Canal Irrigation Management by Tribal Communities: Case Study of AKRSP(I) Supported PIM Societies in South Gujarat

Aditi Mukherji*

Shilp Verma*

Prabhat Rath+

* IWMI - Tata Water Policy Programme

\+ AKRSP(I)

Preface

Though there have been successful initiatives in Participatory Irrigation Management (farmer managed canal irrigation systems) since the 1970's, the work done by AKRSP(I) in South Gujarat has been unique in the sense that there are few cases of tribal farmers taking up PIM in the country.

This case study on AKRSP(I) supported Participatory Irrigation Management societies in south Gujarat was carried out as part of Central India Initiative, a collaboration between the International Water Management Institute (IWMI) – Tata Water Policy Programme and NGOs to understand what stimulates and what inhibits demands from tribal groups to access modern technologies related to agricultural irrigation as a means of livelihood. The four irrigation societies that were studied have shown that there has been significant improvement in the livelihoods of tribals who have adopted irrigated agriculture in south Gujarat and that irrigated agriculture has become central to their livelihoods.

We hope that this case study will offer lessons to others working to improve tribal livelihoods in Central India.

Apoorva Oza
Chief Executive Officer

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Aditi Mukherji
IWMI-Tata

Shilp Verma
IWMI-Tata

Prabhat Rath
AKRSP (I)

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Abstract

Provision of irrigation has been thought to be crucial in improving the livelihoods of millions of tribals in Central belt of India, who are locked in perpetual poverty. Green Revolution Technology, which has been at the heart of India's agricultural development, has more or less bypassed the tribal population. For one, irrigation infrastructure is inadequate in the tribal regions and again when irrigation infrastructure is made available, the tribals do not seem to make adequate use of them. Creating demand for irrigation among the tribal farmers seems to be most important challenge. It is in this backdrop that we undertook our case study in a tribal dominated block of Gujarat. Unlike the other tribal dominated areas (Jharkhand and Chattisgarh), the tribals in our study area were third generation farmers and therefore they faced no cognitive barriers in adopting irrigated agriculture. They are also as skilled a farmer as any other, which is reflected by the fact that there are no discernable yield differences between a tribal and a non-tribal farmer. We studied four canal irrigation schemes, which have been all turned over to the farmers at the behest of AKRSP (I)'s intervention. All these four schemes are tribal dominated, some of them are completely so, others have a handful of non-tribal population. The schemes we studied were Pingot RBMC, Baldeva LBMC, Pingot LBMC and Issar Minor Irrigation scheme. Our results confirm that irrigated agriculture has brought about tremendous benefits to a tribal farmer in the form of yield increases, higher cropping intensity, lower out migration and higher wage rates within the village. The trajectory of change for a typical tribal farming has been from cultivating local paddy in Kharif and migrating in Rabi and summer to cultivating hybrid paddy in kharif and irrigated groundnut or moong in summer. Irrigated agriculture has become central to their livelihoods and this in part explains why Participatory Irrigation Management (PIM) has been more or less successful here. However, the non-tribal farmers have benefited more from PIM than tribal farmers, because they shifted to very lucrative sugarcane farming. The non-tribals (Patels) have also played a significant role in these irrigation co-operatives in that they have provided the much needed "demonstration effect" of profitability of irrigated agriculture. AKRSP (I)'s role as facilitator of PIM in Pingot RBMC and Baldeva LBMC has been acclaimed nationally. But we propose that the success of these two schemes lies in the creation of Pingot LBMC society, where tribal farmers came forward on their own and formed irrigation society to take over management of the canal system. The very fact that an all-tribal farmer group could successfully replicate PIM experiment in Gujarat that was started with Pingot RBMC and Baldeva LBMC is a proof enough for the success of PIM as a whole. We also propose that in the long term, the sustainability of PIM will depend on the overall profitability of irrigated agriculture and therefore efforts should be made to make farming a more profitable venture for the tribal farmers. Encouraging them to shift to highly lucrative crops such as sugarcane and orchard crops could perhaps make irrigated agriculture more profitable in future.

Background and Rationale

Assured irrigation has been one of the crucial elements of the Green Revolution Technology (GRT), which in turn led to rapid growth in agricultural sector over the past three decades (Hazell and Ramaswamy, 1991). However, this growth has not been uniform across crops and regions (Bhalla and Singh, 2001). In the late 1980's, the Eastern and the Southern parts of the country caught up with Punjab and Haryana and registered high growth rates in food grain production, thereby ushering in the second phase of green revolution in the country. However, with a view of increasing food security, most of the investments in irrigation occurred in so called favourable areas (plains and deltas). This was specially so in case of large canal irrigation projects, where many tribals living in the upper catchment areas were displaced so that large dams could be built to serve non tribal farmers down stream. The GRT more or less bypassed the tribal population in the country, who are concentrated in the central belt of India, from Gujarat to Jharkhand. For one, irrigation infrastructure was inadequate in the tribal regions (characterized by forests, undulating terrain and heavy rainfall) and again when irrigation infrastructure was available, the tribals did not seem to make adequate use of them (personal communication Satpathy of PRADAN). Creating demand for irrigation among the tribal farmers seems to be most important challenge for most NGOs working with them. There is very little doubt that adoption of appropriate irrigation technology will bring about positive welfare changes among the tribals. But the pertinent question is: what set of interventions are likely to create the desired result? In this context, one has to remember that tribals are as diverse a group as any other, and no one set of intervention is likely to work across regions and tribes.

It is in this backdrop of relative backwardness of tribal regions in terms of irrigation infrastructure and relative lack of demand for irrigation among them that we took up our case study in a tribal area of Gujarat. This is one of several case studies undertaken under the action based research program called Central India Initiative.

Our case study is unique in many respects. For one, we shall be studying the impact of canal irrigation on tribal livelihoods. Not many tribal areas have canal network, primarily because the geo hydrology of most tribal inhabited areas does not favor canal construction. As already noted earlier, tribals are in most cases victims of mega canal projects, because they have to leave their home and hearth, which gets inundated due to a large dam constructed downstream. Narmada dam is one such example. Secondly, we shall not only study the impact of canal irrigation on the tribals, we shall also study how these tribals have managed these irrigation systems. This is because; the farmers themselves are managing all the study systems as a part of ongoing Participatory Irrigation Management (PIM) initiative of the Government of Gujarat. We shall also study what role a NGO like AKRSP (I) has played in helping tribal farmers manage these schemes.

We have already said that surface flow schemes are relatively rare in tribal dominated areas. Even then, according to Minor Irrigation Census (GOI, 1993), there are over 50,000 minor surface flow schemes in undivided Madhya Pradesh, which is the heartland of tribal population in India. These schemes have an irrigation potential of 0.65 million hectares, of which actual utilization factor is 63%. In addition, major and medium schemes irrigate 1.08 million hectares, which is almost 11 percent of the total area irrigated by major and medium schemes in the country[1]. It is very likely that majority of these schemes are in tribal dominated districts of Madhya Pradesh and

[1] It excludes states of Gujarat, Karnataka, Tamil Nadu and Karnataka for which MI Census (1993) was not conducted.

Chattisgarh. Therefore, the scope for replicability of PIM in canal irrigation exists even in tribal areas. This justifies our study to a large extent. Even, without the scope of replication, our study is justified, if we can break the myth of tribal indolence, which is primarily said to be the reason for lack of demand for irrigation among tribals (IWMI et al, 2002)

Our study has therefore two important components. Firstly, we shall analyze the impact of irrigation on tribals. Secondly, we shall also study how the tribals in our study area are managing these canal irrigation schemes. This will be therefore a study of efficacy of PIM in a tribal dominated area.

Research Questions

Based on our underlying assumption that provision of assured irrigation is key to enhanced productivity and that more such irrigation interventions are needed in tribal regions, we framed our research questions. They were

1. What are various channels through which irrigation affects tribal livelihoods?
2. How do tribal farmers benefit from irrigated agriculture vis-à-vis the non tribals and what are the intervening variables that could explain tribal-non tribal disparity, if any?
3. What is the demand for irrigation among the tribals?
4. How do irrigation schemes that have been transferred in tribal dominated areas perform in terms of key performance indicators?
5. What factors determine their success and failure?
6. What could be the role of other stakeholders in the process, viz. NGOs like AKRSP (I), Government and Funding Agencies?
7. What are the policy implications of this PIM programs, with special reference to tribal welfare?
8. How can we make such efforts replicable in other tribal dominated areas?

Data, Coverage and Methodology

We have studied 4 irrigation schemes. Initially, we had planned to study 5 systems, including one called Dholi in Jhagadiya Taluka of Bharuch district. This is a system where a dam was constructed some 10 years back, but so far there has been no irrigation. AKRSP (I) is now involved in forming irrigation society in this scheme. We had included this as a control sample to see what is the typical cropping pattern in a tribal dominated area where there are no irrigation sources. However, after data collection, we saw that though canal was not operational, a lot of tribal farmers had their own source of irrigation and were growing sugarcane and few even took summer crop like groundnut and moong. We had wanted to capture dynamics of rain fed farming by tribals and this did not therefore seem to be a very suitable control and we dropped it from our analysis. All the rest systems are either minor or medium canal irrigation projects located in the pre dominantly tribal blocks of Bharuch and Surat respectively. All these systems are managed by irrigation co-operatives. Table 1 shows the location, status and degree of AKRSP (I) involvement in these systems.

Table 1: Location of irrigation schemes under study and degree of AKRSP (I)'s involvement

Name of the System	Minor/Medium	Block/District	Degree of AKRSP (I) Involvement
Baldeva LBMC	Medium	Valiya/Bharuch	Withdrawn
Pingot RBMC	Medium	Valiya/Bharuch	Withdrawn
Pingot LBMC	Medium	Valiya/Bharuch	Never Directly Involved
Issar	Minor	Mandvi/Surat	On Going

Given our rather detailed research questions, we decided to rely on multiple sources of data. Firstly, to acquaint ourselves better with the systems, we undertook a weeklong fieldwork (field notes are appended at the end, Appendix 1). During our exploratory field visit, we talked to farmers (mostly tribals), committee members of the irrigation societies and AKRSP (I) staff members who were directly involved in the transfer process. Our open-ended conversations with the farmers gave us considerable insights and enabled us to formulate a questionnaire, which we then administered to the farmers. We took care to select our sample keeping in mind that there was adequate representation of tribal and non-tribal farmers in proportion to their population and also farmers from head; tail and middle reaches were selected. Similarly, we endeavored to keep few non-members of irrigation societies in our sample. However, at the time of writing this report, we had not received society wise details and not all individual questionnaires were returned to us. We shall include those in our next report. Break up of our present sample is shown in Table 2.

We compared the four societies based on some basic performance indicators, such as area irrigated as percentage of CCA in the last few years, types of crop grown, average yield of crops, number of irrigations made available, total collection of water fees etc. In addition, we have also described the mode of water distribution, water rates and membership criterion across systems. For detailed information on each of the systems, we would urge readers to refer to the field notes appended at the end of this document. In the paper, we will limit ourselves to comparisons among systems, instead of describing any one system separately.

We have divided our paper into following sections. In the next section, we shall describe the benefits of irrigated agriculture and the various channels through which such benefits have accrued. After that, we shall briefly discuss some pertinent issue involved in PIM and why it is such a challenge everywhere. This will involve review of literature from known cases of success and failures. In the section following that, we shall briefly discuss each irrigation society, their genesis and compare them with each other. In the final section of our study, we shall report our key findings and their policy implications. We shall also suggest few policy changes, which could perhaps hasten transfer and make it a better proposition for the farmers. In this context, we shall specially deal with rehabilitation issues, as it seemed to be the bone of contention among the irrigation societies and the government in many instances.

Irrigated Agriculture and the Tribals: Is there a lack of Demand?

Evidences from tribal belt across India (especially Jharkhand and Chattisgarh) suggest that tribals prefer "risk averse migration" to "entrepreneurial irrigated farming[2]". Does this hold true across tribes and regions? Our study in South Gujarat

Table2: Sample size and characteristics

Scheme	Sample size	Tribal farmers	Non tribal farmers	Head farmers	Middle farmers	Tail farmers	Members	Non-members
Baldeva LBMC	20	16	4	12	4	4	16	4
Issar	27	27	0	10	8	9	25	2
Pingot LBMC	23	19	4	4	16	3	20	3
Pingot RBMC	17	15	2	5	8	4	17	0
All	**87**	**77**	**10**	**31**	**36**	**20**	**78**	**9**

[2] Quoted from a mail by Dr. Tushaar Shah of IWMI to Rajesh Mit of PRADAN (dated September 10, 2002). To quote "In this general scenario where tribals prefer risk averse migration to entrepreneurial irrigated farming, we need to look for and find out rare situations where some tribal households/communities have treaded a different path.

tribal belt does not confirm this general hypothesis. For one, unlike the Santhals and Gonds of South Bihar, the Bhils of South Gujarat are a more progressive people (used in the general sense that agriculture is considered to be a more advanced from of occupation than forest based livelihoods). In our study area, the predominant tribes are the Vasavas and the Chowdhuries. They are all third generation farmers. The Chowdhuries are more progressive than the Vasavas in that they own more land in general and are economically better off. Agriculture is the chief occupation of all tribals in this region. Many of the villages have fishing cooperatives run by Vasava tribes while Isar fishing co-operative society is being run by Chandhary tribes. In fact, a fishing co-operative is the first society that comes up after a dam is built, irrespective of whether there is a irrigation society or not.

As already mentioned, we studied 5 systems, of which 4 are functional. The villages lying in the command area of these systems are tribal dominated, some are 100% so, and others have small non-tribal population. Most of the non-tribals are Patels from Saurashtra and they have settled here in the last 20 to 30 years. In Dholi irrigation system (where canal irrigation has not started yet), we found that 15% of the tribals have their own source of irrigation and few grow summer crops like groundnut and moong. This was quite unheard of some 10 years ago. In fact, we collected before irrigation cropping pattern data in the other 4 systems we studied. These systems are Baldeva LBMC, Pingot LBMC, Pingot RBMC and Issar. Before irrigation cropping data was based on farmers recollection. It showed that only a very few (only 3 out of 77 tribal farmers) had access to own irrigation sources (dugwells) and could take a rabi crop of wheat or vegetables or jowar. The Patels did have own bore wells and some grew sugarcane. However, the present situation in Dholi suggests that tribals have come a long way from rainfed farming, at least in this region. But, it must be noted that Patels still own and operate majority of the wells and bore wells in the villages and that a village with mixed tribal non-tribal population (as Baldeva) has a far greater number of wells and bores compared to a 100% tribal village. The Patels from Saurashtra have acted as "demonstration effect" and many tribal farmers who could afford private sources of irrigation have done so. This is quite evident in Dholi system. But let there be no gainsaying the fact that tribals have far lesser access to private groundwater irrigation than that Patels have. Diesel engines are used to directly lift water from canals, or rivers, while the group wells have been constructed by either AKRSP (I) or BAIF to help in conjunctive irrigation. Again, there are relatively more number of wells and bore wells in the tail end of the canal command. Table 3 sums up the population characteristics and access to other sources of irrigation in our study villages.

