knowledge of agriculture, support to stop free cattle grazing
4. Agriculture dependent	15	Use HYVs, fertilisers and pesticides, grow varieties of crops with irrigation	3-4	20000-25000	Information on appropriate agriculture, market, credit
5. Agriculture dependent with improved practice	Location specific	Round the year agriculture, market oriented, improved irrigated agriculture with modern inputs	>4	>25000	Credit, better infrastructural facilities

The above classification of tribals based on their agricultural practices are relevant for formulation of strategies for promoting successful irrigation schemes.

8. Findings and recommendations

This section summarizes the major findings of the study based on the above analysis. This is followed by the recommendations

8.1 Major Findings

1. PRADAN had built the irrigation schemes in its endeavour to provide sustainable livelihood to poor tribal communities in Jharkhand region. The planning of these schemes has been ___in villages having water in the basis of the wealth ranking of families. Commands are chosen in such a way that the fields of the poorest are covered. At the start, essentially all the farmers who in and who contributed labour during implementations were included in the informal association manage the scheme. A few members are nominated to carry out the day-to-day operation of the schemes under the over all supervision of the group. Care was also taken to make the poor, the decision makers in the group. However, in the well performing groups the responsibility of managing the schemes was found to be with a small group of 2-5 persons, who are the progressive farmers with large stakes in the schemes. Their farming practices motivate the less skilled farmers and are therefore crucial for the success of the schemes. The groups, where the number of such farmers is less or their holdings in the command area are insignificant, are not faring well.

Based on the observations during the study the tribal farmers have been classified into five categories. The first two categories, mainly the forest dependents and the migratory community, normally are the nonusers of irrigation schemes. The third category uses the facility intermittently and the last two are among the largest users. The people who are used to wage earnings do not normally opt for irrigated agriculture in the initial years. Even if they do so due to free inputs or persuasion they are not able to sustain it. In order to influence them, apart from interacting with them closely to improve their existing practices, one needs to promote irrigation among the agriculture dependent community in the locality. The demonstration normally influences the wage earners to go for irrigation. In many places, the farmers earlier migrating to distant places were found to be using irrigation. However, they were not among the initial adopters. After seeing the benefit of irrigated agriculture they saved the money earned from migration and invested in agriculture. Poor performance of irrigation schemes was observed in the cases where income from forest produce and local wage earning constitute a significant scheme of the income.

Recommendation: Keen interest taken by enterprising farmers should be viewed as an asset and an advantage rather than as a sign of unhealthy intent. Irrigation groups have to be built around the core group of full-time farmers with good skills and stake.

There is no need to include every landholder in the command area, in the scheme as the potential beneficiary. The strategy should be to place the schemes with the fittest group of people. Others in the mean time can be helped to improve their present agricultural practices. From the observation during the study it appears that a positive demonstration on the ground can generate interest in more and more farmers from category two and three in the nearby locality. Afterwards their lands can be brought under irrigation.

The most important considerations for choosing the fittest can be the ability of the farmers to contribute an initial amount in proportionate to his landholding in the command initially. The membership in an irrigation group has to be limited to those who agree to contribute the initial amount decided by the group. An amount of Rs 2000/- per acre appears to be adequate as per the views of farmers gathered during the study. This amount may be kept in the bank as a fixed deposit against which members can avail of crop loans. In the case of a loan financed scheme this amount may be used to pay back the last instalment.

2. PRADAN has promoted these irrigation schemes, in an attempt to provide irrigation services to the poor families in the upper catchments, who have limited options for irrigation, tap water from small rivulets or tanks which normally are deemed unfit for minor irrigation schemes. These sources are vulnerable in later part of *rabi* and summer. So the design command area worked out on the basis of the capacity of the pumpset cannot be served by the scheme.

In areas where cropping intensity is increasing and where there is a demand for water even in summer the problem is more severe. Use of water during summer is on the rise in the well-performing commands as the summer crop is less susceptible to diseases and natural hazards. Initially farmers restrict themselves to only *rabi* since the capital required for summer cultivation is quite high. However, when they grow they attempt to take more and more crops in a year to reduce their vulnerability, as there is always an element of uncertainty regarding the crop yields. In the commands, where water is a constraint, it was observed that the few early entrants were using the source to its capacity and the access to water for summer cropping was denied to latecomers. So there is a difference in ownership between the farmers using the scheme in two seasons and those using it only in one season, later being irregular in paying their dues.

