

IRRIGATION MANAGEMENT TRANSFER (IMT) IN GUJARAT
Policies, Process and Performance

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Introduction

Irrigation is a very important resource in Indian agriculture. Irrigated area produces most of the grains required to feed a large population of India *and it* has the second largest irrigated area in the world after China. India has invested a large amount of money in ground and surface irrigation. According to the Economic survey of government of India, irrigation potential has grown from 22.6 million hectares in 1950 to 94.7 million hectares in 2000. In spite of spectacular increase in the irrigated area, state governments are continuously under severe financial constraints as they find it difficult to finance the recurring costs of irrigation or to collect water charges from the farmers. As a result sustainability of government run irrigation systems are in danger, they have negative effect on efficiency and equity of water use. As per the draft report of National Water Policy of the government of India of 2001, maintenance of water resource schemes is under non-plan budget, it is generally being neglected. The institutional arrangement should be such that this vital aspect should be given more importance than that of new constructions. In the past the government gave more importance to construction of new systems without any participation of farmers. It has been realized that if irrigation performance is to improve, a wide range of following mutually supporting interventions will be needed:

Institutional reform, including the restructuring of irrigation agencies and irrigation management transfer to farmers and private entities

The creation of incentives that treat water as an economic good and promote self-financing of irrigation schemes by water users.

Improve agronomic, maintenance and irrigation management practices

System modernization and promotion of advanced irrigation technologies

Growing realization that new paradigm in irrigation management is needed has ushered in a new wave of reforms in the form of Irrigation Management Transfer (IMT) in the irrigation sector. It has been advocated that on the one hand IMT will reduce the financial burden on the government, on the other hand it will increase the productivity and profitability of irrigated agriculture. In India, a change started taking place in mid eighties when the need for introducing PIM, on the lines of similar measures, was introduced. It was felt that complex tasks involved in water management would be difficult to perform efficiently with cost effectiveness by a centralized bureaucracy. It would be better to transfer some of the power and responsibilities to farmers, the actual users of water. The priority should be to loosen the tight control of bureaucracy and give a significant say to farmers in water management.

Status of Irrigation in Gujarat

Gujarat has 30 per cent area under irrigation but it contributes 70 per cent of total agriculture production. The average annual rainfall in Gujarat is 840mm, but is highly erratic varying from 525mm to 1070mm during the last twenty years. Within the state the rainfall varies from 1350 mm in south Gujarat to about 270mm in the Kutch region. In Saurashtra and Kutch regions annual rainfall is most erratic and varies from 300mm to 660 mm. Therefore these regions face

acute water scarcity. The average annual rainfall in the eastern hilly region varies from 870 mm to 1700 mm. The region receives good rainfall but due to the rocky terrain rain water does not percolate and flows away to the sea. In spite of having high rainfall, the eastern tribal hilly region has less than 10 per cent area under irrigation.

Rainfall is confined to only four months from June to September and the rainy days number between 10 in Kutch and 50 in south Gujarat. There is unequal distribution of rainfall during the season. Sometimes 40-50 per cent rain falls *only in 7-8 days. High rainfall in small number of days does not provide enough time for water to percolate. This results in major portion of the rainwater flowing into the sea. This also causes high erosion of soil. There are long dry spells after a few days of rain. Many times after sowing, due to the long dry spell, germinated seeds do not grow and the crop fails. In this situation support irrigation becomes a lifeline for farmers. So even for kharif (monsoon) crops protection irrigation is needed.* Thus it is very important to develop irrigation sources in the state. It is very difficult for the irrigation department to develop and manage all the sources of irrigation without support of people on a wide scale. Past experience in different fields of development has shown that whenever government worked with the people, the rate of success has been high. This experiment has been tried on canal and lift irrigation in Gujarat and some other states as well through Irrigation Management Transfer (IMT). The process is ongoing and it will take some time for the system to be efficient.

Objectives of the Study

This study proposes to describe current irrigation management transfer (IMT) in Gujarat, with special reference to lift irrigation. The focus will be on the relation between government policy, motivation of individuals involved, actual achievement of management transfer, and goals of transfer. The study has been undertaken with the following objectives:

1. To review the status of irrigation in Gujarat
2. To describe the present state of irrigation management transfer policies and programmes in Gujarat
3. To identify the impact of IMT in Gujarat.
4. To determine the main factors affecting successful achievement of IMT in Gujarat
5. To make recommendations for the design of policy, legislative and institutional frameworks

Methodology

The study has been done in two parts

- 1 Interviews, Reviews and Discussions with the government and non- government agencies and examination of different types of data available in respective states.
- 2 Detailed study of cases of IMT in lift irrigation schemes in Gujarat

The first part included interviews with government officers in the respective states, review of state government and NGO documents and discussion with non-government organizations (NGOs) working on IMT.

The second part incorporated case studies of lift irrigation schemes to understand the impact of IMT on beneficiaries.

Primary information was collected through three sources: (1) government officials from irrigation, electricity, and economics and statistics departments and the Water Resource Development Corporation (2) NGOs such as Aga Khan Rural Support Programme (India) and

Sadguru Water and Resource Development Foundation to provide insight into the working of lift irrigation cooperatives and Development Support Centre for participatory irrigation management in Gujarat; and (3) Lift irrigation(LI) cooperatives

- (1) Interviews with government officials were conducted at three levels:
 - Senior officials involved in policy decisions
 - District level officials playing supervisory roles
 - Field officials involved in direct implementation
- (2) Interviews with NGOs were conducted at two levels:
 - Head of organizations and management staff
 - Field supervisors and implementers
- (3) Interviews with lift irrigation cooperatives were conducted at three levels:
 - Chairpersons (always men) and committee members of the cooperatives
 - Office bearers of the cooperatives like pump operators, water distributors, and secretaries
 - Beneficiary and non-beneficiary farmers of the cooperatives

Interviews with government officials and NGO members were conducted through questionnaires. Information from LI cooperatives was collected through questionnaires, participatory research method, and field observations. Five head and five tailender farmers were interviewed separately from each LI cooperative to study their perceptions about benefits from cooperative management and issues raised by them which may not get addressed. In addition, group discussions with beneficiaries were organized through PRA (Participatory Rural Appraisal) methodology. Data on operational and managerial aspects were collected by Interviewing chairpersons and committee members

Assessment Of Policies And Activities

Sources of Irrigation In Gujarat

Gujarat state has about 31 per cent of net irrigated area and about 34 per cent of the gross irrigated area. In the irrigation scenario of the state, dugwells contribute most. These are mainly private owned and are followed by tubewells, mainly supported by the government. About 90 percent of total tubewells are constructed by the government. Canal and flow irrigation contribute 20 per cent. of gross irrigated area of the state. Only one per cent area of total irrigated area is covered by surface lift irrigation while there is a lot of potential in this source of irrigation. Presently 221 surface lift irrigation schemes are in operation in the state of which 148 (67%) are public owned and 73 (33%) are privately owned. Public schemes are mainly managed by irrigation cooperatives with support from either the irrigation department or NGOs.