Table 3: Population characteristics and access to other sources of irrigation in study schemes

Irrigation System	Number of Villages Covered	% of Tribal Population to Total Population	Other Irrigation Infrastructure		
			Dug Wells and Bores	Diesel Engines	Group Wells
Baldeva LBMC	6	80%	440	58	0
Issar	3	99%	95	64	2
Pingot RBMC	3	95%	78	62	3
Pingot LBMC	6	88%	112	71	0
Dholi	6	99%	53	25	0

Based on village questionnaire survey

Therefore, unlike the other tribal regions, demand creation for irrigated agriculture did not seem a major issue in the systems we studied. In most AKRSP(I) supported projects three seasonal cropping is in practice. Whenever reservoir is full, excess of demand over supply is not a major issue.

Benefits of Irrigated Agriculture

Irrigation has been seen central to ensuring food security on the one hand and poverty alleviation on the other. The various channels through which irrigation is expected to benefit the poor are through improved yields and cropping intensity for the poor farmer, lower food prices for the poor net buyers in both urban and rural regions and through spin-off effect of increasing wage rates, increased availability of wage employment and increased demand for goods and services etc. Tribals are one of the poorest communities in India. In our study villages as well, tribals are poorer than the non-tribals. On an average, a tribal farmer never owns more than 5 acres of land, while a non-tribal one invariably owns more than 10 acres, if not more. Quite predictably, the lion's share of benefits from irrigated agriculture has accrued to the rich Patels, because they have shifted to lucrative sugarcane cultivation, while the tribals have not shifted to sugarcane. Nevertheless, the tribals have benefited in that they can grow two crops (at times even three) as compared to only one crop before irrigation. At the same time the cost of cultivation has gone up, because they now use more market based inputs than before. But in sum, benefits are greater than costs. The channels through which the tribals have benefited are the following:

1. Cropping pattern changes, yield increases and higher cropping intensity
2. Increase in wage rates in the village and longer duration of work available
3. Reduction in migration during lean season
4. Other incidental benefits as increased fodder availability, rise in land prices etc.

Cropping Pattern Changes

The most obvious benefit has been change in cropping pattern and cropping intensity. Our findings are based on cropping pattern of 87 farmers across 4 irrigation systems. We had asked them to recollect their cropping pattern the year immediately before canal water was available and their cropping pattern during the last irrigation season. Since the before data is based on recall survey, it might not be very accurate, but we are reasonably sure that it captures the broad picture.

Before irrigation, almost all the tribal farmers took only one kharif crop. However, inter cropping is a prevalent practice here and in most cases, a farmer could grow paddy along with jowar and tuver. Some progressive farmers also grew soybean along side. Very few farmers took rabi crop of jowar and vegetables. It was possible only if they had their own dug wells. There was no summer crop at all. Typical cropping pattern of a tribal farmer practicing rain fed agriculture was local varieties of paddy, tuver and jowar, all grown in the same field or separately. Yields were predictably low. Few rich Patels grew sugarcane with bore water. But not many Patels could afford it either as it seemed a costly proposition to them. The cropping pattern and crop combination changed drastically after canal irrigation. Kharif still remained the preferred season of cropping, but in addition majority of the farmers took to summer crops of groundnut and moong. Gross cropped area increased, as did cropping intensity. Now, a typical tribal farmer would grow paddy (HYV), tuver and jowar in kharif and either groundnut or moong in summer. Most prefer groundnut to moong, as it is a more profitable crop. They have also shifted to HYV of paddy and consequently the yields are higher than before. The cropping pattern changes before and after irrigation and shown in Table 4 and 5.

Table 4: Season wise area under cultivation before and after canal irrigation

Area in acres

Season	Before Irrigation		After Irrigation	
	Total area	% to total	Total area	% to total
Kharif	375.7	84.39	341.1	53.38
Rabi	25.5	5.73	29.7	4.65
Summer	0	0.00	198.2	31.02
Bi annual (Sugarcane)	44	9.88	70	10.95
Total	**445.2**	**100.00**	**639**	**100.00**

Table 5: Season wise and crop wise area under different crops before and after canal irrigation

Area in acres

Crops/Season	Before Irrigation	After Irrigation
KHARIF SEASON		
Paddy	138.68	141.20
Tuver	89.03	53.83
Jowar	59.99	31.94
Soyabean	32.00	38.20
Cotton	22.25	24.65
Groundnut	5.50	1.00
Kharif Total	**347.45**	**290.82**
RABI SEASON		
Wheat	0.00	20.50
Pulses (Gram etc)	6.50	Neg
Vegetables	6.50	4.20
Rabi Total	**13.00**	**24.70**
SUMMER SEASON		
Groundnut	0.00	140.97
Moong	0.00	40.15
Gram	0.00	16.40
Summer Total	**0.00**	**197.52**

Tables 4 and 5 are based on sample of 87 farmers spread across 4 irrigation systems

Thus, total cultivated area increased by around 45 percent in post irrigation season. This was primarily due to summer crops of groundnut and moong. Here, the farmers preferred summer groundnut to rabi wheat, because summer groundnut is more profitable. Accordingly, all the irrigation societies we visited had decided to supply full water only in summer season and few (eg. Issar) supplies support water for rabi wheat as well. Other societies such as Baldeva and Pingot RBMC do not provide any rabi irrigation. Area under sugarcane too increased after irrigation, but only a few tribal farmers took to sugarcane cultivation. Within our sample, some 17 farmers grew sugarcane. Of these 10 are Patels and 7 are tribals. Again, within tribals, 6 are relatively progressive Chowdhuries and only 1 is a Vasava tribe. Of the total 70 acres under sugarcane, tribals cultivate only 13 acres. The average land size (under sugarcane cultivation) is 1.3 acre and 6.3 acres for tribals and non-tribals respectively. However, there does not seem to be any yield difference at all, which is around 30 to 34 tones per acre for both tribals and non-tribals. The main reason why the tribal farmers do not grow sugarcane is that most of them do not have their own source of groundwater irrigation.

Crop Yields

Another channel through which irrigation leads to positive welfare change is through increased yields. This is because, irrigated agriculture is more input intensive than rain fed farming. The costs invariably go up, but the yield increases more than compensates for increased cost of cultivation. Table 6 shows the average yield of some major crops. Yield increases in paddy can be attributed to adoption of HYV after irrigation and that of tuver and jowar to better on farm management practices, including timely fertilizer application and weeding.

There seems to be hardly any difference in yields between the tribal farmers and the non-tribal farmers, except for that of paddy. Even before canal irrigation, the Patel farmers had been growing HYV paddy, but the tribal farmers have

Table 6: Average yield of major crops, before and after irrigation

Major Crops (Yield in Quintals per acre)/Farmer Category	Before Canal Irrigation			After Canal Irrigation		
	Tribals	Non Tribals	All	Tribals	Non Tribals	All
Paddy	4.00	8.52	4.46	7.79	10.70	7.96
Jowar	3.56	NG	3.54	4.73	NG	4.72
Tuver	3.24	3.48	3.25	3.98	3.41	3.82
Wheat	NG	4.00	4.00	5.31	7.00	5.50
Groundnut	NG	NG	NG	4.55	2.66	4.31
Moong	NG	NG	NG	2.67	2.58	2.65
Sugarcane	NG	332.00	332	322	369	347

NG: Not grown, Based on sample of 87 farmers spread across 4 irrigation systems

started doing so only in the post irrigation period. This is because, earlier, they did not have enough capital to buy HYV seeds and to invest in fertilizer and pesticides needed for its cultivation. After canal irrigation, yields of all crops have gone up and tribals have benefited almost as much as that of non-tribals in terms of yield gains. However, they lag behind the non-tribals, in terms of overall profits, because they do not grow sugarcane, which is a much more profitable crop that either moong or groundnut. In sugarcane, the marketing problem too is taken care of by the local sugar mills, which actually hires labour and pays for cane cutting from the fields. Main constraint for not growing sugarcane is lack of alternate source of irrigation. Canal water is available only for 4-5 months in a year, but for the rest of the year, sugarcane needs regular watering. It would be perhaps worthwhile if tribal farmers are motivated to adopt practices like horticulture, floriculture etc. They would reap more profit without excessively exploiting ground water.

Wage Rates and Migration

In the post irrigation period, market wage rates have gone up, as has the number of days when employment is available in the village. Consequently, out migration from the villages has reduced. Some farmers we talked to said that out migration by farmers has reduced by 70-90% and that by agricultural labour has reduced by 30-50% in the post irrigation scenario. At the other end, actually the last few years have seen influx of labour from Maharashtra. Sugar mills hire these farm laborers and they are engaged in cutting canes from the fields. Wage rates have gone up from Rs 10-15 per day in pre irrigation days to Rs 25-30 in the last few years. Similarly, land rates have gone up too from Rs 25,000 per acre for unirrigated land to Rs 100,000 per acre for irrigated land. The land lease rates too doubled in years after irrigation. This is however seen as a mixed blessing. For one, there is an increasing influx of Patels from Saurashtra who take land on lease from tribal farmers and many fear that in another 20-30 years times, the tribals will be completely alienated from their own land. We need to look at this issue of land alienation more deeply and weigh the pros and cons of benefits from leasing out land and costs of doing so (for a tribal farmer) before deciding its long term impact on them.

Other Incidental Benefits

When asked about benefits of irrigated farming, a tribal farmer from Mouza village in Pingot RBMC canal command pointed out three benefits. Firstly, they can grow a summer crop, either moong or groundnut, secondly, this summer crop gives them ready cash to grow kharif crop, for which earlier they had to borrow money from money lenders. Thirdly, more green fodder is available for livestock due to more crop output. However, they acknowledged that input costs have gone up and they have to carefully treat their soil with manures

every alternate year to prevent deterioration of land quality. Asked about other disadvantages of irrigation, a farmer from Baldeva village said jocosely that now they hardly had time to sit and chat, because as soon as summer harvesting is over, they have to start preparations for kharif crop!

In the preceding sections, we saw that benefits from irrigated agriculture flow through multiple channels. In our study area, tribal farmers have benefited tremendously from irrigated farming, so much so that irrigated farming has become central to their livelihoods. Many of the tribal farmers who used to resort to coping strategy of seasonal migration have stopped doing so now. In absolute terms however, the non-tribal farmers have benefited more, simply because they have larger land holdings and they have shifted to very lucrative sugarcane cultivation, which the tribal farmers have not. Irrigated agriculture has become so central to tribal livelihood, that in 3 out of the 4 systems we studied, demand for irrigation exceeds that of supply.

In our next sections, we shall discuss various issues relating to irrigation management transfer (IMT), also called Participatory Irrigation Management (PIM) in our study systems.

Issues in Participatory Irrigation Management

Government agencies in many countries of the world have evolved processes whereby the management of irrigation services is being increasingly handed over to the farmers' organizations. This process, popularly called "irrigation management transfer" (IMT) has gained currency in recent years and it is seen as a way of reducing pressure on precarious government finances on the one hand and ensuring better irrigation services to the farmers on the other. Many Asian countries such as Philippines (Wijayaratna & Vermillion, 1994), Indonesia (Vermillion et al. 2000), Nepal (Mishra & Molden, 1996) and Bangladesh (Mandal & Parker, 1995) have undertaken full-fledged or limited management transfer and have met with mixed results-some success coupled with some failures. In Latin America, Columbia and Mexico have been pioneers in IMT. In Columbia, for example, way back in 1976, government turned over the management of two canal based irrigation systems to the farmers (Vermillion & Restrepo, 1996). In Mexico, till 1996, the government had transferred 2.92 million hectares of canal-irrigated area to farmers' benefiting more than 88 percent of the service area in over 80 irrigation districts in the country (Johnson III, 1997). New Zealand, on the other hand took a more drastic decision of selling off government irrigation systems to farmers, often at a loss (Farley, 1994).

In a succinct review of literature on IMT, Shah et al (2002) noted that impact of IMT has been far from "uniform and reassuring". Based on a review of impact of IMT by Vermillion (1997), they concluded that IMT in countries such as New Zealand, USA, Turkey and Mexico could be considered successful to a large extent. However, results are far less encouraging in developing countries in general. They noted that IMT has tended to be relatively smooth in regions where irrigated farming in central to people's livelihoods, the land holdings are not too small to render farming uneconomical, there are effective forward and backward linkages with the rest of the economy and costs of self managed irrigation is a small part of the overall returns from irrigation (Shah et all, 2002).

To compound the already complicated issues, is the nature of canal irrigation as a resource. It is a common property resource (CPR) in that no one individual can be excluded from the benefits that others provide. Consequently, each person is

motivated not to contribute to the joint effort, but free ride on the effort of others, thereby minimizing collective benefits (E Ostrom 1990). Success of any collective action also depends on how individual discount future benefits from the resource, which in turn depends on a number of factors including shared norms and beliefs of the individual living in a particular society. At the heart of the problem, lies that fact that in a CPR, the costs involved in transforming a situation in which individuals act independently to a one where they put in concerted effort to manage the resource can be considerably high. To top it all, complexities increase because how the individual users affect the system (say for example, a canal network) as a whole is uncertain. To quote E. Ostrom (1990)

It is not immediately apparent, for example, how one irrigator's forbearance in taking water from a canal will affect the yield obtained by that farmer or by other farmers. In some cases, a farmer located near the head of a system may be able to curtail his water use substantially without major impact on his own yield, while substantially enhancing the yields of downstream farmers. In other cases, the excess water taken by the farmer located near the headworks may subsequently also flow to farmers located lower in the system. Restraint by farmers located higher in the system may not increase total yield. (E. Ostrom 1990, p 34)

Given this backdrop of the nature of canal irrigation as a CPR and the mixed results of IMT so far in developing countries, we shall analyze the impact of IMT in a pre dominantly tribal area. For one, tribal farmers have small land holdings and neither do they cultivate very high value cash crops such as sugarcane. However, irrigated agriculture is the main source of livelihood for these farmers. What, then are the chances of success IMT in the four schemes that we have chosen for our study? The following sections will therefore try to analyze how these irrigation co-operative societies have performed over time and whether these can be called successful or not. In addition, we shall specify under what criteria can we differentiate a successful irrigation co-operative from not so successful one, or in other words, what are the indicators of a successful irrigation society? Having done that, we shall seek to understand the broad policy implications of successful PIM schemes with special reference to its impact on tribal livelihoods. Finally, we shall sum up our discussion by offering few suggestions as to how to make these initiatives more successful and replicable elsewhere.