Recommendation: To decide the minimum area and nature of crops it can support in different seasons of an average year proper assessment of the irrigation source (whether perennial or seasonal and quantum of water available) needs to be made while planning the irrigation scheme. The command area and beneficiaries should accordingly be decided at the onset itself and shares should be allotted to the members for all the seasons. Afterwards, during the years of good rainfall the group may decide to sell water to other farmers interested in taking crops in the command area. This would generate additional revenue for the group. To minimise conveyance losses, pipelines should be provided for ___ of water to the fields instead of earthen channels, especially in the clayey soils.

3. Currently lift irrigation schemes are promoted in areas suitable for the set model, leading to installation of lifts in widely dispersed areas. This not only inhibits promotion of any support system for backward and forward linkages, but also restricts farmer-to-farmer extension. For example, the remote group in village Daldali was found to be struggling with the problem of machine repairing. Their operator could not pick up the skills during the training. Further distance makes it difficult to access mechanics in the

cities. As a result each time the machine went out of order it took a lot of time for them to repair it and the crops in the process got affected. Whereas the farmers in Masiyatu attribute the surrounding irrigation groups a great deal for influencing them to make use of the scheme. Moreover, in the agriculturally developed pockets of Madhuban and Nipania Koiritoli a lot of support from dealers, pesticide companies and government agencies was noticed to be flowing.

*Recommendation: A **cluster approach**, which involves selection of a group of contiguous villages and fully utilising the irrigation potential there with various means as suggested in ensuing point is proposed. While following the cluster approach coverage of the operational holdings of the motivated farmers under irrigation in the beginning is expected to create a demand among the poorer who get influenced by demonstration. The irrigation services should be extended to them subsequently. Progressive tribal (category 5) and nontribal farmers in the cluster, who engage labourers for farm operations, should also be offered required support to maximise irrigation utilisation. Such steps might hold back the section of the community that presently is migrating to distant towns in search of employment. As has happened in many places some of them on a later date may start using irrigation service to increase production from their land.*

For selection of clusters availability of water sources, tribal communities, marketplaces and banks should be considered. Villagers having access to market are a better choice for investment irrigation. The interior villages should be covered on a later date. Ideally the service area of a single bank located in a place that is or can be connected to distant markets should be selected as a cluster. Promotion of a cluster around a bank branch will make the crucial access to credit easier. The lone banker then may be made an important stakeholder to educate farmers about various loan schemes and provide timely credit. Often while deciding the service area of banks, accessibility of the branch is overlooked. It will be wise to select a service area where all the villages can access the place where market and bank are located. A cluster of villages coming under the service area of several banks will make bank transactions tedious.

Cluster approach will also help address many other concerns voiced by farmers during the study.

- i. It will be easier to tackle the problem of free grazing.*
- ii. Cluster mechanics can be promoted to support difficult irrigation groups.*
- iii. Since it is convenient to operate in a compact area, cluster approach may attract a number of agents like suppliers of pesticides and seeds, government officials, processing industries and so on, to extend their support.*
- iv. The people will be able to garner more support to demand infrastructural development in the area.*
- v. Generally speaking, popularisation of modern technologies can take place at a faster pace.*

4. In each village certain amount of land can be brought under irrigation through schemes of different sizes and that are based on both surface and ground water resources.

However, only with one model of lift irrigation, cluster saturation approach is unlikely to work. Even though there is no perennial water source in village Chainpur, around 150 acres of land is irrigated during *rabi* by 70 families from 200 dugwells.

Recommendation: The irrigation development interventions have to include wells, bore wells, tanks and lift irrigations of various sizes to bring maximum area of the villages cultivable land under irrigation. A comprehensive plan for each village in the cluster has to be prepared to benefit most of its residents. However, the plan should be executed in a phased manner taking in view the preparedness of the potential users. Considering the fact that there is a huge runoff from the region and ground water sources are limited, importance of water harvesting through tanks should be given highest priority to enhance irrigation. It will enhance recharge to ground water sources besides augmenting surface water availability during non-rainy season.

5. Presently the sources of learning for the farmers are limited. PRADAN professionals, most of whom are not trained in agricultural sciences, acquire required information and support the villagers mainly during the initial years. Again, their support is inadequate to address the day-to-day problems faced by the farmers. From the study it was learnt that progressive farmers in the village or the nearby villages could be the best trainers. Exposure of farmers to their fields has encouraged many. Moreover, tribal farmers were found to be very comfortable to learn from the people of their own community. Only the farmers in category (5) were found to have learnt from the nearby non-tribal community. The suggestions made by the farmers during the study toward equipping them with better agriculture skills, distribution of literature among the educated farmers, exposure and opening of information centre at *panchayat* level.