Table 1: Sources wise area under irrigation

Sources	Net irrigated area (in '00 ha)	Irrigated area more than once(in '00 ha.)	Gross irrigated area (in '00 ha.)	Percent to gross irrigated area
Tanks	298	62	360	1
Flow irrigation	4511	916	5427	14
Canal	1846	269	2115	6
Surface lift Irrigation	243	69	312	1
Private tubewells	970	205	1175	3
Public tubewells	7132	1900	9032	24

Dug wells	15585	3792	19377	51
Total	30585	7213	37798	100

Source: Season and Crop Report of Gujarat State 1997-1998

Utilization of Irrigation Potential

Timely and balanced irrigation is one of the important components for assured agriculture production. The state has about 96 lakh hectares under cultivation and about 65 lakh hectares under estimated irrigation potential through surface and groundwater sources. This indicates that through proper water resource development planning about 68 per cent of the net cultivated area could be brought under irrigation. Till 2001 the state has created about 37 lakh hectares (39 per cent of the cultivated area) of irrigation potential while about 33 lakh hectares (34 per cent of the cultivated area) were actually irrigated.

Table 2 indicates that the state has 39.40 lakh hectares of potential through surface irrigation of which 14.24 lakh hectares (about 36 per cent) have been actually brought under irrigation. The state has 24.48 lakh hectares potential irrigation through groundwater sources of which 18.29 lakh hectares (about 75 per cent) are actually covered under irrigation. This shows that there is greater scope for surface irrigation in the state. Groundwater resources are relatively limited and some of these are almost fully exploited to the point of ecological degradation. There is an urgent need to curb the over exploitation of groundwater and the only alternative is to harvest maximum rain water through different techniques like check dams, percolation tanks, percolation wells, direct well recharge and measures of water conservation etc.

Table 2: Potential and Actual Irrigation in Gujarat (2001)

Sources of Irrigation	Targeted irrigation potential (in '00 ha)	Created irrigation Potential till 2001 (in '00 ha)	Actual area under irrigation (in '00 ha)
Major and medium surface irrigation schemes	35.92	14.07	12.67
Minor surface irrigation schemes	3.48	2.57	1.57
Total surface water schemes	39.40	16.64	14.24
Groundwater irrigation schemes (including private sources)	25.48	20.30	18.29
Total irrigation schemes	64.88	36.94	32.53

Source: Socio-Economic Review Gujarat State 2001-2002

Lift Irrigation In Gujarat

Lift irrigation connotes the process of raising water from lower level to make it available as input for agriculture. The sources of water can be rivers, streams, tanks, open wells, tubewells, etc. In a lift irrigation scheme water is pumped from the source to the highest point in the command area

through a rising main and from there it is distributed into fields by gravity via a network of underground pipes or open field channels. In Gujarat lift irrigation schemes have been introduced for small scale irrigation. Usually 50 to 100 hectare land can be irrigated through one scheme. Lift irrigation can be classified as:

- Surface lift irrigation
- Groundwater lift irrigation

Surface Lift Irrigation

In surface lift irrigation water is lifted from rivers, canals, backwaters of irrigation dams, and tanks. For lifting water from notified rivers permission is to be obtained from the irrigation department. In canal irrigation systems, since building of field channels takes long time, the irrigation department uses water lifting technology to provide water through irrigation societies. In hilly areas, where it is very difficult to construct irrigation channels, lift irrigation schemes have been introduced.

Almost all rivers in Gujarat are non-perennial; therefore it is difficult to get water throughout the year. Sadguru, a NGO working in the northeastern part of Gujarat, introduced a technique of building check dams on streams in the early 1980s to ensure availability of water for irrigation through lifting. Later this technique was adopted by AKRSP(I). Check dams are used for either direct irrigation or for indirect irrigation through dugwells which get recharged. Both NGOs are carrying out this work with people's participation through irrigation societies. Now other NGOs are coming forward to adopt this technique.

The state government also has a policy of handing over lift irrigation schemes to irrigation societies after commissioning. The societies have to play a crucial role in collection of water charges, distribution of water, repair and maintenance, and audit of accounts. One of the major purposes of forming a lift irrigation society is to benefit from the efficiency of scale. It is much more efficient for a group of farmers to draw water from one motor than for each of those farmers operating separate pumps. Even the poorest farmer or a farmer with very small land holding can have access to irrigation through a society as one has to pay only in proportion to land holding size. Since the beneficiaries of a lift irrigation scheme are the members of the society there is greater possibility that they will make the scheme sustainable.

The Gujarat government is making efforts to involve people in minor irrigation schemes. The state government introduced the Sardar Patel participatory water conservation programme on a large scale in January 2000 with the active participation of beneficiary farmers in the Saurashtra and Kutch regions. In this programme 40 per cent cost of the structure is to be contributed by beneficiaries and the remaining cost is borne by the government. The objective of this programme is to conserve rainwater to recharge groundwater, which otherwise flows into the sea. As a part of this programme, in 2000-2001, a total of 13476 check dams were constructed in 2315 villages. During the last monsoon in 2001, all the check dams over flowed two or three times. A study conducted by the Gujarat Water Resources Development Corporation indicated that there was 5 to 14 meter rise in groundwater level after the first monsoon.

In north Gujarat the government is trying to recharge groundwater by deepening the existing tanks and by diverting rainwater into surrounding tanks. The government has planned to deepen 600 tanks which will create about 10000 hectares of potential irrigation.

Groundwater Lift Irrigation

Groundwater lift irrigation is accomplished through tubewells and dugwells. Though tubewells and dugwells are privately owned, the government is trying to popularize groundwater lift irrigation through irrigation societies. The Government has established Gujarat Water Resource Development Corporation Ltd (GWRDC) for investigation, exploration, development, and management of groundwater resources through public tubewells and lift irrigation. The corporation has drilled 3521 tubewells and commissioned 3494 tubewells for irrigation which have created about 2.1 lakh hectares of potential irrigation. It has also completed 63 lift irrigation schemes on different irrigation projects and work on another 15 schemes is in progress. The corporation also forms irrigation societies to facilitate irrigation through tubewells. In 1987 the government decided to hand over functional tubewells to beneficiaries or construct new tubewells for them. The condition is that a minimum of 11 beneficiaries should come forward and put up their demand for a tubewell after forming a society. Only landholders can become members of the society. Formal registration could be done after commissioning of the tubewell. GWRDC helps the group in getting it registered as a society. After registration the tubewell is handed over to the society on rental basis. The society has to deposit Rs.5000 as security with GWRDC before the tubewell is handed over to it. Till now GWRDC has handed over about 1800 tubewells to the people. Under this scheme the beneficiaries/ irrigation society have to contribute 15 per cent of the cost in cash or labour. The society is responsible for repair and maintenance of the tubewell. In case of conflicts, the tubewell would be closed down but assets are not removed. The government provides pumpset, underground pipe-distribution system, and residential space for the pump operator while the society has to pay for the salary of the operator. Tubewells for irrigation societies are drilled either on public or private land. In the latter case land has to be donated to GWRDC by the owner.