AKRSP (I) Promoted Canal Irrigation Societies

History

AKRSP (I)'s foray into the realm of canal irrigation societies is well documented (see Singh and Kumar 1993, Shah, no date, Brewer et al, 1999, Mistry 1996). Since 1985, AKRSP (I) was promoting small lift irrigation projects in various parts of Gujarat, including Bharuch. It was a chance remark of a government official that AKRSP (I) could get a bigger bang out of its buck if it were to get involved in organizing canal irrigation societies that led the then CEO of AKRSP (I), Mr. Anil Shah to consider taking up canal irrigation projects. Pingot RBMC's Jeevan Deep Co-operative Irrigation Society was the first canal irrigation society to be formed under the auspices of AKRSP (I) in Gujarat. Going was not smooth to begin with, for one the farmers were reluctant to believe that water would indeed flow down a canal that has been left unused for several years after construction. However, positive efforts from AKRSP (I)'s field workers, coupled with sincerity of Irrigation Department (ID) staff finally own over reluctant farmers, who formed the first co-operative irrigation society in 1991-92. A year after, the farmers in Baldeva LBMC took the lead provided by their neighboring Pingot RBMC society and formed a co-operative in 1992-93. AKRSP (I) was directly involved in these two

projects and withdrew in 1995-96. Pingot RBMC did not face major problems after AKRSP (I)'s withdrawal. However, the Baldeva society has had a rather chequered history. Right after the withdrawal of direct intervention of AKRSP (I), the co-operative society was plunged into a crisis. The auditors raised certain queries on book keeping and the society was served a notice to reply to those questions. However, the Society failed to do so within the stipulated time and consequently, it was taken under government custody. From 1997 to 1999, the society was under government custody. In the meanwhile, the farmers in the command area formed a committee and expressed the desire of managing the co-operative again. The government turned over the management to this "custodian committee" on a trial yearly basis. This arrangement worked for another two years and in 2001, the society was removed from government custody and allowed to function as an independent one. Pingot RBMC and Baldeva LBMC became acclaimed success story of PIM in Gujarat. Enthused by this success, the farmers in Pingot LBMC decided to form an irrigation co-operative of their own. Earlier, from 1990 to 1995, they were getting canal water from the government. The Pingot Left Bank Irrigation Co-operative Society was formed in 1995, without the help of either AKRSP (I) or any other NGO. This was so because, in one of the command villages of RBMC, viz. in Mouza village, there already existed a multi purpose co-operative and an oilseeds pressing co-operative. The farmers therefore felt that they could manage to create and sustain irrigation co-operative on their won without the help of AKRSP (I). This is incidentally the only Society we visited which has an office premise of its own. This office also doubles, rather triples up as the office of the multi purpose society and the oilseeds pressing co-operative. This was certainly an achievement in itself, for one it is a tribal dominated society (all office bearers are tribals) and for another, it came on its own, as a direct result of successful intervention in the neighborhood. The last society that we shall study is the Issar Minor Dam Minor Irrigation Co-operative Society. This too is a 100% tribal society, inhabited mostly by Chowdhury tribes and few Vasavas. In 1995-96, at the behest of AKRSP (I) and government officials, the farmers in the command area of Issar project agreed to form a co-operative and take over the management of the canal system. AKRSP (I) is still involved in this society, which incidentally has taken a lead role in formation of PIM Federation being promoted by AKRSP (I).

Table 7 presents the salient features of all these irrigation schemes. For more details on individual schemes, the readers are urged to consult field notes on each system, appended at the end of this paper.

Membership and Organizational Set Up

All the four irrigation societies we studied were registered as co-operatives under the Co-operatives Act of India. All farmers who own land within the canal command area are eligible to be members of the co-operative society. To become member, one has to buy a share of Rs 51 each. In all the four societies, one farmer owns one share, irrespective of his size of land holding. However, in Issar society, the committee members told us that they are contemplating to link shareholding with land size. Here, the committee is planning to change over to area-based share from next year after getting approval from the members. In this, the share price will be Rs 100 per acre of land holding. The advantage of this system according to the society President and Secretary are two. Firstly, money collected, as share fees will increase. Secondly, in times of scarcity, it will be easier to ration water, each will get water for one share at first and if water is in cess, then he can get water for the rest. To this we add a third advantage. A big farmer will certainly gain more from irrigated

Table 7: Basic features of irrigation systems studied

Scheme wise Details	Pingot RBMC	Pingot LBMC	Baldeva LBMC	Issar
Location (Block/District)	Valia/Bharuch	Valia/Bharuch	Valia/Bharuch	Mandvi/Surat
Year of dam construction	1980-81	1980-81	1977-78	1975-76
Year of first irrigation	1991-92	1991-92	1992-93	1983-84
Year when PIM initiated	1991-92	1995-96	1992-93	1995-96
Number of villages covered	4 villages	5 villages, 2 hamlets	5 villages, 1 hamlet	3 villages
CCA (ha)	543 Ha	800 Ha	1155 Ha	354 Ha
Area irrigated (2001-02)	315.17 Ha	310 Ha	455 Ha	273 Ha
Number of minors	1	2	4	3
Number of water courses	18	19	12	12
Number of members	241, 216 with voting rights	305 members	181, 167 with voting rights	397 members
Main irrigation season (months)	January –May (Summer crop only)	November-May (Rabi support & Summer crop)	January- May (Summer crop only)	November- May (Rabi support & Summer crop)
Number of irrigation provided	5-6	6-8	4-6	7-8
Three main irrigated crops (area wise)	Groundnut Sugarcane Moong	Groundnut Moong Vegetables	Sugarcane Groundnut Moong	Groundnut Wheat Moong
Population composition	Tribal and non Tribal	Only Tribal	Tribal and non Tribal	Only Tribal
PIM implementing agency	AKRSP (I)	Farmers Themselves	AKRSP (I)	AKRSP (I)
Stage of AKRSP (I)'s intervention	Withdrawn in 1995-96	Never Involved	Withdrawn in 1996-97	Ongoing

Source: Based on field work conducted in August 2002

agriculture than a small farmer and therefore his stake in the system will be much higher. Therefore, it only seems fair and logical that he contributes more towards share capital than a small farmer does. If number of share owned were also linked to number of votes, then the big farmers will perhaps go out of their way to make the irrigation co-operative a vibrant one. In addition to the shareholders, there are other nominal members, who do not voting rights because they do not own land. In most cases, these are women and have been included in the committee to ensure gender equity. We contend that merely including women in irrigation societies without giving them voting rights makes a mockery of gender equity issues. However, giving them voting rights without ascertaining their stakes in irrigated agriculture too does not make much sense.

All the members with voting rights elect or select the Chairman, Secretary and other members of the committee. The committee is entrusted with day-to-day functioning of the co-operative. Though there is a provision for election, in all the co-operatives we visited, the committee members were selected rather than elected. Quite predictably, the committee members were larger landowners in their respective villages. Each of these societies holds an Annual General Body Meeting, when the accounts of previous year are read out. Some also hold monthly or weekly meetings. Attendance in AGBM is low to medium. Table 8 brings out some of the salient features of each co-operative in terms of its organizational set up.

Water Distribution Mechanism

Head tail issues are a constant source of conflict in a canal irrigation system and the systems under study are no exception. Issar minor irrigation scheme seemed to be the best in terms of head tail equity in water distribution because of physical

Table 8: Organizational details of canal irrigation societies

System	Size of Committee	Chairman (Tribe/ Non Tribe)	Secretary (Tribe/ Non Tribe)	Minor Wise Committee (Yes/No)	Frequency of Meetings	Attendance in AGBM
Baldeva LBMC	5	Non tribal	Tribal	No	Monthly & AGBM	60-70%
Pingot LBMC	7	Tribal	Tribal	No	Monthly & AGBM	50-60%
Pingot RBMC	7	Non Tribal	Tribal	No	As and when required & AGBM	Less than 50%
Issar	17	Tribal	Tribal	Yes	Weekly, Special meetings & AGBM	60-70%

Based on field work during August 2002

Table 9: Comparison of irrigation fees across systems (2001-2002)

Irrigation Society	Crops and Water Rates (Rs/Ha/season)					
	Groundnut	Moong	Sugarcane	Wheat	Vegetables	Other crops
Government	Rs 400/ha	Rs 330/ha	Rs 680/ha	Rs 400/ha	Rs 400/ha	Rs 400/ha
Pingot RBMC	Rs 912/ha	Rs 660/ha	Rs 1820/ha	—	—	—
Pingot LBMC	Rs 900/ha	Rs 650/ha	Rs 1800/ha	Rs 650/ha	Rs 900/ha	—
Baldeva LBMC	Rs 912/ha	Rs 642/ha	Rs 2100/ha	—	—	—
Issar Society [3]	Rs 600/ha	Rs 500/ha	Rs 1400/ha	Rs 600/ha	Rs 600/ha	—

Based on field work undertaken in August 2002

design advantages. The system has been designed in such a way that each of the three minors caters to three different villages, viz. Issar, Devgarh and Junwan. Therefore, within each village, there are farmers who are in the head, middle and tail reaches of the canal respectively. There is a minor wise committee, and given that its jurisdiction coincides with one single village, head tail issues are better dealt with. Our discussions with the farmers in Issar revealed that the committee had tried to distribute water from tail to head, but after two irrigation cycles, it was discontinued because of high water losses. The committee however maintained that they distribute water from tail to head. The Baldeva committee members made similar claims, but the farmers again seemed not so sure about it. In Pingot LBMC and Pingot RBMC, water distribution is from head to tail. They maintained that tail to head distribution, though equitable, leads to higher water losses and since water scarcity is a problem, they prefer head to tail distribution. In all these systems, water is released every 8 to 12 days. In Baldeva, for example, a 12 days rotation is followed, where the head, middle and tail villages get water for 4 days each. Number of irrigation varies from society to society. In Baldeva LBMC and Pingot RBMC, water is released 5 to 6 times in a normal year. In a normal year, they do not give support water for rabi, but in a year of good rainfall, they do give rabi support irrigation. In Issar and Pingot LBMC, however, number of rotations is more. Here they also give water fro wheat. Consequently, we find some considerable area under wheat in Issar and Pingot LBMC.

Water Rates and Penalty Clauses

Water rates vary across these 4 irrigation systems as is seen from Table 9. The societies are at liberty to decide their water charges, provided that they are more than the government water rates. Some societies like Issar charges 1.5 times the government rate, while some like Baldeva charge

[3] In Issar Society, water rate is charged per irrigation and not per season. We have calculated per season charges by multiplying per irrigation rates with number of irrigation provided.

more than 2.5 times. Again, only in Issar society the water rates are based on per irrigation (Rs 40/ acre/irrigation). But in all other societies, they are determined on a per season basis and a farmer who takes the first irrigation has to pay the full season charges even if he does not take water consequently. Few farmers lift water directly from the canal using diesel pumps and in such cases they have to pay 40% of the irrigation charges levied. In addition, in Issar and Pingot LBMC, the non-members are charged 1.5 times more than the members, but there is no such practice in Baldeva LBMC and Pingot RBMC.

Every year, at the beginning of the irrigation season, farmers have to fill in a demand form, whereby they mention what crops they want to grow and how much area they need irrigation. Based on these demand forms, the co-operative members and officials from ID undertake plot-by-plot surveys and determine the society's total due to the government as per government rates. The society is required to pay the government rates within a stipulated time period. If they do so, they get back 30% of the payment as fund for repair and maintenance and another 20% as rebate for timely payment. In addition, whatever extra the society charges over and above the government rates are kept in reserve fund of the society and may be used for O&M or for any other activity such as input marketing.

All of these societies have formulated norms to penalize farmers who break the rules of the game. We have already mentioned that canal irrigation is a CPR and therefore the temptation to free ride would always to present. It is in this backdrop that the irrigation societies have to frame rules and regulations to ensure that members adhere to some basic norms. The rules pertain to various types of malpractices and they differ from one irrigation society to the other. Some societies like Issar and Pingot LBMC have more number of penalty clauses and more explicit rules about a number of issues, while Baldeva and Pingot RBMC have lesser number of such norms. Water theft and non payment of dues are at most important issues, followed by taking water out of turn, under reporting crop acreage, misreporting crop type in order to pay lesser irrigation dues. In addition, few farmers also reported canal breaching and lifting water without permission as problems, which need stricter penalty. In Table 10 we have summarized all the possible misbehaviors that calls for penalty and also state the penalty amount as stated to us by the committee members of these four irrigation co-operatives.

Table 10: Types of offence and penalty paid

Irrigation Society	Types of Offence and Penalty Charged					
	Late Payment	Non Payment	Taking water Out of Turn	Under Reporting Irrigated area	Misreporting Crops Irrigated	Other Offences
Baldeva LBMC	12% interest p.a.	Stop water	Rs 1000 for first two irrigations, Rs 5000 thereafter	1.5 times the water rates	No penalty	Decided based on seriousness of the offence
Pingot LBMC	18% interest p.a.	Stop water	1.5 times the water rates	1.5 times the water rates	1.5 times the water rates	Decided based on seriousness of the offence
Pingot RBMC	12% interest p.a.	Stop water	Rs 100 per offence	1.5 times the water rates	No penalty	No policy as of yet
Issar	12% interest p.a.	Stop water	Rs 2052 per offence	1.5 times the water rates	1.5 times the water rates	Decided based on seriousness of the offence

Based on fieldwork undertaken during August 2002.

Each of the society has developed a very intricate system for penalizing defaulters. These systems did not evolve overnight, nor are they rigid over time. For example, the provision of not supplying water to the defaulter is at times relaxed, if the committee members decide that the person was in position to pay. The robustness of these co-operatives however is tested when the powerful and rich farmers refuse to pay their dues. For example, in Pingot LBMC, few politically powerful farmers (who happen to be tribals) refuse to pay their dues; the committee cannot do much about it. Similarly, it seems in Baldeva, the rich Patels dilly-dally in payment and not always the committee has been able to be strict with them. But on the whole, most of the farmers seemed to be aware of the penalties attached to deviation from rules and try to stick to the right side of the line.