Recommendation: The approach should be to make more trainers or learning grounds available in an area during the support phase following the execution of the schemes. Activities such as exposure trips to successful schemes and introduction of a package of cropping and agronomical practices for crops need strengthening. While the need to bridge the knowledge gap is of utmost priority, sole reliance on formal training in advanced agricultural practices given the largely illiterate audience has adversely affected effective knowledge transfer. There is a need to recognise the value of intra-village and inter-village exchange of ideas. The strategy should leave scope for staggered entry of the risk averse poor as their confidence level with irrigated agriculture builds up and creating institutionalised support mechanisms for those who take it up. The cluster approach discussed earlier could be a powerful avenue for peer learning and a focal point for provisioning of services. In the selected cluster first a few successful irrigation schemes should be established by focusing on the most prepared community. The others, in the mean time, may be supported to improve their existing agricultural practices. They should then be extended the irrigation service once they are attracted by the success next door and became ready. The dealers, on whom the farmers' have confidence, on them should be selected in the area and strengthened to provide the required information. The study shows that they can be strong vehicles to carry messages to the farmers. The cluster approach will provide them a viable business too. Instead of sole reliance on NGO representatives the approach should take other possible actors on board. Farmers'

suggestions as enumerated above may be acted upon to increase their access to timely information.

6. In NGO promoted schemes a lot of time is invested in creating and installing certain systems related to operation and maintenance of the schemes. One person from each group is trained to maintain the accounts. The accountant is supposed to keep printed coupons to be sold to irrigators at a price decided by the group before each season. The irrigator has to give the coupons to the operator to get water and fill up diesel as per the use. The operator submits the coupons to the accountant for his payment at prescribed rates. For regular maintenance, the operator has to take advance from the accountant and settle it with actual bills as soon as the work is done. The accountant is expected to keep the balance money in the group's bank account and present the accounts before the group in weekly or monthly meeting. The leaders are trained in maintenance of minutes' books and other group documents.

In practice different systems were observed. Coupons (self made, not printed) are used only in a few places. In good groups there are no separate accountants. The operators provide irrigation after collecting the predefined charges and keep accounts. A group of 4-5 leaders, who are the key decision makers, check accounts from the operators at regular intervals and make his payments. For major repairs, when the group fund falls short of requirement, one of the leaders pays for it and subsequently the money is collected from the members. This ensures timely repair of pump-set. Group meetings are called only when some major decisions are to be taken. On the whole, better management was observed in the villages where agriculture is superior.

While enforcement of these systems claims a lot of time from the promoters, its role in determining ultimate success of the scheme was found to be limited.

Recommendation: Play down the strong desire to provide for all issues that are likely to arise in the course of running of the scheme, in advance and help users to develop ability to create systems that they find appropriate. Instead the more benefit they take from the scheme the more interested they turn out to be in creating and sustaining systems. So the whole approach should be centred on providing utmost gain to the users of the schemes.

The table below summarises the changes being recommended in the existing approach and other suggestions based on the understanding gathered during the field study and analysis of the data.

Table 8: Suggested approach with reference to the existing approach

Present approach	Suggested approach
<i>1. Selecting clientele</i>	
<ul style="list-style-type: none"> • Selection of poorest 	<ul style="list-style-type: none"> • Selection of the fittest through initial cash contribution for availing of the infrastructure, which will ensure more commitment from farmers
<ul style="list-style-type: none"> • Inclusion of all land holders in the group 	<ul style="list-style-type: none"> • Inclusion of only the stakeholders who contribute an initial agreed upon amount in cash
<ul style="list-style-type: none"> • Avoid better off to have more control over the scheme 	<ul style="list-style-type: none"> • Progressive farmers need to be included in the whole approach who are the best teachers for the rest
<i>2. Allocation of right</i>	
<ul style="list-style-type: none"> • A source suitable for installation of lift irrigation is taken and command area is worked out without strictly looking at the yield of the source 	<ul style="list-style-type: none"> • Assessment of command area across the three seasons, as per the yield of the source in an average year and allocation of rights to members accordingly. Provide pipes where conveyance losses in field channels are high.
<i>3. Cluster approach</i>	
<ul style="list-style-type: none"> • Schemes are scattered over a large area 	<ul style="list-style-type: none"> • Saturate the area in a cluster by tapping all its irrigation potential for maximising the impact
<i>4. Multi model schemes</i>	
<ul style="list-style-type: none"> • Promotion of a single model makes the schemes dispersed and villages without a perennial surface water source devoid of irrigation 	<ul style="list-style-type: none"> • For area saturation, strategy should be eclectic about technical approaches and institutional mechanisms and should experiment with a wide variety of approaches to promote irrigation provision