History Of Irrigation Management Transfer

The irrigation sector is highly subsidized and remains non-viable in India so far. A study group appointed in 1985 by the irrigation department of the government of Gujarat found that water rates covered only 8 per cent of the cost of delivering water and recommended a gradual increase so that by 1991-'92 this proportion would reach about 33 per cent. Because of low rates and poor recovery, only 20 per cent of the cost of operation and maintenance is covered. This makes the sector highly subsidized and non-viable. Water rates were not revised since 1960 because of political pressures. In 2001 there was a significant increase in water rates from Rs. 1700 per hectare to Rs.4000 per hectare. The relationship between farmers and the irrigation department is not very cordial because the farmers perceive that the systems are not working well and therefore not worth paying while the department expresses inability to maintain systems.

The scope of work of the irrigation department is quite wide and it is difficult to manage all the schemes. Besides regular work, government officials are involved in activities such as election, immunization, census, etc, which divert them from their main work and objective. Looking at the constraints of the irrigation department, it is important that the department gets outside assistance. NGOs, specialized in rapport building with people and farmers, can provide good support to the irrigation department. The government of Gujarat realized the strength of NGOs and agreed to collaborate with them.

Since water was a priority item, farmers were constantly looking for alternatives. In this scenario, a few NGOs, mainly N.M Sadguru Foundation and AKRSP (Aga Khan Rural Support Programme), took up some small scale water related activities such as lift irrigation, check dams, recharge structures, and percolation tanks between late 1970s and 1980s. Majority of these schemes proved successful but the scale was too small to solve the problem of the whole area. Moreover it was difficult for NGOs to maintain the structures on their own.

During 1985 to 1987 Gujarat faced one of the worst droughts of the century. This left an indelible impression in the minds of the farmers regarding the importance of irrigation and the need for new irrigation schemes throughout the state. The status of the irrigation sector was highly unsatisfactory, most of the minor irrigation schemes with a command area of less than 1000 hectares were not functioning. At most places, tailenders did not have access to water. Some attempts were made to improve the situation by introducing a system of participatory management of irrigation. The emphasis was on formation of water users' associations and their active participation. Since these associations were formed to satisfy the requirement of external development agencies, without establishing rapport with the people, convincing them of the benefits of participation proved difficult and thus was very low.

In 1987 AKRSP(I) helped the irrigation department establish lift irrigation co-operative societies in Bharuch, a tribal district of Gujarat. In spite of having 1100-mm average annual rainfall, Bharuch had only 6 per cent area under irrigation. After co-operative societies were formed, the lift irrigation schemes started working satisfactorily. There was significant increase in area under irrigation. The co-operatives decided their own rates of water which were three to four times the government rates. Positive results based on experience of lift irrigation management transfer led to replication of this model for canal irrigation in Bharuch district of Gujarat.

One positive outcome of the above experiment was the understanding that people were willing to pay if water supply was satisfactory. In the case of private irrigation schemes, farmers either individually or through organized groups, bear the financial liability for construction of the irrigation scheme and thereafter bear the expenditure towards operation and maintenance services. By paying all these costs, they get assured water supply. In reality, compared to surface irrigation facilities controlled by the state government through major, medium, and minor irrigation schemes, farmers opting for their own water supply bear high capital expenditure and pay high irrigation rates. Farmers ensure high productivity with security through their own assets. Farmers are prepared to pay high water rates if they are assured of such facilities. For the scheme to be acceptable to farmers, it is essential for the facilities to be efficient and competent in all respects so that beneficiary farmers could be served with sufficient and timely irrigation facilities on the basis of equality.

In February 1992, a national level workshop in Hyderabad suggested, developing partnership between government and farmers as an effective alternative and necessity towards irrigation management operation and maintenance responsibilities. A book titled 'Transforming a Bureaucracy' written by Benjamin Bagadion had great impact on the process of irrigation management transfer in Gujarat. Mr. Anil Shah, former Secretary of Rural Development and later Chief Executive Officer of AKRSP (I), was highly impressed by this book and convincingly communicated the idea of participatory irrigation management to higher policy and decision makers of the Gujarat Government. The book narrates how the irrigation sector in the Philippines had involved farmers to participate in management of irrigation systems. Mr. Anil Shah convinced the Ford Foundation to sponsor an exposure visit of government officials and staff members of AKRSP (I) to the Philippines. The visit was a great success.

In early 1993, a second exposure visit to the Philippines led by the irrigation secretary of the government of Gujarat resulted in a workshop on Participatory Irrigation Management (PIM) in February 1993 at Water and Land Management Institute (WALMI), Anand,(Gujarat). The workshop was attended by the government officials, representatives of NGOs and funding agencies. In the workshop Mr. Benjamin Bagadion the founder of PIM in the Philippines was invited to address the participants.

After the workshop, officials of the irrigation department were clear and convinced about PIM but the concept did not percolate to the field-level staff. It was difficult for them to accept the new role for farmers and intervention of NGOs. Later the field-level staff was oriented towards PIM by AKRSP (I) and WALMI through several training programmes. Over a period of time many staff members from the irrigation department emerged as trainers, which made it easier to convince newer staff.

In June 1995 the government of Gujarat passed a resolution that PIM based on partnership between farmers associations and the government should be established as a “Turnover Programme” for administration and economical management of government water resources. In August 1996 a resolution detailed the procedure for PIM for the tribal population. It was resolved to follow the procedure described below after due consideration:

1. Water from dams/rivers /nalas for irrigation shall be provided free of charge to the tribal communities.
2. If demand is raised by the tribes for constructing a check dam or initiating lift irrigation schemes on dams/rivers/nalas by forming an irrigation society and if they are prepared to take the responsibility of operation, maintenance, and management of such schemes with their own funds, these schemes should be constructed by the government or through the society’s own resources.
3. The limit for approval to lift irrigation schemes on notified rivers up to 5 per cent of the command area on major or medium irrigation schemes shall be treated to have been cancelled in the case of tribal areas.

Goal Of IMT In Gujarat

The specific goal of IMT in the state is to raise irrigation efficiency through involvement of people by forming irrigation societies. The central notion is that if people are involved, they are more likely to maintain the irrigation schemes and run them efficiently. Sustainable irrigation systems cannot be established without the full participation and collective action of people. There is a great need for coordinated irrigation resource management to reduce the external cost and wastage.