Having described some of basic feature all the irrigation systems we studied, we shall now in the following sections look at the impact of PIM on livelihoods of the farmers. We have already noted in a previous section that irrigation has brought about positive welfare changes in the region as a whole. Cropping intensity has gone up, as have yields. Migration has gone down and wage rates and lease rates have increased. Out of the four societies we studied, in two viz. Issar and Pingot LBMC, government ID was distributing canal water before PIM initiative. However, in Pingot RBMC and Baldeva LBMC, there was no irrigation before PIM. Therefore, in these two societies, the impact of PIM is synonymous with impact of irrigation. But in the other two systems, PIM definitely improved conditions. Most of the farmers from Issar and Pingot LBMC reported that during government management, less than 100 ha could be irrigated in summer. We shall compare these four systems in terms of agricultural indicators (cropping pattern and yields), financial indicators and degree of participation. We shall further report our findings separately for the tribal and non tribal farmers and also differentiate between the head, middle and tail farmers to see if there is any difference in impact based on social status and geo-hydrological location.

Agriculture Related Impacts of PIM

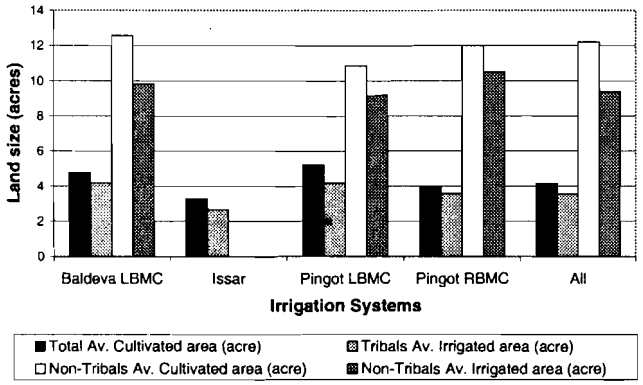
One of the basic arguments for PIM is that it increases efficiency of irrigation and therefore gets translated into higher agricultural productivity (evidence, though at best is scanty). However, in our case, this does seem to have happened, simply because, there was no irrigation before PIM initiative in two of the four schemes we studied. So, it was more a question of benefits from irrigation than benefits from PIM per se. But certainly, there is no gain saying the fact that these systems have performed much better than a similar system under government management.

The net benefit that a farmer gets from irrigated agriculture will depend on a number of factors such as his capacity to invest in HYV seeds are other market inputs, his skill levels and of course whether he gets adequate water from the canal. Therefore, land size (a good proxy for wealth), social status (tribal/non tribal) and location on head/middle/tail of the canal will perhaps have an effect on net gains of the farmers. There is a view that most of the small and the marginal farmers would be relegated to the tail ends of the system (van Koppen et al. 2002). It would be interesting to see how land size holdings of the tribals and non-tribals differ from ach other and how do they differ across head, middle and tail.

On an average it is seen that tribals own and operate much less land than a non-tribal does. However, the percentage of land that is irrigated as a proportion of total cultivated land is marginally higher for the tribal farmers that the non-tribal ones. Though there are very few non-tribals in our study villages, they irrigate and own land higher than their proportion in total

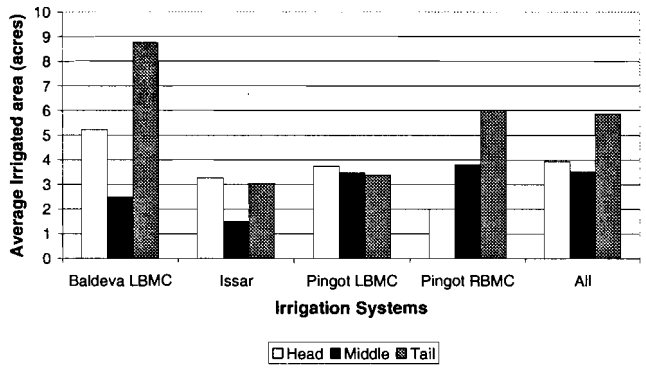
population. This trend has been further exacerbated in recent years, when there has been a influx of Patels from Saurashtra, who have taken on lease tribal lands.

Figure 1: Tribal and Non tribal Disparity in cultivated and irrigated area (per farmer)



Source: Based on sample of 87 farmers spread across 4 irrigation systems

Figure 2: Land distribution and irrigated area per farmer in head, middle and tail



Source: Based on sample of 87 farmers spread across 4 irrigation systems

The figure above shows that there is no clear and discernible pattern of head/middle/tail distribution of irrigated area across systems. However, it does come out that average irrigated area in tail reaches is considerably higher in Baldeva and Pingot RBMC.

Cropping pattern changes has been the most important impact of irrigation in general and PIM in particular. In general, the trends are very clear. The tribal farmer has started growing groundnut and moong and the non-tribal farmers have shifted to sugarcane. The Table 11 below shows the system wise changes in yields before and after irrigation for Baldeva and Pingot RBMC and before and after PIM for Issar and Pingot LBMC.

Yields of paddy and sugarcane have certainly gone up in post PIM period, but the yield other kharif crop of jowar and tuver seems to have declined marginally. This is because, these are grown mostly with paddy and with the advent of irrigated agriculture, and farmers invest far less in these low value crops (especially jowar). They try to save as much as possible for the summer crop of groundnut. Again, the yield figures do not vary significantly for the tribals and non-tribals. The increase in paddy yields has been due to shift to HYV of paddy.

We have already mentioned that cropping pattern is different among these societies. For example, in Baldeva Society, a very large amount of irrigated land is under sugarcane cultivation, but it is not so in the other system. In all the other systems, irrigated area under groundnut is largest followed by moong. The Table 12 shows the cropping pattern in four systems in 2001-02 (irrigated crops only).

Table 11: Yields of some major crops before and after PIM

(Quintals/Acre)

Irrigation system/Crops	Paddy		Jowar		Tuver		Groundnut		Moong		Sugarcane	
	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
Baldeva LBMC	5.5	7.2	4.4		3.8	2.2	NG	5.1	NG	3.9	32.0	34.0
Issar	4.3	8.7	3.8	5.3	3.5	2.9	NG	4.5	NG	2.8	NG	NG
Pingot LBMC	4.7	6.7	3.2	2.6	2.8	3.1	NG	4.5	NG	3.0	NG	31.0
Pingot RBMC	3.9	4.8	3.1	2.2	2.1	2.7	NG	4.2	NG	2.2	29.5	32.1

Source: Based on sample of 87 farmers spread across 4 irrigation systems, NG: Not Grown

Table 12: Area under different irrigated crops (ha) in four irrigation systems

Scheme/Crop	Groundnut	Moong	Sugarcane	Others	Total
Baldeva LBMC	134.70	58.57	233.67	28.86	455.80
Pingot LBMC	362.69	127.19	24.80	2.99	517.67
Pingot RBMC	117.85	71.03	52.83	15.44	257.15
Issar	162.18	40.84	5.93	52.54	262.49

Source: Secretaries of respective irrigation co-operatives.

Economic Impacts of PIM

How does this cropping pattern change and yield increase leads to increase in income and how has this vary across irrigation systems? Let us take a hypothetical example of 2 farmers each (one tribal and one non tribal) from Baldeva, Pingot LBMC and Pingot RBMC and 1 tribal farmer from Issar (Issar does not have any non-tribal farmer). Table 13 shows the net returns from agriculture, before and after irrigation for the tribal and non-tribal farmers. Of course, a lot of assumptions have been made while calculating these figures. Firstly, we have assumed that average yield figures in a system hold good for all the farmers, which is certainly not so. Second, we have assumed the same cost of cultivation for all farmers. This cost of cultivation data is based on averages derived from data generated by our questionnaire survey. The market price too is averaged across observations and is again based on or questionnaire survey. Third, to simplify our calculations, we assume that a typical tribal farmer's cropping pattern will be only rain fed local paddy in pre irrigation scenario and hybrid paddy and groundnut in post irrigation scenario. For a tribal farmer the cropping pattern will be hybrid paddy in pre irrigation time to sugarcane in post irrigation period. Our calculations therefore are only as good as our assumption. However, our assumptions again are based on cropping pattern data of 87 farmers that we surveyed. We do not claim this to be truly authentic estimate of returns from agriculture, but we think that it at least gives us a broad picture. It is seen quite clearly that the tribal farmers have benefited tremendously from irrigation, but their gains are not anywhere near that achieved by the non-tribal farmers. This is simply because the non-tribal farmers have gone in for high value sugarcane cultivation.

Table 13: Returns from (Rs/acre) agriculture for tribal and non-tribal farmer[4]

System	Before		After	
	Tribals	Non Tribals	Tribals	Non Tribals
Baldeva LBMC	650	1335	6185	22585
Issar	290	—	6336	—
Pingot LBMC	410	376	5090	—
Pingot RBMC	170	180	3992	23067

Source: Based on calculations as explained in footnote 4.

[4] To come with these figures we made a number of assumptions, some of which are stated in the text. Here, the returns figure before show only returns from rainfed paddy for both tribals and non tribals, while after returns for tribals takes into calculation returns for rainfed by HYV paddy and irrigated groundnut, as these two are the most common crops grown by a tribal farmer. However, farmers in Baldeva command area were already growing HYV paddy even before canal irrigating, so we took that as the before irrigation crop. For a non-tribal farmer, after irrigation cropping pattern is only sugarcane, as most of Patels have indeed shifted to only sugarcane after irrigation. For calculating net returns, we first calculated the average yield of each of the crop viz. rainfed paddy (either local or HYV), irrigated groundnut and sugarcane across systems. Then we calculated the average market price for each crop. Since, all these irrigation systems are close to each other, we assumed the same market price for all. We multiplied yields in quintals per acre with market price per quintal and got the gross returns form each crop. From the gross returns we subtracted the total expenditure. We used average values of crop wise expenditure based on our sample survey of 87 farmers. For the before period, the average expenditure for paddy was kept constant, while in the after irrigation period, we added up the actual expenses incurred for each component. The expenditure varied because costs of irrigation varied across systems. For sugarcane, we assumed that the yield in the first year was 35 tonnes and next year it was 20 tonnes and that expenditure was incurred only once. The expenditure in sugarcane is again based on our sample survey data.

Cost of irrigation has gone up in years after PIM, ranging from 1.5 times to as high as 2.5 times as in Baldeva. Even then, canal water is very cheap and constitutes only 15 to 40 percent of total cost of cultivation and only 5 to 15 percent of total returns from agriculture. The irrigation costs are highest for sugarcane, so are the returns from it. Therefore, increased cost of irrigation has been more than compensated by increased returns from irrigated agriculture.

Collection rates of irrigation charges are much better under farmer's management that it was during government management in Issar and Pingot LBMC. The total volume of business has gone up in these societies. As for Baldeva LBMC and Pingot RBMC, we have already noted that there was no irrigation before these societies were formed. The societies also charge higher than government rates and keep the rest as reserve funds. Besides, they also get back 50% of the payment they make to the government for O&M. The table below shows the yearly dues of societies to the government. While, looking at these figures, we must remember that total business of the society was at least 1.5 times to 2.5 times more than the amount they have to pay to the government and they have (or will) get back at least 30 to 50% of the money they have paid to the government[5].

The volume of business is the largest in Baldeva. This is because of two reasons, firstly, irrigation charges are the highest here and secondly, a very large area is under sugarcane cultivation, for which irrigation charges are highest among all irrigated crops.

Impact on Repair and Maintenance

Repair and maintenance of the turned over irrigation systems is a bone of contention among the various stakeholders, particularly, the government and the irrigation societies. If the society takes up the R&M work, then government gives back 30% of the total water charges deposited to the government, which the societies are

Table 14: Water charges paid to government in 4 irrigation schemes (in Rs)

Year/Scheme	Baldeva LBMC[6]	Pingot LBMC[7]	Pingot RBMC	Issar
1991-92	—	—	23527	—
1992-93	—	—	48814	—
1993-94	94407	—	20804	—
1994-95	122274	95682	49726	—
1995-96	126533	No irrigation	71786	—
1996-97	95610	68716	23472	28164.18
1997-98	85640	84060	63166	44021.22
1998-99	196043	94000	74420	44809.90
1999-00	120432	22910	61660	27192.96
2000-01	No irrigation	35253	76063	No irrigation
2001-02	236568	22490	No irrigation	No irrigation

Source: Secretaries of respective irrigation co-operatives.

5 If the society is able to pay all government dues within a stipulated time, they are eligible for a rebate of 20% of the total amount. In addition, they are eligible to get back 30% of the deposited amount for O&M irrespective of whether they meet the deadline or not.

6 Baldeva society started working from 1992-93 and provided first irrigation in 1993-94. It went to government custody during 1995-96 onwards, which perhaps explains the low figures for 1996-97 and 1996-97. In 2000-01, there was no irrigation because of less rainfall.

7 This system was under government management from 1990-95. In 1995, the irrigation co-operative was formed. However, the very next year, there was no irrigation because the society decided to lay underground pipelines and repair canal network before releasing water. From 1996-97, the society has been providing water every year. In 2001-02, it also provided water for rabi wheat in addition to water for summer crops like groundnut and moong.

supposed to spend for R&M of the canals. We had sought details of actual expenditure incurred by a society on R&M, but what we got was a rather standard figure of Rs 10,000 to Rs 12,000 per year. It also seemed that the societies do only routine maintenance work (desilting and jungle cutting) and very minor repairs. But for anything like a canal breach or lining work, they look forward to government intervention, even if they have a robust corpus fund with them. Only in Pingot LBMC, we found that the society had made R&M investment of over Rs 7 lakhs from their own reserve and had given the bills to the government for reimbursement (of which incidentally, they have got back only Rs 1.8 lakhs). It also seemed that the societies were not ploughing back the yearly profits towards maintenance work, rather (perhaps pragmatically), they were thinking in terms of extending input marketing facilities to the members. Given this scenario, even the government seems apprehensive that the irrigation societies might not undertake R&M work, harming the infrastructure in the long run. Similar trend has been observed in other countries such as Turkey (Shah et al. 2002). At one end, it does seem clear that these irrigation societies do undertake temporary and small repair work with alacrity, but depend on government for major repairs. We believe that there ought to be more clear cut rules, as to who undertakes what repair and who pays for what. At present, there seems to be many diverse views. Thus the question of "Who should be responsible for undertaking the work of rehabilitation, repair and maintenance of canals?" presents divergent views from the various stakeholder groups.

Government's View

- Since the society is involved in the management of irrigation, it is the society who should take up the repair and maintenance work.
- Since the society is going to earn more by enhancing the area under irrigation, it is the society who should take up the repair and maintenance work.
- Since the government does not have sufficient money, it is the society who should take up the repair and maintenance work.