<i>5. Information dissemination</i>	
<ul style="list-style-type: none"> • Training on a few selected crops is undertaken along with irrigation provision 	<ul style="list-style-type: none"> • Training is still required but avenues for availing information should be diversified. Peer learning through both intra and inter village communication in a cluster approach in addition to exposure are helpful.
<ul style="list-style-type: none"> • Planned flow of information is only from the promoter to farmers and promoters set training and learning agenda on the basis of their assessment of the situation in consultation with the farmers. Besides it is doubtful whether one promoter can really acquire skills in diverse cropping systems and practices 	<ul style="list-style-type: none"> • Instead of an one time injection of information, farmers' need is to have on-going assistance. Involvement of actors such as the seed dealers, pesticide agents, government extension workers and the like may equip farmers better and only a critical number of farmers practising intensive agriculture can make it viable for other actors to take an active interest in promoting new techniques
<i>6. Need for de-emphasising</i>	
<ul style="list-style-type: none"> • Great emphasis on systems to be followed by the groups 	<ul style="list-style-type: none"> • Emphasis should be more on utilisation of infrastructure than <u>operationalising</u> systems

9. Conclusion

Benefits of irrigation can not be overemphasized. Irrigation not only brings more income to farmers but also improves the husbandry of land resources. Economic survey of 1997-98 has rightly pointed out that the yield rates have reached a plateau in agriculturally developed area and hence attention ought to shift to those regions where production is well below the average. Jharkhand is one such region, where despite an average annual rainfall of 1326mm, only 9% of net sown area is irrigated. Scope for expansion of irrigation is enormous here. Considering the large proportion of families living below the poverty line including tribals, who mostly hold lands, the need for irrigation development is very high. In the absence of employment opportunities in the vicinity, most of these families presently migrate to distant towns after the kharif season. This has not only affected education of children but also caused health hazards. In return they do not even get enough to make both ends meet. The poor economic condition has restricted private investment in irrigation. So the government now needs to address the issue of irrigation development on a priority basis. Small-scale community managed irrigation schemes that make use of both surface and ground water resources in a conjunct has a definite role to play in the economic development of poor people in the state, who are living in the uplands and whose holdings are not irrigated by major and minor irrigation projects.

The present study indicates that the farmer find such schemes extremely viable. An additional income of Rs. 8000-10000 a year, as revealed by the study for the users, is quite significant for the poor families. This would bring many of them above the official poverty line, presently drawn at an annual income of Rs. 24000. Due to reduction of dependence on forest and increase in drudgery during migration, the tribal farmers' of (foremost choice) for employment more often than not is irrigation, which is next only to secured jobs.

A myriad of problems have restricted the farmers from taking the full benefit of these irrigation schemes. The most important factor that came out as affecting the viability of these irrigation schemes was the selection of farmers. Projects built around the farmers having interest in agriculture appear to be more successful than those that are in the hands of unenthusiastic farmers who are lacking basic agricultural skills. Their association in addition to higher utilisation caused noticeable impact, much more than the formal training events, on the farming practice of poor performers.

The study also helped to understand that with a single model for irrigation development and too many criteria for solution of beneficiary villages and groups, the schemes get scattered over a large area. The study argues that an approach to fully utilise the irrigation potential of a cluster of villages with a mix of schemes rather will improve farmer-to-farmer learning, backward and forward linkages and solidarity to fight against menaces like free grazing.

Now a concerted effort can be made in various parts of the state where keen actors are available with relevant experience. Each actor can select a cluster in its operational area for promotion of irrigation. While selecting the districts along with consecrations such as presence of enthusiastic actors, physical consideration such as evaluation sufficient ground water may also be considered. Conjunctive use will make saturation of easy. As per the data of CGWB, pockets in East Singhbhum, Giridih, Godda, Palamu and Sahebganj have good groundwater potential for tubewell construction. Presently Swarnajayanti Gram Swarojgar Yojana (SGSY) and Watershed Development Programme (WDP) are the major poverty alleviation initiatives in the states. While the former is a loan plus subsidy scheme, the later is a full grant scheme. Utilisation of funds under WDP for water resource development and that under SGSY for irrigation infrastructure development together, targeted at all sections of community in a given region, will make an all-inclusive approach.

Such an attempt to promote irrigated agriculture among the poor, especially the tribals, of Jharkhand certainly can go a long way in improving their living standards and hence the economy of the state. As such, a long-term strategy for development of the state strongly demands realization of its potential in agricultural production. Raising the incomes of poor families through enhancing the productivity is the most direct route towards achieving agricultural growth. Unless the economic development of its people is brought about, the battle is only partly won by the formation of a separate State.