Ngo’s Approach To Lift Irrigation Cooperatives

AKRSP (I) and Sadguru are well known for their participatory approach to development of natural resources. AKRSP(I) has developed various forms of irrigation such as lift irrigation, canals, percolation wells, and percolation tanks. Till now AKRSP(I) has built 17 LI schemes. AKRSP(I) learned the technique of lift irrigation from Sadguru which was first replicated in Samdhiala village of Junagadh. AKRSP(I) still working on better participatory approaches, institutional development, and coordination of different institutions for efficient use of LI schemes.

The N.M. Sadguru Water and Development Foundation, popularly known as Sadguru is a pioneer in community based lift irrigation systems in Gujarat. This approach was selected on the basis of intensive and extensive dialogues with the people of about 200 villages of Dahod and Panchmahal districts of Gujarat in 1974 for about one and a half year by its director Mr. Harnath Jagawat. The area had perennial rivers and streams but very low level of irrigation owing to

non-availability of suitable and economical techniques for lifting water. It was difficult and expensive to provide lift irrigation pumps to all farmers. Therefore, the community system was introduced to share the available asset. The technology for lifting water was earlier developed in Maharashtra and Karnataka. The experiences of these two states were used for lifting water in Dahod district. From 1976 to 1982, Sadguru built six lift irrigation schemes with supervision and management services provided by the staff of Sadguru. Looking at the positive results, demand for more lift irrigation schemes started growing. It was difficult for Sadguru to take care of construction, maintenance, and management. In 1982 Sadguru decided to empower people and handover the LI schemes to them with Sadguru providing support from outside. This helped Sadguru to focus on building more LI schemes. From 1982 to 1992 Sadguru built 39 LI schemes. Till 2002 it has completed 210 LI schemes. The organization manages to get 100 per cent grant for establishing LI schemes. Sadguru's working areas are tribal and poor and it is difficult for the people to contribute money for large-scale activities. However, they are willing to contribute in planning and supervision. The handing over process was followed by rigorous training in management, supervision, record keeping, liaisoning, and repair and maintenance. Almost all LI schemes initiated by Sadguru are working successfully. There are several reasons for this. Once or twice a year, Sadguru organizes training programmes on different components for all office bearers and committee members of LI cooperatives. This gives an opportunity to refresh their knowledge about the working of LI schemes and learn from other cooperatives. Regular follow-up of the progress of newly formed LI schemes is another reason for the better success rate. Sadguru staff members frequently visit one to two year old LI schemes and give technical, financial, and administrative inputs.

To ensure availability of water through the year in normal rainfall years for all LI schemes, Sadguru has built a series of check dams. In this case even if upstream villages lift water, downstream villages do not get much affected as they get water from their check dams. The organization has built check dams with capacity varying from 1 MCFT to 70 MCFT. But majority of check dams have between 6 and 26 MCFT capacity. On an average, one check dam can support two to three LI schemes. Sadguru ensures regular maintenance of check dams by people themselves. Every year before monsoon, desilting of the command area of check dams is done to maintain the capacity of water conservation. After every monsoon all check dams are inspected by people. In case of any damage repair work is undertaken with the help of Sadguru. Rich experience gained by Sadguru in people-managed lift irrigation schemes could be utilized by other organizations. At present, Sadguru organizes training programmes for government officials, NGOs, and village people who are interested in promoting LI schemes in their areas.

Formation Of Federations

At the end of December 1996, Sadguru supported 136 LI cooperatives were in operation. The satisfactory functioning of such a large number of cooperatives required a full time efficient support system. With increasing responsibilities Sadguru found it difficult to provide support. Also there was a need to make the village institutions sustainable and self-sufficient. As a step in this direction efforts have been made to bring these cooperatives under an apex body. This resulted in the formation of Jhalod Federation of Lift Irrigation Cooperatives in 1997. In 1999 Limkheda Federation of Lift Irrigation Cooperatives, the second federation, was formed. Both federations are working successfully. One of the functions of the federations is to ensure timely payment of electricity bill to avoid electricity disconnection. The member cooperatives of both federations are paying electricity bills well on time.

A federation has three full-time office bearers: manager, accountant, and field supervisor, and three part time office bearers: 1. electrician, 2. mechanic, and

3. pipe fitter. Part time office bearers are mainly required during the rabi season and sometime in summer. The skill of various functionaries is constantly improved and updated through training programmes. Supervision of the functioning of LI schemes and arrangements for the services of electrician, mechanic, or pipe-fitter are done by the field supervisor. If any problem persists the member cooperative can complain to the federation and the problem is attended within two days or as early as possible. According to the member cooperatives, services are available regularly and at lower rates. The federations keep spare parts of all machines so the members do not have to run to the market each time in search of a part. Purchasing spare parts in bulk turns out to be cost effective for the federations. Every year 15-20 days before the rabi season greasing/servicing of water lifting pumps of all member cooperatives is done by the federation at a nominal charge of Rs.200. This helps in keeping the pumps in good condition for the rest of the year.

In a short period the Jhalod federation has received the “A class” audit certificate from the Cooperative Department. The statutory audit inspects the activities as well as financial aspects including account keeping. The Jhalod federation is playing a good role in procuring agriculture inputs for farmers and has managed to shortcut the procedure by obtaining authorization for the irrigation cooperatives. The federation is also taking up crucial issues to higher level government officials and organizing people to solve their problems. The membership fee for each cooperative is Rs. 1001. In addition the member cooperative has to pay Rs.10 per person member for all its members. At present the Zalod federation has a membership of 54 LI cooperatives. The federation has accumulated about Rs. 10 lakh and in addition it has material and assets worth about Rs. 4 lakh.

Main Roles of Federation

1. To support weak LI cooperatives to improve their management skills.
2. To liaison with the government on issues like supply of electricity, water lifting, etc.
3. To develop local support systems for member LI cooperatives in terms of pipe fitting, electricity fault repair, maintenance of water lifting pump, collection of water charges, payment of electricity bills, and account keeping.

Structure of Federation

The federations supported by Sadguru have a three-tier structure. General body, cluster committee, and executive committee. The roles of these structures are described below:

General Body

The general body consists of four representatives from each LI cooperative. The role of the general body is to bring the issues raised by the members of their cooperatives before the cluster committee.

Cluster Committee

The cluster committee is made up of five to six neighbouring LI cooperatives. The committee has one representative selected from the general body of each cooperative. The role of the cluster committee is to discuss the issues raised by the general body and select main issues, which need to be taken up before the executive committee.

Executive Committee

The executive committee consists of two representatives from each cluster committee. It is a decision making body of the federation for day to day functioning and implements the suggestions of the general body and cluster committee. Members of the general body through a secret ballot elect members of the executive committee. Sadguru has an ex-officio representative. The executive committee elects one of its members as chairperson for one year. The responsibility of the executive committee is to address the issues raised by the cluster committee and take action. The executive committee has exclusive rights to accept or reject for genuine reasons the membership of any LI cooperative. It also has full rights to cancel the membership of any cooperative on disciplinary grounds.