Irrigation Societies' View

- Since the government is the owner of the canal network, it is the irrigation department who should take up the repair and maintenance work.
- Since the government has not done the basic job of construction (at the beginning), it is the irrigation department who should take up the repair and maintenance work.
- Since the government is collecting the water charges from the society, it is the irrigation department who should take up the repair and maintenance work.
- Since the government is not doing any thing other than collecting revenue, it is the irrigation department who should take up the repair and maintenance work.
- Since the societies do not have sufficient fund at their disposal, it is the government who should do the major repair and maintenance work.

It is here at a NGO like AKRSP (I) can play a very crucial role and help the government and the irrigation societies see eye to eye on this very important issue. In the long run, we think that the ownership of the irrigation systems should be handed over to the farmers and they should take care of R&M. But, till the period, the government owns the assets and charges fees for using the same; they should contribute towards R&M on a regular basis.

Has PIM Succeeded?

One of our objectives was to measure the relative success and failures of the irrigation co-operatives that we have studied. For measuring success, we need to define indicators of success in the context of irrigation co-operative and then measure our four co-operatives against these indicators. Following Shah (1995), we propose that an irrigation co-operative has succeeded if has achieved "patronage centrality[8]", "member centrality[9]" and "domain centrality[10]". We must however, at the very outset state that we did not strictly operationalize any of these measures in terms of measurable indicators. We have simply used these concepts and tried to measure how successful an irrigation co-operative has been based on our observations and our conversations with the members of each of the four co-operatives we studied. Therefore, we shall not try to compare these co-operatives with each other and rank them accordingly. We shall merely note how they have performed keeping in mind the three "centrality" concepts enunciated earlier.

Patronage centrality in the context of a canal irrigation co-operative will mean that majority of the farmers who practice irrigated agriculture will take water from the co-operative. In other words, very few will depend on other sources of irrigation such as wells and bore wells for growing irrigated crops. Under these criteria, all the four systems can be said to have achieved patronage centrality. This is because, irrigated agriculture as a livelihood took roots only after the creation of these co-operatives. In addition, very few tribals have their own source of irrigation. However, non-tribals (who are much less in number) have their own source of irrigation and cultivated sugarcane (a irrigated crop), even before canal water was released. But they are very small in number. Perhaps, a good measure of patronage centrality in this context will be the total irrigated area in the post PIM period as a percentage of sugarcane and rabi crop area in the pre PIM period. This is because in the pre irrigation period (which is also pre PIM for two systems under study) in order to grow rabi crop and sugarcane, one needed one's own source of irrigation, either a well, bore well or diesel engine to lift water from a river. The higher this ratio, the lower will the patronage centrality and vice versa. Based on our sample of 87 farmers, this ratio comes to around 0.14 for all systems as a whole. This ratio is much higher in Baldeva and much lower in Issar.

Table 15: Measure of Patronage Centrality

Society name	Area Irrigated Before PIM (1)	Area Irrigated After PIM (2)	(1)/(2)
Baldeva LBMC	45.0	103.5	0.435
Issar	5.0	71.4	0.070
Pingot LBMC	14.5	64.0	0.227
Pingot RBMC	5.0	59.0	0.085
All	**69.5**	**297.9**	**0.233**

Source: Based on sample of 87 farmers spread across 4 irrigation systems

All these four co-operatives certainly enjoy a high domain centrality. Agriculture is the main occupation of majority of the people and it has become more central to their livelihoods after PIM. This is partly reflected by the fact that net out migration has gone down in the post PIM period. This shows that farmers who earlier used to migrate in lean season (read rabi and summer season), now stay back in the village and practice irrigated agriculture. We can perhaps say the same about member centrality, though we shall not be

[8] Patronage centrality is measured as the proportion of " ...the domain's potential business which can be transacted through the co-operative, the proportion that is actually routed through the co-operative" (Shah 1995, p 85)

[9] Member centrality is best measured by "computing the volume of co-operatives business as a ratio of the total volume of its members' business from *all* of their economic and livelihood activities" (emphasis in original text, Shah 1995, p 86)

[10] Domain centrality is "approximated by the co-operatives business as a fraction of the value of total economic transactions in the entire domain". (Shah 1995, p 86)

able to support it with figures at this point. Member centrality means that each member will derive increasing share of his/her income from irrigated agriculture in the post PIM period. We know from certain that absolute incomes from agriculture have increased in the post PIM period for both the tribals and the non-tribals (see Tables 13 and 14). But we do not know for certain if the share of income from agriculture to total income from all sources has increased during this time period, because we did not specifically collect such income data (which any way, is a very difficult thing to do). But, what we do know is that other sources of income for a tribal farmer are livestock, seasonal out migration, fishing and perhaps service. We do know from our conversations with the farmers that livestock population did not go up in the study villages in post PIM period. Actually one farmer pointed out that it is very difficult to keep large livestock population and practice irrigated agriculture at the same time, because both need utmost care and attention. This is in general also reflected at the national level, where livestock population is inversely related to irrigated area (Rao et al. 2002). The other income option of out migration certainly is not as lucrative one as irrigated farming. This is proved by decline in overall out migration. As for other sources of income (fishing and services), it has at best remained constant over time. Therefore, we can safely assume that the contribution of irrigated agriculture to a farmer's total income has certainly gone up after the post PIM period and perhaps the irrigation societies do enjoy member centrality as well. This is also reflected by the fact that over time the member ship of these co-operatives has gone up.

Shah et al (2002) have indicated conditions under which PIM has been successful. These among others include the overall profitability of irrigated farming in general and the stake of the farmers in irrigated farming. It is obvious that if irrigated farming is central to livelihood options of the farmers, they will have certainly high stakes in the irrigation systems per se. In addition, they will be willing to manage these systems, if the enhanced cost for doing so (both money and time) is a very small proportion of the overall returns from agriculture. In our study systems, cost of irrigation varies from between 5 to 15% of the total returns from irrigated farming. In simple words, farmers will come together and manage a CPR like canal irrigation, only if the benefits of doing so far outweigh the costs. This has happened here and therefore PIM seems to have succeeded to a great

Table 16: Year wise membership (numbers) in four irrigation societies

Year/Scheme	Baldeva LBMC	Pingot LBMC	Pingot RBMC*	Issar
1991-92	—	—		
1992-93	—	—		
1993-94	168	—		
1994-95	168	124		
1995-96	174	149		227
1996-97	174	160		279
1997-98	174	190		284
1998-99	186	215		295
1999-00	186	230		302
2000-01	186	260		303
2001-02	186	294		366

Source: Secretaries of respective irrigation co-operatives. Membership data of Pingot RBMC not available.

extent. However, by this we do not imply that all have benefited equally. A Patel farmer has benefited much more than a Vasava farmer, because he has shifted to very high value sugarcane and got greater returns. Besides, initial resource position in terms of higher land holding of a non-tribal farmer also made him eligible for higher returns. Incomes have certainly improved for all (tribals and non-tribals), though the implications for inequality are not clear- but which is of greater significance? There are a lot of gray areas in PIM in this region, which needs further research. One of them is the constraint faced by a tribal farmer in cultivating sugarcane, which is undoubtedly a more profitable crop. It seemed clear that lack of private sources of irrigation (read groundwater irrigation) is a reason for this, but what did not seem clear is why the tribal farmers are not investing a part of returns from irrigated farming for well construction. Is it because of capital shortage, long gestation period of sugarcane, marketing bottlenecks that tribal farmers are not shifting to sugarcane? If this were so, it would be interesting to see how few tribal farmers have shifted to sugarcane cultivation and why majority of them could not. In our sample of 77 tribal farmers, some 10 grew sugarcane. Their yields are comparable with those obtained by Patels, though their total earnings were much less than a Patel, simply because on an average a tribal farmer grew sugarcane on 1.5 acres of land, as compared to 6.5 acres for a non tribal farmer. The second issue would be perhaps the increasing concern on part of NGOs like AKRSP (I) about land alienation of the tribals as a result of irrigation. This too would need more research.

Role of a NGO like AKRSP (I)

There is no gainsaying the fact that AKRSP (I) played a vital role in promoting PIM in our study cases. They have acted as facilitator in the entire endeavor. But for the vision of senior level staff and dedication of field workers, PIM in Gujarat might not have evolved as it has done today. However, the time is ripe now for AKRSP (I) to analyze its own efforts and decide how sustainable will it be for the organization to devote 5-8 years for each system. Now that good demonstration effect has been created, AKRSP (I) and other NGOs working on PIM must forge greater alliance with the government and scale up their activities faster. It's role as we envisage it now is to help evolve model drafts for PIM legislation, based on its extensive and incisive field experience.

A look at Baldeva LBMC and Pingot RBMC societies (the first two success stories of AKRSP (I)'s involvement with canal irrigation) clearly bring forth the role that non-tribal (Patel) farmers have played in making PIM a success. This is intuitively clear; they being large farmers have a greater sunk costs and greater stake in proper function of the systems. AKRSP should encourage these farmers to take the lead and at the same time should work towards empowering the weaker sections in order to help them realize full potential benefits of irrigated agriculture. AKRSP should also encourage the societies to build up reserve funds to reduce their dependence on the government for repair and maintenance works. AKRSP (I)'s effort of forming federation of PIM societies should be taken up in right earnest. At a higher level of federation, we believe, there is a need to hire professional staff to manage the irrigation systems. This of course will be possible if irrigated agriculture is profitable enough to absorb the enhanced costs of maintaining and managing a system. Here again, AKRSP (I) and other NGO's in the region can play a very crucial role by removing obstacles (either backward or forward linkages) in practicing irrigated agriculture. They should perhaps encourage more and more tribal farmers to grow sugarcane, which is clearly a much more profitable venture than either groundnut or moong. The other alternative

could be orchard crops, such a mangoes. On the whole, PIM will succeed in the long run, only if irrigated agriculture remains a profitable venture in years to come and AKRSP (I) should endeavor to do so for the tribal farmers.

Lessons Learnt: Can they be replicated?

We will summarize findings of this study in this section. As mentioned at the very outset, the objective of this study was to evaluate the impact of irrigation of livelihoods of the tribal farmers and because the irrigation systems we studied were also turned over to the farmers for management, we got an opportunity to study how tribal farmers have managed these systems. One must remember managing a canal irrigation system is a daunting task by itself, given the complex nature of the system and institutions involved. Nevertheless, we find that the tribal farmers have managed their systems with a modicum of efficiency and the non-tribal farmers, especially in Baldeva have played a very significant role in this. The following are the main findings of this study:

1. Irrigated agriculture has been at the heart of changing the tribal lifestyle, from one of seasonal migration to cities, to that of growing summer crops of groundnut and moong in summer.
2. Gain from irrigation has been tremendous and has got reflected in changed cropping pattern, higher yields, lower migration rates, higher wage rates and higher land prices.
3. Tribals have adopted irrigated agriculture without much difficulty. This is because quite contrary to the general notion that tribals are not skilled farmers, here we found that tribals are indeed a good a farmer as any other. This was reflected in the fact that yield of major crops did not vary much between a tribal and a Patel farmer. That their overall income from irrigated farming was less could be attributed to their smaller land holding rather than any productivity differences. The tribal farmers we interacted with and studied are 3rd or 4th generation tribals. This study also made us aware of the fact that there is great heterogeneity among the tribals and it would be grave error to put them all in the same basket, as we are very apt to do.
4. The presence of non-tribal farmers has acted as a "demonstration effect" in irrigated agriculture. Most of the Patels in our study villages were already growing sugarcane and few other irrigated crops and the tribal farmers were aware of dynamics of irrigated agriculture. So when the time came for them to shift from rain fed to irrigated farming, they did not find it as difficult as they might have had they not seen irrigated agriculture at all?
5. PIM efforts of AKRSP (I) have borne fruit. On the whole, we contend that PIM has created positive welfare benefit for all farmers in general and tribal farmer in particular. Pingot RBMC and Baldeva LBMC have been rightly acclaimed as success stories of AKRSP (I) and have got nationwide attention as they deserved. Perhaps, we can say that Pingot RBMC and Baldeva LBMC are success cases because they inspired society formation in tribal dominated Pingot LBMC and Issar. A model unless replicated, cannot be called successful. But the very fact that farmers in Pingot LBMC got enthused by success of Baldeva LBMC and Pingot RBMC societies and formed a society on their own without the help of any intermediating NGO indicates that PIM has succeeded in general and AKRSP (I)'s efforts in particular have been well spent.
6. However, there still remains a lot to be desired. For example, it did not seem clear as to how the irrigation societies were spending their reserve funds and why were they solely dependant on the government for R&M work.

We believe for these systems to be sustainable in the long run, the government must eventually hand over the management of these systems to the users and the users in turn must take care of all R&M.

7. The most important finding of our research is that we could shatter the myth of tribal indolence, which has been so often blamed for their backwardness. In an enabling environment, a tribal can become as good a farmer as any other.
8. Finally, can the lessons we learnt from this study be replicated in other tribal dominated regions? We cannot claim to know this for sure. For one, as of now, we do not know the exact extent and prevalence of such canal irrigation projects in other tribal dominated areas. But, as we saw earlier, in Madhya Pradesh and Chattisgarh at least, there seems to be a lot many of such minor flow irrigation schemes. We really need to find out more about them, before we can assert that our findings can be replicated. But, there is no doubt whatsoever, that tribal farmers can pick up the art and science of cultivation, especially if they live cheek and jowl with other non-tribal and skilled farmers.