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Annexes

ANNEX A: Informal survey checklist

The following checklist was used to guide the informal interviews held with the former beneficiaries of the irrigation scheme during the study.

1. How is the village located in relation to markets?
2. How many families are there in the village and what is the caste break-up?
3. How old is the irrigation scheme and what is the scheme size?
4. How was it started?
5. What is the coverage of the irrigation scheme?
6. How many households have lands in the command area and how many used it in different years and from which wealth category they are?
7. How does the group manage the irrigation system?
8. How much do users pay towards irrigation?
9. What are the major problems encountered by farmers to practice irrigated agriculture?
10. What are the different crops grown during *kharif* and irrigation seasons?
11. What levels of input use, yields and profit do farmers get in both *kharif* and irrigation seasons? Is it uniform across farmers?
12. How easy or difficult it is to procure input and sell produce?
13. What do members perceive about the irrigation service available to them?
14. Who are presently using the facility? How has been the trend since beginning?
15. Why are not the rest using it? Why don't the problems that the nonusers have stop users from using them?
16. How can the nonusers be made to use the service?

ANNEX B: List of villages visited during the study

Region	SI no	Scheme name	Tribe	Irrigation type	Whether in use	
Central Lohardaga and districts)	(Ranchi, Gumla	1	Salgi Chhapartoli	Oraon	PRADAN LI	Functioning
		2	Danru Pahantoli	Oraon	PRADAN LI	Functioning
		3	Danru Pujartoli	Oraon	PRADAN LI	Functioning
		4	Masiyatu	Oraon &Turi	PRADAN LI	Functioning
		5	Butgorwa	Manjhi	PRADAN LI with loan	Functioning
		6	Kurag	Oraon	PRADAN LI	Functioning
		7	Sehal Bansitoli	Oraon	PRADAN LI	Functioning
		8	Tengria Nawatoli	Oraon	PRADAN LI	Functioning
		9	Chhota Danru 1	Oraon	PRADAN LI	Not in use
		10	Chhota Danru 2	Oraon	PRADAN LI	Not in use
		11	Drankel Mahuatoli	Munda	PRADAN LI	Not in use
		12	Senha Barwatoli 1	Nontribal	Govt. LI	Functioning
		13	Senha Barwatoli 2	Oraon	Govt. LI	Functioning
		14	Guyu	Munda	World Vision irrigation	Functioning
		15	Rud Hargara	Oraon	PSI promoted tank	Functioning
		16	Bodeiya	Oraon	Individual wells	Functioning
		17	Badla Mahadevtola	Oraon	Individual wells	Functioning
		18	Chainpur	Nontribal	Individual wells	Functioning

Region	Sl no	Scheme name	Tribe	Irrigation type	Whether in use	
South (West Singhum district)	19	Kokrobaru	Ho	PRADAN LI	Functioning	
	20	Kundubera	Ho	PRADAN LI	Functioning	
	21	Banjhikusum	Ho	PRADAN LI	Functioning	
	22	Dumerdiha	Ho	PRADAN LI	Functioning	
	23	Landupada	Ho	PRADAN LI	Functioning	
	24	Kustuiya	Ho	PRADAN LI	Not in use	
	25	Banamgutu	Ho	PRADAN LI	Not in use	
	26	Ulijhiri	Ho	PRADAN LI	Not in use	
	27	Pandubadi 1	Ho	ASRA LI	Functioning	
	28	Pandubadi 2	Munda	ASRA LI	Functioning	
	29	Otar	Nontribal	Govt. borewell	Functioning	
	North (Godda and Dumka districts)	30	Baghakol	Nontribal Santhal	& PRADAN LI	Functioning
		31	Beltikri	Santhal	PRADAN LI	Functioning
		32	Bariyarpur	Santhal	PRADAN LI	Functioning
		33	Daldali	Santhal	PRADAN LI	Not in use
		34	Pathalgama	Nontribal	Individual borewell	Functioning
		35	Madhuban	Santhal	Individual wells	Functioning
		36	Mahulbana Nijhrtoli	Santhal	Govt. tank	Functioning
		37	Sulanga	Santhal	Govt. tank	Functioning
		38	Bhurkunda	Nontribal	BHALCO owned LI	Not in use
		39	Nipania Koiritoli	Nontribal	Individual wells	Functioning
		40	Murbhanga	Santhal	AAA LI	Not in use

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