Case Studies of IMT In Lift Irrigation

The Government and the NGOs have developed their own policies for IMT, but all the policies may not have been implemented. LI cooperatives might have developed their own rules and regulations according to their convenience. They might be finding difficult to understand government policies and their implications. The following case studies will help understand actual implementation of IMT.

Study Areas

The samples for the case studies were selected from three districts located in different areas. Junagadh district is a non-tribal area located in the western part of Gujarat. Bharuch is a tribal area and located in the southeastern part. Dahod, also a tribal area, is located in the north-eastern part of Gujarat.

Sampling Design

Purposive sampling technique was used to cover different types of LI Cooperatives. Table 3 shows the sample size and Table 4, provides a classification of the sample LI cooperatives.

Sample LI cooperative: Fourteen LI cooperatives from the three districts of Gujarat were selected for the study. On the basis of support criteria ten LI cooperatives were formed by two NGOs: Aga Khan Rural Support Programme (India) known as AKRSP(I) and N.M. Sadguru Water and Development Foundation known as Sadguru. The government formed three and one was formed through the initiative of the villagers.

According to location criteria, seven LI cooperatives are located on the road side and seven are located in remote areas.

Seven cases are successful LI cooperatives, three are partially successful, and four are unsuccessful LI cooperatives.

Table 3: Sample Size

Status of LI scheme	Government		NGO		Self- initiative		Total
	RS	R	RS	R	RS	R	
Successful	0	0	1	5	1	0	7
Partially successful	1	0	0	2	0	0	3
Unsuccessful	2	0	1	1	0	0	4
Total	3	0	2	8	1	0	14

Note: RS : Road side R: Remote area.

Table 4 : Classification of Sample Lift Irrigation Cooperatives

LI cooperative	District	supporting agency	Status of success	Village location
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Samdhiala	Junagadh	NGO	Successful	Remote village
Zadaka	Junagadh	NGO	Unsuccessful	state highway side
Kajali	Junagadh	Self-initiative	Successful	State highway side
Ghanikut	Bharuch	Govt./NGO(joint)	Successful	Remote village
Koliwada	Bharuch	NGO	Partially successful	Remote village
Anjoli	Bharuch	Government	Unsuccessful	District highway side
Kathipada	Bharuch	Government	Partially successful	District highway side
Amli	Bharuch	NGO	Successful	Village road side
Ghodi	Bharuch	NGO	Unsuccessful	Remote
Vakol	Dahod	NGO	Successful	Remote
Kachumber	Dahod	NGO	Partially successful	Remote
Kesarpar	Dahod	Government	Unsuccessful	Village road side
Kesarpar	Dahod	NGO	Successful	Village road side
Degawada	Dahod	Ngo	Successful	Remote

Source: Field visits 2002

Equity Issue In Selection of Sample Farmers

Lift irrigation schemes are small scale irrigation schemes in which all members are aware of the technical component. Water is supplied through water chambers. In each chamber valves are fitted to control the flow of water. In each lift irrigation cooperative, one pump operator and one water distributor are appointed whose responsibility is to ensure equity in water distribution. In this system, all farmers have an equal opportunity of getting water. Therefore, per acre benefits are almost equal for head and tail-end farmer. Thus in the study, an analysis of the benefits for head and tailend farmers was not done separately. Similarly analysis of land holding (large, medium, and small farmers) is also not very significant, since volume of water is distributed according to the rules of the cooperative. Per acre benefit is almost similar for large and small farmers. Net income of farmers has increased in proportion to land holding size. In Gujarat land holdings are spread over several places; therefore, in the command area of a lift irrigation almost all farmers have less than five acres of land and the majority of them have land holding between 0.25 and 2.5 acres. Irrespective of caste or land holding size, everybody has to pay in order to get water. If for any reason some farmers do not get water, they do not have to pay. If water charges are not collected from everyone it is very difficult to maintain the scheme. Therefore, it is in the interest of all farmers that every farmer will have equal opportunity to get water. Bharuch and Dahod are tribal areas and LI cooperatives have almost homogeneous composition of social groups. Therefore caste and class discrimination does not arise. In Junagadh, Samadhiala and Kajali LI cooperatives have heterogeneous composition of social groups, However, backward castes are aware of their rights and, therefore, nobody can discriminate against them. Zadaka LI cooperative in Junagadh is a homogeneous cooperative of the Muslim community.

Description of Sample Li Cooperatives

Successful LI Cooperatives

Samdhiala

The Samdhiala LI scheme in Junagadh area was established in 1988 with technical and management support from AKRSP(I). The cost of the LI scheme was Rs.6,55,000. The cooperative received a subsidy of Rs. 2,72,000 from the District Rural Development Agency and the remaining amount of Rs. 383,000 was provided by the State Bank of Saurashtra as a loan with

an interest rate of 12 per cent to be repaid in ten years in ten installments. The cooperative repaid six installments in six years without any delay. In the seventh year it repaid the remaining amount at one time and saved three years' interest. Owing to good financial discipline, the cooperative is running in profit and, therefore, able to meet sudden expenditures on repair and maintenance. The scheme has been running successfully since 1989.

The LI cooperative has two 35 horse power pumps for lifting water. It has to pay a flat rate of Rs. 42,000 a year as electricity bill for the two pumps. Since the LI cooperative pays bills on time it gets a discount of Rs. 5000. The Samdhiala village economy is totally dependent on agriculture. An increase in kharif crop production and ability to take the rabi crop also are very important. Since there is no other source of income the farmers want to take advantage of all crops. They understand the importance of irrigation and, therefore, make all efforts to run the cooperative smoothly. The cooperative gives importance to maintenance of pumps, pipelines and irrigation field-channels. It also keeps the accounts up to date. The maintenance fund and profits are kept as fixed deposit in a bank and the bank receipt is kept in locker. The secretary cannot keep more than Rs. 2000 at any time. If more money is required he/she has to take permission from the executive committee. At present the cooperative has more than Rs. 3 lakh in its account. In order to make speedy communication the LI cooperative took a telephone connection. Now the secretary does not have to go to the electricity office to lodge complaints about electricity fault or summon the pump mechanic in person. It also helps in knowing whether concerned government officials are available for the meeting. Sometimes members get information about availability of agriculture inputs and the market rates of agriculture products also.