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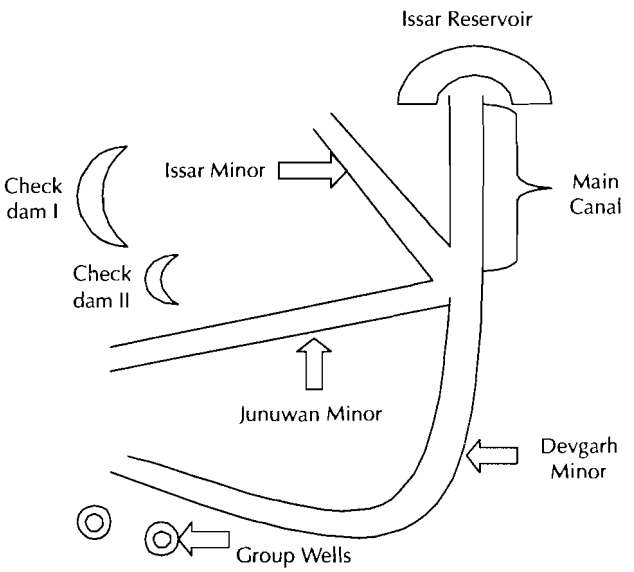
Field Notes on Participatory Irrigation Management in Pingot, Baldeva and Issar Irrigation Schemes of South Gujarat

Aditi Mukherji
IWMI, Anand Office

Issar Minor Irrigation Project - Field Notes

Issar dam was built in 1975-76 and irrigation department supplied water to the farmers from 1983 till 1995, after which Issar Co-operative Irrigation Society took over. The project has three minors, each catering to three different villages, namely Issar Minor (2160 m), Devgarh Minor (1880m) and Junuwan Minor (1560 m). The main canal is relatively short, only 375 m in length. All these are 100% tribal villages, inhabited by only Vasavas and Chowdhuries. During government management, less than 100 hectares were irrigated. The main irrigated crops were wheat and moong. Farmers were required to pay irrigation fees after each season, but because there was never adequate irrigation available, most of the farmers defaulted on payments. In 1995-96, at the behest of AKRSP (I) and government officials, the farmers in the command area of Issar project agreed to form a co-operative and take over the management of the canal system. Before handing over the canal, the irrigation department and AKRSP (I) along with the farmers carried on rehabilitation work at a cost of 1.5 lakhs, which included lining a part of the main canal, stop leakage form the main outlet and canal gate repair. A check dam was constructed in Issar village where leakage water from the dam was stored and could be used for irrigation by 10-15 farmers. AKRSP (I) with funds from Tribal Sub Plan has also constructed two group wells in Devgarh village for purpose of conjunctive irrigation. The main canal is partially lined, as are some parts of Issar and Devgarh Minors. However, Junuwan Minor has a technical snag and water does not reach almost 50% of the designed command area. AKRSP (I)'s intervention is still on in this project but it plans to eventually withdraw as it had done in Pingot and Baldeva schemes.

Schematic Diagram of Issar Minor Irrigation Project



Not drawn to scale

The co-operative at present has 397 members and a committee of 17 members including four women. Besides, there are three minor wise committees. The President of the Society is also the Secretary of the village fishing co-operative and a member of the village panchayat. Similarly, most of the committee members are also affiliated with either the panchayat or the fishing co-operative or the milk co-operative. There are 12 watercourses in the system and there is an informal committee at each watercourse to look after the water distribution below the minor level. The committee

holds regular meetings and there is an annual general body meeting. To become a member of the irrigation co-operative, farmers have to buy share worth Rs 51 each. The committee wanted to increase the share fees to Rs 151 per share, but the government auditor refused to grant permission. At present, share allotment is based on number of landholders; a farmer with 1 acre and a farmer with 5 acres can hold only one share each. However, the committee is planning to change over to area-based share from next year after getting approval from the members. In this, the share price will be Rs 51 per acre of land holding. The advantage of this system according to the society President and Secretary are two. Firstly, money collected, as share fees will increase. This is because now 397 members pay Rs 51 each as share fee, the total collection being Rs 20247. However, these 397 members own 680 acres within the command area and under the new system, the total collection will be Rs 34680. Secondly, in times of scarcity, it will be easier to ration water, each will get water for one share at first and if water is in excess, then he can get water for the rest. The co-operative also gives water to the non-members and at present some 20-30 non-members take water from the canal. In last year, i.e. 2001-2002, a total of 273 hectares were irrigated using canal water. This scheme also provides support water for kharif crops when water is available, but it generally caters to rabi and summer crops only.

Within the canal command of the Issar scheme, there are 30 dugwells, of which 2 are AKRSP (I) constructed group wells. Of the rest, only 3-5 wells have reliable yields. There are 22 diesel pumps within the command, of which 13 are privately owned (5 HP each), BAIF, a NGO owns 7 (5 HP each) pumps and 2 (10 HP each) are owned by the panchayat. These are used to directly irrigate those fields, which are too high for canal water to reach through gravity flow. There are more number of wells and pumps in operation at the tail end of each minor canal.

There have been marked changes in cropping pattern after the dam was built. Before the dam was constructed, farmers practiced rain fed farming and grew local varieties of jowar, tuver (pulse), rice and cotton. After irrigation was available through government department, farmers in the head reaches took to wheat, moong and groundnut. After PIM, when water availability was better, there were more changes cropping pattern. In addition to wheat, moong and groundnut, few farmers also started cultivating sugarcane. Similarly, area under vegetables increased. Area under sugarcane is still very low, firstly because individual land holdings are small and secondly, most of the farmers do not have wells or bores of their own to provide irrigation to sugarcane when canal water is not available. A normal irrigation season starts from November, with first water for wheat. Wheat gets five irrigations, so total cost for irrigating an acre of wheat in a season is Rs 200/acre. After rabi wheat, summer crops like groundnut and moong get 6 and 4 irrigations respectively. Towards the end of the season in April-May, tail enders do not get enough water. Therefore, most tail enders prefer to grow winter wheat than summer groundnut. In our earlier meeting with the committee it was claimed that water distribution is from the tail to the head. However, later when we met villagers at the tail end of the village, they claimed that though tail to head system was followed during the first two irrigations in the last season, due to water shortage in the later stages, head to tail water distribution system was restored. Moreover, In Jaunuwan Minor, almost 50% of the command area remains unirrigated due to design fault.

The society water rates are higher than the government rates. For example, the government rates for irrigating one acre of wheat, groundnut and moong is Rs 32/acre per watering, while the society rate is Rs 40/acre per watering. For sugarcane, it is still higher at Rs 80/acre per

watering. For farmers who lift water directly with diesel engines are charged 50% of the society rates. For non-members, the water charges are 30% more than the society charges for its members. At the beginning of irrigation season, the irrigation department officials along with the Society members carry out a joint inspection of fields based on demand forms filled by each farmer. Based on this, the irrigation department calculates its irrigation dues from the Society. Of the total irrigation fees collected, the societies are required to pay the government its stipulated water rates before a certain due date. The government after receiving the irrigation charges within a specified time period gives a rebate of 20% and gives back to the society another 30% for carrying on repair and maintenance work. Thus in essence, the society gets back 50% of the irrigation fees that it deposits to the government. In addition, whatever extra fees the Society collects over and above the government rates are to be kept in reserve by the society and can be used for O&M works as decided by the Society from time to time. The Society pays a salary of Rs 1050 to its secretary per month and Rs 800 per month to the operator. However, the operator, who also doubles up as the watchman, is paid only when the canal system is in operation. The Society has also devised detailed norms for dealing with defaulters, under reporting of area irrigated, taking water out of turn and direct lifting of water without its permission. In case of default, they stop water till the dues are cleared. However, some exceptions were made in case the committee decides that the defaulting farmer was in no position to pay and they let him take water only on the condition that he will clear his dues at the end of the season. In case of taking water out of turn, a head end farmer was recently made to pay a penalty of Rs 2051, of which Rs 1051 was fine and Rs 1001 was compensation to the Society. Under reporting of area leads to a fine of 1.5 times the water charges as does misreporting of crops and lifting water without permission.

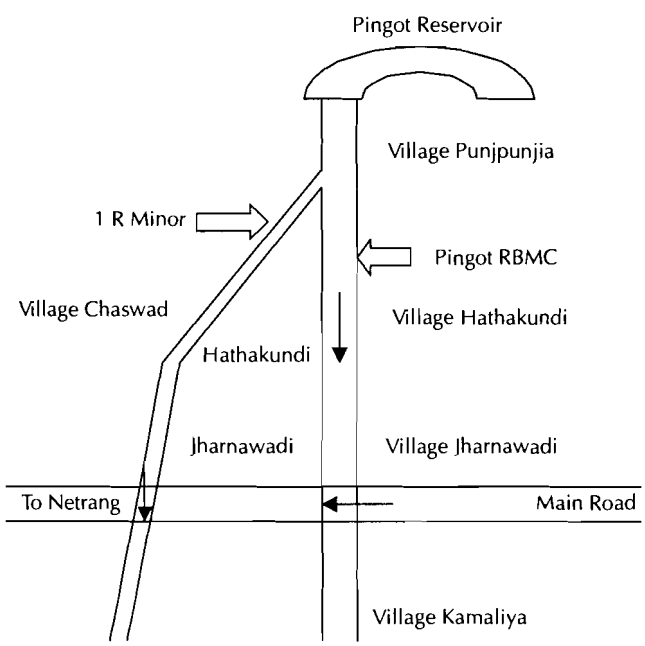
Issar Society played a leading role in formation of PIM Federation in South Gujarat. This has been promoted by AKRSP (I) with a view of providing common platform to all the PIM societies operating in the region. Moreover during the last financial year, the Society had published an account of its profits and losses and distributed it among the farmers. This is possibly the only society among the entire South Gujarat PIM societies to have done so. The committee members also feel confident that they can manage their affairs once AKRSP (I) withdraws its managerial support, as it will eventually do. There have been few other benefits of PIM. Firstly, out migration has gone down by almost 90% among the landowners and 50-60% among the land less laborers. This is because, now the farmers take two or even three crops in an year as compared to only one crop in pre irrigation days. Secondly, the land prices have gone up from almost Rs 25,000 per acre for unirrigated land to almost 1 lakhs for irrigated land.

Pingot Right Bank Irrigation Co-operative Society - Field Notes

A dam was made on river Tokri in Valia taluka of Bharuch district in 1980-81 and canal network of the Pingot Irrigation Scheme was completed by 1985. There were two main canals in the system, viz. the Right Bank Main Canal (RBMC) and the Left Bank Main Canal (LBMC). However, till 1990, almost 5 years after completion of construction, water was not released from the dam. The RBMC was designed to serve four villages viz. Hathakundi, Jharnawadi, Kamaliya and Punjpunjia. In 1990, after almost a year long concerted effort by AKRSP (I), irrigation co-operative was formed to manage and distribute water in the Pingot RBMC. The RBMC is designed to serve 275 hectares through 8 watercourses. The entire main canal has brick lining. The length of the RBMC is 4480 m. There is only one minor of the RBMC, called 1 R Minor. Its length is some

200 meters more than the RBMC. This too is totally lined and has 10 watercourses through which water reaches the farmers fields. The 1R Minor, was designed to serve an area of 281 hectares. Unlike the Issar Scheme, where all the beneficiaries were tribals, in this system, there are tribals as well as non-tribals. Especially Kamaliya and Jharnawadi village have good number of non-tribal households and more importantly, non-tribals own more land that the tribals do. On an average, tribal land holding is almost always less than 5 acres and that of a non-tribal is more than 10 acres. Thus, according to the villagers, 10% of the non-tribals own 50% of the village land in these two villages. The other two villages, viz. Hathakundi and Punpunjia are however, predominantly tribal villages.

Schematic Diagram of Pingot RBMC Medium Irrigation Project



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The co-operative at present has 241 members, of which 216 members have voting rights ands the rest, mostly women are nominal members. Of these, some 5-8 members are Patels. The working committee of the Society has 6members including the Secretary, who is paid a monthly salary of Rs 450. The rest are all honorary members. The Chairman of the Society is a Patel from the tail end village of Kamaliya, while the Secretary is a Vasava tribe from Hathakundi village. Since 1990 till 2002, there have been some changes in the working committee of the Society. From 1990-96 (till AKRSP's intervention was on), the Chairman of the Society was a tribal, but in 1996, a Patel took over as the head. Most of the tribals we talked seemed to think that a Patel performed better as a Chairman than a tribal did mostly because he had larger stake in the proper functioning of the system as they as a community own larger share of the land. However, a tribal has always held the paid post of committee Secretary right from 1990 till now. The committee does not hold regular monthly meetings, but call a meeting as and when some issue needing discussions are raised. However, they do have an AGBM, but attendance varies from year to year. Last year, because the AGBM dates coincided with the Chaswad Dairy AGBM, most irrigation society members preferred to attend the dairy co-operative meeting. Shareholding, very like the Issar Society, is not linked with land holding size. To become a member of the irrigation society, one has to buy a share of Rs 51 each, which is quite unrelated to the total land holding. The nominal members do not have to buy shares, as they do not own land in their own name. Unlike the Issar Society, where they are planning to link share ownership with land size, there is no such initiative in Pingot RBMC Society. Within the command area of the Pingot RBMC, there are some 20 to 25 private bore wells, almost exclusively owned by the Patels. These are used to irrigate sugarcane at times when canal water is not available. Some 5 to 6 pumps directly draw water from the canal and pay half the stipulated rates.

Like, everywhere else, irrigation has brought about cropping pattern changes in the region. However,

this change has been different for the tribes and the non-tribes. Before 1990-91, the pre dominant cropping pattern in these villages were kharif paddy and local cotton. Some rich Patel, who had own wells, grew some pulses and vegetables as rabi crop. There was no summer crop. Sugarcane was not cultivated at all, because bore well yields were not reliable. After canal irrigation was available, the non-tribals promptly shifted to sugarcane cultivation, which was made further lucrative by the presence of sugar mill at Chaswad village nearby. The tribals on the other hand, continued growing kharif paddy and in addition stared taking rabi and summer crops of moong and groundnut. The local cotton variety was replaced because of pest problems. There is a lot of intercropping; jowar and bajra are intercropped with soyabeans and urad. Apparently, intercropping intensity has come down after irrigation, though it is still prevalent in the rainfed kharif crop. Tribals have not shifted to sugarcane dominated cropping pattern, because they do not have their own assured source of irrigation. In this irrigation project, a normal irrigation season starts from January, when the first water is released. There is no supplementary rabi irrigation due to inadequate water for summer crops. The distribution system is from head to tail. A 12 days rotation process is followed, where 4 days of irrigation each are allotted to farmers in the head, tail and the end reaches respectively. A maximum of 6 such irrigation cycles can be achieved in a good rain fall year, but in a bad year, it comes down to 4-5 irrigations. In such years, groundnut and moong crops are given precedence over sugarcane. At times, towards the end, the tail enders do not get adequate water. When asked as to why the tail to head rotation system was not followed, the committee members opined that already demand exceeded supply and tail to head distribution system would lead to wastage. Since, the Chairman is from the tail end village of Kamaliya, it helps in resolving head tail crisis to some extent.