The secretary is selected through a proper selection procedure. The post gets advertised in the local newspaper and also through word of mouth. A panel of experts which consists of chairperson and vice chairperson of the cooperative, a senior official of AKRSP(I), and an outside expert or a government official which chooses the secretary. The secretary is on probation for a year and gets paid Rs. 1000 a month. In the next year after reviewing his/her work, the salary would be revised to Rs.2000. Later on, salary goes up based on the quality of work. It is important to mention here that working experience as a secretary of the Samdhiala LI cooperative is so well recognized that usually a secretary finds a good job after serving two to three years in the cooperative. The responsibilities of the pump operator and water distributor are given to one person who belongs to Samdhiala. The person's skill has improved through several technical training programmes. Therefore his monthly salary is Rs.2600.

The cooperative received international recognition in 1995 for its work to improve the economic well-being of the community through people's participation. The cooperative was awarded a certificate of recognition by the Friends of the United Nations as part of the "We the People" programme.

Participatory management is one of the reasons for the successful functioning of the cooperative as it assures disciplined behaviour from all members. The Annual General Body Meeting (AGBM) is held in September. The major agenda of the meeting is to form various committees, such as the executive, justice, supervision, and agriculture committee. Efforts are made to have representation of all castes and classes in these committees. The roles of the committees are as follows:

Executive Committee

The executive committee consists of seven members who meet twice a month. The committee decides on repair and maintenance, water distribution, cropping pattern and area to be cropped

based on availability of water, exposure visits, purchase of agriculture inputs and resolving conflicts.

Justice Committee

The committee consists of five members who decide about the defaults and punishment for such acts as wastage of water, taking water without turn, fiddling with valve for increasing or reducing water flow, and misbehaving with office bearers.

Supervision Committee

The supervision committee has three members who check maintenance of pumps, tools, and pipelines and regularity in record keeping.

Accounts Committee

The accounts committee consists of three members who supervise the work of the pump operator, water distributor, and secretary. The committee also checks daily expenditure and balance of money and sees whether the *cash* balance has been entered in the record.

Kajali (Ground Water LI Scheme)

The [Kajali groundwater LI] scheme is totally supported by the Gujarat Water Resource Development Corporation. It is a good example of self-initiative of villagers. The village is located only 4 kms. away from the Arabian Sea. There is continuous ingress of saline water and the villagers faced problems [in availability] of sweet water for domestic and irrigation purposes. Drought from 1984 to 1987 worsened the situation. The then chairperson of Gujarat State Cooperative Marketing Federation Limited (GUJCOMASO) suggested to villagers to get water from Hiren river located eight kms. from the village. Some village leaders liked the idea and started working on that. They surveyed the area with the help a geologist and found waste land in a village on the bank of Hiren river where enough groundwater was available. The next step was, acquiring the waste land from the village panchayat. A 90 feet deep tube well was drilled, two lift pumps of 25 horse power were installed and water was brought to the village through pipelines and two distribution chambers. The cooperative did not construct distribution channels. Water is released upto the distribution chambers and from there it is the responsibility of farmers to take water to their fields through pipes. The work was completed in six months.

The expenditure came to Rs.1.3million, which was obtained as a loan from the Junagadh District Cooperative Bank. The loan was to be paid back in ten years. Subsequently, the village leaders and committee members came to know that government subsidy can be availed of the LI scheme. They were successful in obtaining subsidy after few follow-ups. Besides collection of water charges for drinking and agriculture purposes, the cooperative earns money through agriculture input supply, running a ration shop, and credit and savings activity. The cooperative assures smooth operation of the LI scheme through regular maintenance and regular review of the work of the pump operator, valve operator/water distributor, and secretary. The cooperative has taken insurance for the scheme, which covers 75 per cent of the repair and maintenance cost. It has entered into a contract with a pump mechanic who has to attend the cooperative's complaints and carry out repair work within a day or two. It pays electricity bills on time, so there are no disconnections. Since the village is located on the roadside, it has easy access to the office of the electricity board. It has developed good rapport with grass-root level officials of the electricity board. The LI cooperative has been functioning successfully for twelve years.

Ghanikut

Ghanikut is located in Walia taluka of Bharuch district. The village is inhabited by the oustees of the Karjan river dam. More than 95 per cent of the population belongs to Wasava tribe. The irrigation department decided to provide irrigation to the village by lifting water from Karjan river, since the village could not be served by the dam. The lift irrigation scheme was taken up by AKRSP(I) with financial support from the irrigation department. The cost was about Rs.10 lakhs. Since members are homogenous in this cooperative, conflicts are far less among members. The chairman is Higher Secondary pass and is well informed. Besides irrigation, the cooperative is also involved in agriculture input supply and marketing.

The membership strength is 52. The command area is about 200 acres. Potential irrigated area is 160 acres and 40 acres are waste land in nature. As of now, 73 acres are under irrigation. Area under lift irrigation is partly dependent on availability of water in the stream. In the beginning upstream villages did not lift water from the stream but when they saw the benefits gained by the Ghanikut LI scheme, they too started lifting water. Farmers from these villages are also planning to form a cooperative and take advantage of lift irrigation schemes. When upstream farmers start lifting water, there may not be enough water to meet the requirements of the command area for rabi and summer. Before planning for any LI scheme, it is important to keep the agriculture environment of upstream villages in mind and due care be taken to estimate such needs. If upstream villages start taking water, a downstream LI cooperative may not get enough water. This is best illustrated below:

The LI cooperative in Devrupan village of Bharuch worked successfully for ten years from 1988 to 1998. When nearby farmers saw the LI scheme of Devrupan functioning well, they too installed their own pump-sets along the upstream of the river for lifting water. This resulted in water shortage and the cooperative could not provide enough water in summer. The LI scheme was designed to provide water in rabi and summer seasons but in the new scenario only rabi irrigation was possible. This led to low collection of water charges which had an impact on the successful operation of the LI cooperative. Ultimately the cooperative was closed. (Parekh 1997). The Ghanikut LI cooperative too needs to solve the issue of upstream farmers; otherwise it may face problems like the Devarupan LI cooperative.

Aqli

The Aqli lift irrigation scheme was completed in 1999 with financial support of Rs. 11 lakh from the irrigation department and technical and human resource support of AKRSP(I). The scheme is comparatively new but is an example of successful collaboration of the government, NGO, and people. Owing to the government support, all administrative procedures could be carried out in lesser time while the NGO's support was useful for the skill development of the people to handle a cooperative. Backwater from the Isar dam is used for the scheme. This LI scheme is a good example of deriving indirect benefits from an irrigation dam. Aqli village has undulating landscape where canal irrigation will be very expensive; therefore, lifting water is a better option. The command of the scheme is 205 acres of which 180 acres have potential for irrigation. At present about 100 acres are covered under irrigation. Out of 170 households, 103 are beneficiaries of the scheme. The membership strength is 103 of which 5 are women and among 11 committee members 2 are women. Although women are not active participants on crucial issues like increasing water rates or water distribution to tailenders they raise their voice. During a recent annual general body meeting, some women said that their fields were located at the tailend and since the diameter of the pipe at the tailend is small they got less water than the head farmers, while they had to pay on hourly basis like head farmers. The system is transparent and each member can freely express his/her view regarding the working of the cooperative.