Here again, the Society water rates are higher than those of the government. In fact, one of the clauses of transfer as agreed upon by the government irrigation department and AKRSP (I) was that the society couldn't charge lower irrigation rates than the government. Pingot RBMC Irrigation Society charges 1.5 times the government rates for groundnut and moong and almost 2.5 times the government rates for sugarcane. Besides, a very small amount is added over and above this as "co-operative development" fees, which have to be paid yearly by the Society to the government. The existing Society rates for different crops are Rs 265/acre for moong, Rs 365/acre for groundnut and Rs 1820/ha for sugarcane, while the government rates are Rs 125/acre, Rs 160/acre and Rs 680/ha respectively. The water rates here are more than the Issar scheme, where it comes to Rs 160/acre and Rs 240/acre for moong and groundnut respectively. Again, unlike, Issar society, here the water rates for the members and the non-members are same. When asked about this, we did not get any satisfactory answer from majority of the members. However, one member told us that most of the non-members were from the tail end village of Kamaliya and did not receive water regularly and therefore it was decided not t charge extra from them as they take water only once in a while. However, the committee members are aware that they are legally allowed to charge more from the non-members, if they so desire. The society has some norms about defaulters, but the norms are not as detailed as we found in Issar Society. It might be because they have been operating for the last 12 years and by now have devised some informal, but equally effective means of penalizing the defaulters. Here the water charges are collected partly in advance according to demand forms and partly at the end of the season. One has to pay the full fees, even if he/she had stopped taking water after only one rotation. If the irrigation charges are not paid by the last date stipulated by the

committee, then according to the latest government order, the committee has been empowered to impose an interest of 12% per annum for late payment. However, some committee members have proposed charging 18% interest as against 12% recommended by the government. This will come up for discussion at their next committee meeting and a decision will be taken. If all the pending dues are not cleared, then water is stopped for the next season. There are no penalties for under reporting or misreporting of area, though Rs 100 is charged as fine for taking water out of turn. The committee members said that there is no scope for misreporting or underreporting of area, as they and irrigation officials jointly carry out plot-by-plot survey based on initial demand forms filled by the members and all anomalies are sorted out there itself. Through this process, the government also notifies the Society as to how much they have to pay to the government as irrigation fees. Collection has been problematic, especially after government raised its rates. At present, there are old dues to the effect of Rs 30,000 or so.

The major constraint of this system is that demand exceeds supply and during deficit rainfall years, there is not enough storage in the reservoir to cater to the tail end farmers. There is a minor leakage in the system and water seeps into the Tokri River, from which some rich farmers directly lift water. Apparently, there was a scheme to construct a small check dam to capture this leakage water and survey work for the same was done last year, but so far no construction has started. The farmers from both Pingot RBMC and LBMC complained that residents of village Pingot and Paniamba located upstream of the reservoir have not moved out, though they have been given compensation and the villages are a part of the planned submergence area. If these two villages were to be relocated, then the dam height could be increased by another 1 meter and reservoir capacity would have increased. However, relocation and compensation are contentious issues, as the villagers themselves understand. There is fishing co-operative in Punjpunjia village, the President of this co-operative is also a committee member of irrigation co-operative. This fishing co-operative has been working since 1974, long before the dam was constructed and its members (total 74 in number) spread across 5 villages falling in Pingot RBMC and LBMC command areas. The fishing co-operative earned a net profit of Rs 11 lakhs in the last financial year. As with Issar irrigation co-operative, most of the committee members of Pingot RBMC irrigation society are also executive committee members of either fishing co-operative or dairy co-operative.

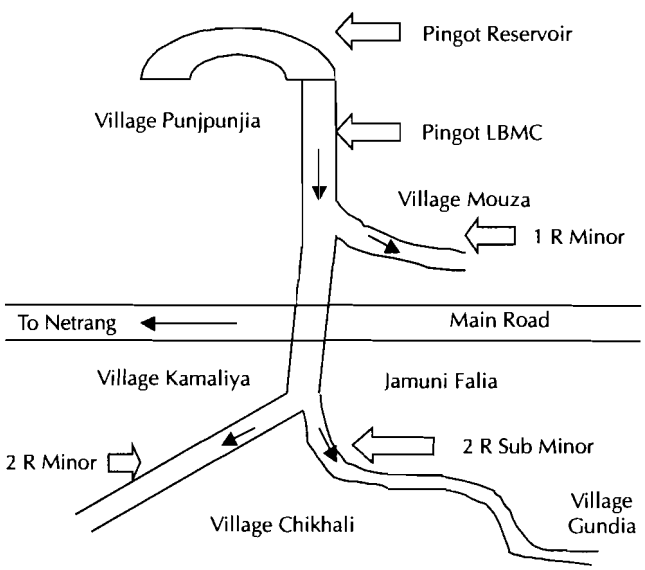
This Society has been working since 1990-91 and has provided irrigation from 1991-92 in almost all years since then. This was the fist Irrigation Co-operative in Gujarat at the behest of AKRSP (I) and government of Gujarat. AKRSP (I) after six successful years of intervention withdrew in 1995-96. During AKRSP (I) intervention, a lot of rehabilitation works in the form of lining; pitching and laying under ground pipelines took place. The pace of repair and maintenance has gone down ever since. The farmers drew our attention to dilapidated state of repair in a part of the main canal and estimated that it might need Rs 80,000 to Rs 100,000 for repairs. However, instead of carrying out the repair work from their reserve funds and getting reimbursement from the government later, they are waiting for the government to directly undertake the repair work. It was not clear how much reserve fund they have been able to create in the last 12 years; however, we hope to get this data from the Secretary soon. However, there is no gainsaying the fact that PIM and consequently accessibility to irrigation has had a positive impact on tribal livelihoods. Not only do they take two and at times even three crops a year, out migration rates too have dropped

drastically if the farmers we talked too are to be believed. In fact, there has been some amount of in migration of farm laborers from Satara in Maharashtra, which is indirectly associated with PIM. These farm laborers are hired by the Chaswad sugar mill for cutting sugarcane from the fields for bringing them to the factory. Acreage under sugarcane has increased after PIM. There has been another indirect benefit, as one farmer pointed out. Fodder availability has increased as has the wage rates in the village (from Rs 15 to 20/day before PIM to Rs 30-35 after PIM) and the land lease prices. On the whole, PIM has been beneficial to the tribals as well as the non tribals, more so for the non-tribals as they have been able to get a bigger bang out of it through private investment in groundwater irrigation infrastructure. Organizations like AKRSP (I) and BAIF might think in lines of investing in group well schemes in this command area as they have done elsewhere. This will allow conjunctive use.

Pingot Left Bank Irrigation Co-operative Society - Field Notes

The Pingot reservoir was built in 1980-81 and the work on canal network got over by 1985. However, from 1985 to 1990, no irrigation was provided to the command area farmers by the irrigation department. In 1990, the farmers in the Pingot RBMC organized themselves into irrigation co-operative with the help of AKRSP (I) and from the next year farmers in RBMC started receiving benefits of canal irrigation. However, in the same year, the irrigation department also started releasing water in the LBMC command area and this continued till 1994. But during these four years, coverage in terms of area irrigated remained very limited, because of uneven terrain and absence of underground pipelines to negotiate this structural anomaly. According to the farmers we met, some 80 to 100 hectares of land could be irrigated during this period. In the meanwhile the irrigation co-operative Society was operating successfully in RBMC command area and attracting state wide attention as the first case of successful PIM. Consequently, AKRSP (I) approached LBMC farmers to form a co-operative and the irrigation department too promised to invest more on improving the network if they agreed to take over the management of the canal. However, the farmers of the LBMC declined offers of help from AKRSP (I) and decided to form a co-operative Society on their own. The Pingot Left Bank Irrigation Co-operative Society was formed in 1995, without the help of either AKRSP (I) or any other NGO. This was so because, in one of the command villages of LBMC, viz. in Mouza village, there already existed a multi purpose co-operative and an oilseeds pressing co-operative. The farmers therefore felt that they could manage to create and sustain irrigation co-operative on their won without the help of AKRSP (I). This is incidentally the only Society we visited which has an office premise of its own. This office also doubles, rather triples up as the office of the multi purpose society and the oilseeds pressing co-operative. In 2001-2002, a total of 360 hectares were irrigated.

Schematic Diagram of Pingot LBMC Medium Irrigation Project



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This medium irrigation project serves 5 villages, and 2 hamlets. These are Mouza, Jamuni Falia, Kamaliya, Chikhli, Gundia and one hamlet each in Punjpunjia and Mouza village. Unlike RBMC command area, where there are tribals as well as non-tribals, the LBMC command is is predominantly tribal inhabited. The villages are Vasava and Chowdhury tribe dominated ones. The main canal is almost 6 km long and minor 1 and 2 are 300 m and 1050 m respectively. While the main canal is more or less lined, lining work is going on in Minor 1 and 2. From its inception till now, the Society has invested almost Rs 7 lakh in repair and maintenance from their reserves but have so far got back only 1.8lakhs or so from the government. After the formation of the Society, 19 pipelines were installed and the effective command area increased drastically.

In 1995, the Society was formed with 12 members and now there are 305 members. Here too members have to buy 1 share each of Rs 51 and it is not linked to land holding size. There is an 8 member working committee of the Society and the Secretary gets a monthly salary of Rs 2000. The Society has also employed 4 watchmen to guard the entire canal network and each is paid Rs 800 per month for 4-5 months when the canal is operational. In 1995, when the Society was formed, one professor from a college in Surat was the Chairman. He relinquished the post in 1997 and since then, one Maganbhai Chowdhury of Hathakundi village is the Chairman. He is also the Chairman of the other two co-operative Societies and the Secretary of irrigation society doubles up as secretary for the other two societies. Some of the committee members are also members of fishing co-operative based in Punjpunjia village. Almost all the members of the irrigation co-operative are also members of Chaswad dairy co-operative. This village belies the general assumption that tribals are less likely to work and prosper in the "co-operative society" mode, which has been always associated with the better off non-tribals. In fact, of all the irrigation societies we visited so far, this one seemed to be the vibrant of them all. Majority of the committee members had come to meet us and they have a very good system of keeping written records. The fact that the same management committee runs three co-operative societies, itself speaks well of the tribal farmers involvement. Unlike most other tribal dominated regions in Central India, creation of demand for irrigation is not a major impediment in this South Gujarat region. The tribal farmers here are 3rd to 4th generation farmers and are well versed with agriculture. Even shifting to irrigated farming did not seem a major obstacle to them, they changed over to it without any major difficulties. They hold regular committee meetings, but the attendance in this year's AGBM was low. However, there are proportionately higher numbers of defaulters in this scheme and the committee members alleged that so-called "mathabhari" or politically powerful refuse to pay on time and the committee is at quandary over them.

In 2001-2002, the Society provided rabi support irrigation to 50 hectares of land and summer irrigation to 310 hectares. The Pingot RBMC however, does not provide support water, while LBMC does. This was seen as an achievment on the part of the LBMC members. Here too, cropping pattern has changed drastically after irrigation and more so after PIM in 1995. Before the canal became operational in 1990, the main crops were paddy, local cotton, pulses and local groundnut, all grown in kharif season. After irrigation, the farmers gradually shifted to hybrid paddy, summer and rabi pulses, soybean, vegetables and in some instance to even sugarcane. Here again, sugarcane is limited to those few farmers who have their private irrigation source. Now the typical cropping pattern of a tribal farmer would be kharif paddy,

*intercropped with soyabean or tuver or grown alone, followed by rabi wheat or summer moong or groundnut. Most prefer summer crop to winter crop, because they get canal water from mid January to mid May, which is too late for rabi cropping. However, even in rabi season, they grow vegetables. Besides, some amount of land is dedicated to jowar and bajra cultivation, which yields both food and fodder. When asked about the benefits of irrigation, the farmers pointed out at least three distinct benefits. Firstly, they can grow a summer crop, either moong or groundnut, secondly, this summer crop gives them ready cash to grow kharif crop, for which earler they had to borrow money from money lenders. Thirdly, more green fodder is available for livestock due to more crop output. In addition, most farmers reported a decline in out migration by almost 60 to 75% and more availability of work within the village. The wage rates too have gone up from Rs 15 to Rs 20 a day to Rs 30-35 a day. However, input costs have gone up significantly. Now they have to apply more fertilizer during kharif season than before. Some farmers want to shift to sugarcane, but cannot do so as they do not have bore wells of their own. They are waiting for BAIF to construct a group well in the village. It was not very clear why the tribals do not want to invest in own wells and bore wells, especially when they say that profits from agriculture has increased more than 5 times after irrigation was available. Some farmers we asked told that farm sizes were too low to justify the investment, other farmers said that getting capital was difficult, while some opined that electricity connection was difficult to get by. They seem to be now banking their hopes on schemes under "New Gujarat Plan for Tribal Development", under which agencies like AKRSP (I) and BAIF would construct group wells in the village. This unwillingness to invest in own well or bore is more or less found among all the tribal farmers we talked to in all the project areas and this merits further attention.

The water rates are 1.5 times the government declared rates. The prevailing rates are Rs 260.acre for moong, Rs 360/acre for groundnut and Rs 1800/ha for sugarcane. The rates are more or less same as that of RBMC. They too have some norms relating to late payment, taking water out turn, under reporting of area etc. As per the new government order, they have started charging 12% interest for late payments. Besides they charge 1.5 times the Society rates for taking water out of turn, misreporting and underreporting of area and crop. One problem that they have been unable to solve has been of under reporting of canal-irrigated land when the owner has well on that same plot. Very often, the owner under reports canal irrigated area and shows that the land is well irrigated, while it might not be so in reality. They are thinking of bringing a rule whereby when canal rotation is on, no one can operate wells, or conversely, if there is a well in the plot, then that farmer cannot demand canal water. However, the clause needs further discussion. In the last year, the Society irrigated 360 ha of land, thereby earning total revenue of almost Rs 2.5 lakhs, of which only 1.8 lakhs could be recovered till 14th August. Of these 1.8 lakhs, they got back Rs 90,000 from the government, a part of which will be used this year for jungle cutting and canal maintenance.

Water distribution system is from head to tail and water is released every 10 days. There is no formal co-ordination between the RBMC and LBMC management committees so far except that each release water after alternate 10-12 days. They do not have joint meetings with each other as of now. As one farmer pointed out, water distribution is smooth so far and there has been no reason for coordination, but they are open to it as and when need arise. LBMC Society is also a part of PIM

federation for South Gujarat floated by AKRSP (I) and they have so far attended all the meetings of the federation.

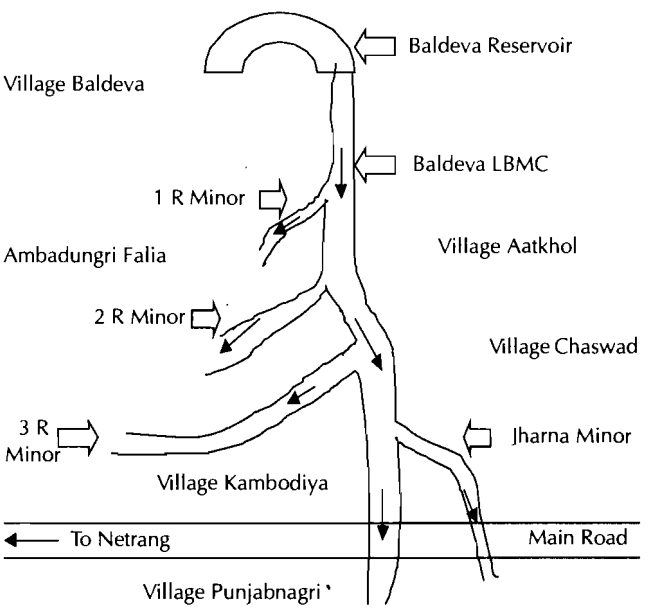
This Society came up on its own and it seemed to us one of the most vibrant societies in terms of participation and initiative. However, as the members acknowledged, financial position was not as robust as they desired it to be. They were also the only co-operative which had invested large amounts from its reserves for repair and maintenance.

Baldeva Left Bank Co-operative Irrigation Society - Field Notes

Baldeva Left Bank (LBMC) Co-operative irrigation society has had a rather chequered history. The Baldeva dam or reservoir was built in 1977 and the work on canal networks got over by 1982. However, the canal was not operational till 1990. In that year, in the neighbouring Pingot Irrigation scheme, a co-operative society was formed with the help of AKRSP (I) and the same year the society started delivering water to the farmers in RBMC command area of Pingot Minor Irrigation Scheme. This further enthused the farmers in the Baldeva canal command area. Next year, i.e. in 1992, AKRSP (I) approached farmers in the Baldeva LBMC command area and asked them to emulate the example of Pingot RBMC and organize themselves into irrigation co-operative. To begin, the farmers were apprehensive; as they have had bitter experience with co-operatives before. At the same time, all were very interested to gain access to irrigation. Thus, after some amount of cajoling, the farmers in the Baldeva LBMC agreed to form a co-operative society and started irrigation in the same year. AKRSP (I) provided was directly involved in capacity building and functioning of the co-operative from 1992 to 1997. Right after the withdrawal of direct intervention of AKRSP (I), the co-operative society was plunged into a crisis. The auditors raised certain queries on book keeping and the society was served a notice to reply to those questions. However, the Society failed to do so within the stipulated time and consequently, it was taken under government custody. From 1997 to 1999, the society was under government custody. In the meanwhile, the farmers in the command area formed a committee and expressed the desire of managing the co-operative again. The government turned over the management to this "custodian committee" on a trial yearly basis. This arrangement worked for another two years and in 2001, the society was removed from government custody and allowed to function as an independent one.

The culturable command area (CCA) of this scheme is 1155 ha, of which some 455 ha was irrigated in 2001-02. There are 181 members in the society, of which only 14 are women. It serves 5 villages including one hamlet in Baldeva village. The management committee is comprised of 5 people, one person representing one village. Of these, 3 are tribals and two non-tribals. There is a

Schematic Diagram of Baldeva LBMC Medium Irrigation Project



Secretary, who gets a salary of Rs 1200 per month. Besides, the committee hires 3 watchmen for 4 months and pays them Rs 1200 per month. The present President is a rich Patel from Kambodiya village and the Secretary is a tribal farmer, who has been working in the same post since the formation of the co-operative. The present President also is a member of number of other co-operatives and Chairman of the local high school board. The Chairman and the committee members were chosen through selection, though there is a provision for election. There are no minor wise or village wise committees, only one central committee of 5 members. However, they do call a meeting whenever any special issue arises and more importantly, they meet on the 21st of every month. The command area of Baldeva LBMC has mixed tribal and non-tribal population, though tribals are more in number, they have lesser land per family than the non-tribals. During AKRSP (I)'s intervention, major rehabilitation work was undertaken. The main canal and the minor canals were lined and new underground pipelines were installed. Post AKRSP (I), the society was taken under custody and only minimal jungle cutting and canal clearing work was done to ensure that water flowed from the head to the tail. Last year, when the co-operative was again restored to its independent status, the committee undertook some minor repair work of the underground pipelines and laid a new pipeline, in addition to routine operation and maintenance work. Even during the custody period, irrigation continued more or less undisturbed. For the first two years of direct government custody, the government water operator released water. However in the next two years of management under custodian committee, the committee looked after day-to-day operation of the canal. Here too, like the other societies, members have to pay share fee of Rs 51 per person, irrespective of land holding. However, from next year, they have agreed to shift to area based share, where two shares worth Rs 51 will be issued against 1 ha of land holding. If this is applied, this will be the only irrigation society so far to link membership share with land holding. Issar Society members too have been thinking on similar lines. Water scarcity is a major problem, as demand often exceeds supply. Consequently, head tail equity issues are at stake. The committee claimed that they distribute water from tail to head for all the irrigations; however, some farmers did not seem to agree with this contention. But, at the same time, several tail end farmers conceded that water availability was better during the last two years, ever since the new management committee took over. We need to investigate these issues further.

This canal command area has the largest number of bore wells and wells among all the cases studied so far. There are almost 150-160 bore wells, mostly concentrated in Baldeva and Kambodiya villages. The Chairman himself has 25 bores and 4 dugwells. Besides, there are some 20-30 dugwells fitted with electric pumps. However, the tribals own none of the bore wells and they own only 10% of the total dug wells. It is therefore no wonder that out of the 195 ha that were under sugarcane in 2001-2002, only 10 ha or so belonged to tribals. Sugarcane cultivation was a common practice among the non-tribals even before canal water was available. However, after canal irrigation, area under sugarcane has more than trebled. For the non-tribals, the cropping pattern changes have followed another route. Instead of shifting to sugarcane cultivation, they have started summer groundnut or moong cultivation. Earlier, they used to take only one kharif crop, viz. paddy, which they inter- cropped with tuver or soybean. The change in cropping pattern has been one of the most important and predictable change ushered in by irrigation in general and PIM in particular. The trajectory of change has been almost uniform

for the tribal farmer, from rainfed paddy farming to irrigated summer crop cultivation. The trajectory has been different for the non-tribal; he has mostly shifted away from paddy and cotton to sugarcane. The tribals have not been able to shift to sugarcane cultivation because of lack of independent source of irrigation, fragmented holdings and high input costs. However, the tribal farmers have shifted to other remunerative crops. One such crop is a high value bean, which sells at Rs 40 per kg. Many tribal farmers have profited well from it last year. Income from agriculture has gone up several times, as have the input costs due to increased fertilizer application. One farmer recounted that when he practiced rainfed farming, his net profit in a good year was be Rs 10000 from 5 acres. Now, it is up to 1 lakhs from the same land.

A typical irrigation season begins on 15th January, when first water is released, though in some years they release water for support irrigation for rabi crops, when members so request and if there is enough water in the reservoir. Generally 6-7 irrigations are given and the cycle is completed by 15th May. Water distribution system is from tail to head, however few farmers seemed not so sure about it. We need to find out more on this. Groundnut, moong and sugarcane get 6, 4 and 4 irrigations each. In case of scarcity, groundnut and moong get precedence over sugarcane. Out of the total 455 ha irrigated this year, 195 ha were under sugarcane, another 109 ha under groundnut, 46 ha under moong and 15 ha under vegetables and other crops. Of these 445 ha, formal application was filled for only 365 ha and for the rest 90 ha no such advance demand was made. Therefore, farmers who did not apply before hand had to pay 1.5 times the Society rate, which again is more then double the government rates. The water rates in Baldeva Society are the highest among all the irrigation co-operatives we studied. The President was of the opinion that higher rates are necessary to bring back the co-operative on a sound financial footing and once it is achieved, the rates might be lowered in future. Incidentally, it charges the same rates from members and non-members, because there are very few non-members and they take water occasionally. Water rates are decided by the committee and are for one whole season. This means that even if a farmers takes only one water out of his four allotted irrigations for ground nut, he has to pay the whole amount. Mode of payment is partly in advance and partly after selling crops. The last date of clearing all irrigation dues is 30th September every year, after which the society charges 12% per annum interest on late payment. If all dues are not cleared, water is stopped for the next year. This society also has the most stringent rules about taking water out of turn. The fine amount is very steep, being Rs 1000 during the first 2 watering (when water is relatively abundant) and Rs 5000 towards the last watering. Last year, 6 people were fined Rs 1000 each and they have already paid their fines. Another 5 people were fined Rs 5000 each; they are yet to pay their dues. Underreporting, or misreporting crop type and area also invites a penalty of 1.5 times the normal society fees. The water rates for different crops are Rs 2300/ha of sugarcane, Rs 911/ha of groundnut and Rs 642/ha for moong and vegetables. The water rates are half for those who lift water directly from the canal and there are some 15-20 farmers who do so. The society, as already mentioned has started functioning as a full fledged co-operative only in the last year and is trying to build up a good corpus fund. They have been one of the best societies in terms of recovery of water charges. In 2001-2002, they sold water worth Rs 2,36,000, of which they have already recovered Rs 2 lakhs and paid the same to the government. The society has also registered profit in the last three financial years.

Tribal and non-tribal disparity in land holding is quite stark within this command area. However, PIM and canal irrigation has benefited both these categories through increased incomes and yields. Out migration due to necessity has come down and in fact, we found many rich Patel families have immigrated to New Zealand and Australia with their newfound wealth. The tribals did not benefit proportionately, because they could not shift to the highly remunerative sugarcane crop. All the same, they have benefited in terms of better income (some reported even 10 times increase in income, others less), better education and food security. On asked about perceived difficulties after irrigation, one farmer jokingly said that now they hardly had time to sit and chat, because as soon as summer harvesting is over, they have to start preparations for kharif crop! On the whole, PIM has brought about positive changes in their livelihoods. The irrigation society has managed to pull itself out from a sticky situation and now intends to stabilize itself, before diversifying into input provision services in near future.

Aga Khan Rural Support Programme: AKRSP – (I)
Sampling Plan

Name of the Project	Number of Members	Number of Villages	Sample from each village	Total	Sampling Norms
Isar Irrigation Project	316	3	10	30	3 - Head 3 - Middle 3 - Tail 1 - Non Member
Pingot RBMC	241	4	6	24	1 - Tribal Non Member 1 - Non Tribal Non Member 3 - Tribal members 1 - Non Tribal Member
Pingot LBMC	315	5	6	30	1 - Tribal Non Member 1 - Non Tribal Non Member 3 - Tribal members 1 - Non Tribal Member
Baldeva	177	6	4	24	1 - Non Tribal member 2 - Tribal Member 1 - Non Member
Dholi	-	6	5	30	4 - Tribal 1 - Non Tribal
TOTAL				**138**	

- All Samples to be Land owners and Canal Irrigators from the Project Command Area
- Avoid taking the society office bearers in the sample

Protocol for Case Study on AKRSP (I) Supported Canal Irrigation Schemes

Objectives of the Study

Impact of canal irrigation on the livelihoods of the tribals, with special reference to AKRSP (I)'s intervention in terms of institutional capacity building to help tribals manage these irrigation systems on their own.

Primary Objectives

- To see the functioning of Canal Irrigation network promoted by AKRSP (I) under the Participatory Irrigation Management.
- To study the institutional structure of the Canal Irrigation Societies at different levels i.e. the Canal Irrigation Society, Minor-wise committees and field level Informal Farmers' Groups.
- To study the Canal Irrigation Societies at different stages of maturity i.e. Inception Stage, Ongoing AKRSP intervention and Post-AKRSP withdrawal.
- To study the perception of the tribal farmers about irrigated agriculture vis-à-vis its impact on livelihoods.

Scope of the Study

Four systems at different stages of management transfer will be studied. These systems would be chosen from the list of AKRSP (I) promoted irrigation societies listed in the table below. The first two systems will be ones that has been transferred to farmers in the command area considerable time back and from which AKRSP (I) has withdrawn after giving necessary support towards capacity building. The third system will be one where AKRSP is still involved in the transfer process, but plans to withdraw in the future. The fourth system will be one where AKRSP has just started its planned intervention, but it is still at an embryonic stage. This stage wise study of four systems will help document the entire transfer process and the role that an intermediary like AKRSP (I) can play making irrigated agriculture accessible to the tribals.

Sources of Information:

- AKRSP (I) records and documentation
- Canal Irrigation Society's records
- Government Department's records
- Some qualitative and quantitative primary surveys

Methodology

The dominant method used for this study would be to undertake case study of each of the systems mentioned above. The cases will emphasize on the following points:

AKRSP (I) Promoted Irrigation Societies

Name of the System	District	Number of Villages	Status
Pingot	**Bharuch**	**4-5**	**Post Withdrawal**
Baldeva	**Bharuch**	**7-8**	**Post Withdrawal**
Issar	**Surat**	**3**	**Ongoing Intervention**
Lakhigam	Surat	4	Ongoing Intervention
Kevdi	Surat	4-5	Ongoing Intervention
Chopadwa	Narmada	16	Ongoing Intervention
Kakadiamba	Narmada	8-10	Ongoing Intervention
Dholi	**Bharuch**	**3**	**Inception Stage**
Khuparworsan	Narmada	2	Inception Stage

- The process of transfer and capacity building among the tribals so that they can successfully take over and manage a canal irrigation system.
- Role that an NGO like AKRSP (I) can play in this process.
- Impact of the schemes on the livelihoods of the tribals in terms of enhanced income, crop productivity, migration etc.
- Before after analysis of the schemes (before and after transfer) in terms of operational, financial, economic and agricultural indicators.
- With and without comparisons made possible through the study of three systems, which are in three stages of being turned over.

Expected Outcomes

The study intends to document the practice by and impact of irrigated agriculture on the tribal farmers of the Bharuch Program Area of AKRSP (I). The study also intends to study the different stages of maturity of the Canal Irrigation Societies and document the time-line and the process of evolution and maturity.

People Involved:

- Shilp Verma [IWMI-Tata]
- Aditi Mukherjee [IWMI-Tata]
- Prabhat Rath [AKRSP (I)]

Study Referee

Mr. Harnath Jagawat (SADGURU)

Time Period

August-September 2002.

GLOSSARY

AGBM	Annual General Body Meeting
AKRSP(I)	Aga Khan Rural Support Programme (India)
CCA	Cultivable Crop Area
CPR	Common Property Resource
GRT	Green Revolution Technology
HYV	High Yield Variety
ID	Irrigation Department
IMT	Irrigation Management Transfer
IWMI	International Water Management Institute
LBMC	Left Bank Main Canal
NGO	Non Government Organisation
O&M	Operation and Maintenance
PIM	Participatory Irrigation Management
R&M	Repair and Maintenance
RBMC	Right Bank Main Canal