Vakol

The Vakol LI scheme is located on the bank of the Machhan river in Jhalod taluka of Dahod district. Sadguru set up the scheme in 1995 with an expenditure of Rs. 6.7 lakh. The cooperative is working successfully. All records of the cooperative are kept properly. The cooperative has its own informal rules which are followed by members. Conflicts are resolved with mutual understanding. Because of the homogeneous group and the strong leadership of Manjibhai (traditional village head) the cooperative is working smoothly. It is involved in other development activities such as provision of drinking water to the village, agriculture input supply, wasteland development through social forestry and horticulture, and water shed development. Non-beneficiaries of the LI scheme have benefited from other development activities. The cooperative is member of the Jhalod federation which has a membership of 54 LI cooperatives (for details please see 'Federation').

Degavada

Degawada is a non-tribal village and is located in Limkhaed taluka of Dahod. The LI scheme was built in 1995 with an expenditure of Rs.37 lakh. It has a command area of 350 acres. The scheme was funded by the government and Sadguru equally. On the request of villagers Sadguru also provided technical and management support. More than 90 per cent households of the village are beneficiaries of the scheme. The cooperative has framed rules for equal distribution of water in rabi and summer seasons. It has become self-sustaining over a period of time and has developed good rapport with government officials. The cooperative is also involved in milk marketing through the milk cooperative and supply of agriculture inputs. The community has managed its system so efficiently that it has created a reserve fund of Rs. 1.5 lakh in a period of only six years.

'January 7th', the day when the LI scheme of Degawada was commissioned, is celebrated as irrigation day every year. On this day, members decorate the pump house, hoist the flag, and sing prayers throughout the night. To this celebration the cooperative invites all important government officials and NGO members. This helps to build strong linkages with the government and NGO.

Kesarpar

Kesarpar is a tribal village in Dahod. In 1996 Sadguru built a LI scheme costing Rs. 4.75 lakh. The command area is 133 acres. At present the scheme is working successfully. (In 1980 the Government built a LI scheme which is defunct now. (For details please see Unsuccessful LI Schemes.)

Partially Successful LI Cooperatives

Koliwada

Koliwada is located in Bharuch district. The LI scheme here was established in 1995 with AKRSP(I) support. The command area is 120 acres. At present potential irrigated area is 60 acres but only 20 acres are under actual irrigation. Only ten farmers are deriving benefits of the scheme. Owing to high elevation, water cannot reach a piece of land of about 15 acres, which remains unirrigated. The cost of cutting the elevation or diverting the pipeline will be about Rs. 10,000. People understand the benefits but at present they are short of funds. They may look for low or interest free loan for this purpose, which can be repaid after they start getting benefits from the irrigated land.

Another example of inefficient working of the LI scheme is loss of time and water because of a minor technical fault. A valve of the water-lifting pump is defective; therefore, for starting the

pump, water has to be filled. The pump operator cannot do this alone. The whole operation of filling water and starting the pump takes 30 to 40 minutes. If electricity is supplied for three hours, half an hour supply is wasted in starting the pump. Many times electricity gets disconnected for few minutes; this break necessitates restarting the pump by filling water again. This causes wastage of another half an hour. The valve may cost about Rs. 25 but to get it from the nearby town the cooperative has to spend Rs. 50 on transportation. Looking at the benefit this expenditure is worth but nobody is paying attention to it. The LI cooperative needs support for proper management of the scheme.

Kathipada

The Kathipada groundwater LI scheme was built by Gujarat Water Resource Development Corporation (GWRDC) in 1992 at a cost of Rs 7 lakh. After commissioning, the scheme was handed over to the cooperative on 20 year lease at a token rent of Rs. 240 a year. The cooperative is made up of 13 members, mainly the elite of the village, who have land around the tubewell. The depth of the tubewell is 140 feet with irrigation potential of 60 acres. In ten years, only 20 acres could be irrigated. Originally an eight hundred feet long pipe was laid to cover the total potential area. This passed below a highway. Over a time the pipe broke because of heavy traffic. Therefore the remaining 40 acres cannot be irrigated. Neither the government nor the cooperative is ready to repair the pipeline. According to people the pipeline should be laid minimum three feet below the highway; otherwise it will be damaged by heavy traffic.

At present the cooperative is running in loss as only 12 beneficiaries are paying water charges which cannot meet the expenses of electricity bill and maintenance. There are no rules for repair and maintenance. Often during the monsoon the electric motor breaks down. There is need either to remove the water lifting pump and keep it in a shed or run it at least once every 15 days. Nobody supervises the maintenance of the pump. Since the cooperative consists of only 12 beneficiaries there are no rules for water distribution and collection of water charges. Neither regular monthly meetings nor annual meeting are held by the cooperative. Meetings are held only before the rabi season to decide the turns for water distribution. The cooperative has no plan to repair the pipeline and provide water to remaining 40 acres of land. GWRDC is also not taking any action. Looking at the investment the scheme is underutilized and underprivileged are deprived of precious water. The cooperative does not get any guidance from the government for the development of the cooperative. The government did not initiate even the processes of development of skill regarding record keeping, financial matters, and rapport building with other government organizations, and repair and maintenance.

Kachumber

The Kachumber LI scheme borders the Vakol LI scheme. It was built by Sadguru in 1995 at a cost of Rs. 9.51 Lakh. Both Vakol and Kachumber schemes lift water from the Machhan river. Kachumber can be seen as a less successful LI scheme. There is conflict between the head and tailend farmers on distribution of water from one chamber. During the turn of tail farmers, head farmers divert the water to their fields. When electricity is supplied at night, it is very difficult for tailenders to come again and again to the chamber in the dark to divert the water to their fields. The conflict is not getting resolved, as there is no mechanism to punish the defaulters. The executive committee is weak and does not have any control on the members. Committee meetings are not held regularly. The chairperson does not take interest in the smooth working of the cooperative. There is a large outstanding amount of water charges. Part of electricity bills have also not been paid. Surprisingly most members are not aware of annual general body meeting. The problems are of strong leadership and appropriate management. The Kanchumber LI cooperative is also a member of the Jhalod federation. Maybe the federation can play an important role in improving this LI cooperative.

Unsuccessful LI Cooperatives

Zadaka

Zadaka village is located near Samdhiala village . Both villages share the backwater of the weir built on the Meghal river. The cost of the Zadaka LI scheme was Rs. 12 lakh and the government provided a subsidy of Rs.8.2 lakh. The balance was met through a loan from the State Bank of Saurashtra in 1991 which was to be repaid in five years. The scheme was actually commissioned in 1993 and started working in 1994. Therefore, the cooperative started repayment of loan from 1995; a subsequent installment was paid continuously till 1998. The cooperative did not pay the installments in 1999 and 2000, since these were drought years and even the kharif crop failed by 50 to 60 per cent. Due to non-repayment of bank loan in the initial two years of 1992 and 1993 and later in 1999 and 2000, the interest amount on the loan has shot up. Till now the cooperative has repaid Rs. 4.8 lakh towards the loan of Rs.3.8 lakh but still owes Rs. 2.8 lakh.

The cooperative also did not pay the electricity bill for 1998; therefore, electricity supply has been disconnected. Since 1999 and 2000 were drought years and the cooperative did not get permission for lifting water from the river. Payment of electricity bill for these years was waived. When the cooperative pays the pending bill for 1998, electricity connection will be restored.

Even before introduction of the LI scheme, economic condition of the Zadaka village was much better than the Samdhiala village. Payment of bank loan and electricity bill is not a problem for them. Their main occupation is transport; about 50 per cent families own trucks. Earlier these people were truck drivers and cleaners. Later on with experience and through bank loans they purchased their own trucks. On average one truck gives a gross monthly income of Rs. 70,000. After deduction of loan installment, fuel, and maintenance cost the net income is about Rs.30,000. Looking at their main occupation it seems as if they are not very keen to improve their crop production. Even if they do not harvest a good crop they have other sources of income.

Ghodi

The Ghodi LI scheme worked from 1989 to 1999 very successfully. This was one of the successful stories of ASRSP (I). During the monsoon in 1994 the pump was swept away by the floodwater. Members contributed 30 per cent of the expenditure and free labour to recover the loss. Members of LI cooperative did labour work outside their village and managed to earn Rs. 20,000, which they contributed to flood rehabilitation. The joint efforts yielded good results and the cooperative speedily resumed its operations in December 1994.

At present the LI is non-functional. The problem started when the cooperative sold the old electric pump, which was not submersible and bought a new submersible pump for Rs. 1 lakh from the savings of the cooperative. In the first year of the guarantee period the pump developed some fault. The cooperative gave the pump to the dealer for repair through AKRSP (I). It took more than six months to get the pump back. In the meanwhile the farmers could not take rabi and summer crops owing to non-availability of irrigation. This was great loss and disappointment for farmers, which resulted in losing interest in continuing their membership with the cooperative. When the pump was brought back after repair, nobody was interested in installing it. The farmers were not ready to pay for water charges and electricity bill. They were not ready to pay even the pending electricity bill of Rs. 3000 from the previous season. This led to disconnection of electricity supply. At present the pump is lying idle at the ex-chairperson's house. An investment of Rs. 1 lakh has become unproductive.

As a result of nonfunctioning of the scheme, farmers from Ghodi cannot take rabi and summer crops at all. In case of failure/delay of rain they lose about 50 per cent of the kharif crop. The loss is estimated at about Rs 15000 an acre in a year. In addition more than 100 mango trees died which were planted after the LI scheme was built. Crop intensity has decreased and landless and marginal farmers have to migrate for work. It is surprising that the cooperative which worked so well for ten years suddenly ceased operation. This indicates that the LI cooperative did not become sustainable in ten years. Till 1999, it had support from AKRSP(I). Community organizers and agriculture specialists visited the village frequently and guided the cooperative on different issues. Since Ghodi is not included in the new programme, AKRSP (I) has withdrawn from the village and there is nobody to bring people on the same platform.

Anjoli

The Anjoli surface irrigation scheme on the Amaravati river in Bharuch district was built by the government in 1990. The scheme worked till 1998 and since then it is defunct. This scheme was the result of the efforts of *Goapalbai* the village head. When he came to know that he could get an irrigation system for the village at no cost in the name of tribal population, he formed a cooperative of 11 tribal farmers having landholding around his field and managed to get sanction for a LI scheme worth Rs. 6.6 lakh from the Tribal Development Fund. Two water-lifting pumps were installed of which one was 5 horsepower diesel pump and the other was 10 horsepower electric pump. Electricity charge was fixed at a flat rate of Rs. 9000 a year. Since the number of beneficiaries was only 11 it was expensive for them to pay electricity bill as well as maintain the scheme. The potential irrigated area was 150 acres but only 50 acres were actually irrigated as nobody took interest to lay pipes to other areas after carrying out some land development activities. In the initial years Gopalbai did take trouble to run the scheme. Owing to the lift irrigation scheme, his economic condition has improved and he has bought a tractor besides having his own tubewell. Now he does not need the irrigation cooperative. Other beneficiaries also became better off and do not need the scheme. At present electricity bills are pending, pipelines are broken, and the pumps are not in working condition and lying in the open near the water-lifting place. The sad part of the story is that with such a large investment only 11 farmers got the benefits while there was a scope for providing benefits to more farmers.

Kesarpar

Kesarpar a tribal village is located in Limkheda taluka of Dahod. In 1980 a LI scheme was built by the government with a 10 HP diesel pump and pipeline of only 500 feet. Since the pipeline was only 500 feet long, there were not many takers of water. Therefore, the chamber always overflowed. The diesel pump turned out to be very expensive for the farmers. In addition there was only a small number of water takers to share the cost of diesel. Immediately after completion the scheme was handed over to the people without giving adequate training for managing the community asset. While a committee was formed, nobody took the responsibility seriously. Nobody was accountable for repair and maintenance and water distribution. The scheme was located on one side of the hill, where very few farmers have fields. It was very difficult and expensive for farmers to bring water from the other side of the hill through field channels. The LI scheme worked only for four years and because of lack of maintenance became defunct.

ANALYSIS OF INFORMATION

On the basis of the case studies, an analysis has been done of how LI cooperatives have fared. There are some common features in all the LI cooperatives, while others have contributed to their success or failure. The discussion below highlights the operational systems, impact on social, economic and physical environment of rural life and the policy matters.

Operational Systems

Rules and Regulations of Cooperatives

All LI cooperatives have framed rules and regulations for their operations. While there are minor differences, the common ones are described below. It is observed that the successful LI cooperatives sincerely follow the rules, while disobeying the rules is one of the reasons for failure of many LI cooperatives.

Rules for Members

1. In case any committee member does not attend monthly meetings and if any member fails to attend the annual general body meeting he/she has to pay a fine of about Rs. 20.
2. If any member fails to contribute labour in the voluntary work of the cooperative, he/she has to pay a fine equaling the labour charges.
3. All members must cooperate in digging water courses adjoining their fields. If they damage the water courses they will be punished.
4. At least 15 days before the onset of the monsoon, all members must complete the weeding operation in their water courses, otherwise water supply will be withheld.
5. If committee members make mistakes they have to pay double the fine paid by ordinary members.
6. Fine is levied. If water goes outside the sanctioned area or is released in an other farmer's field without his/her turn. When this happens for the first time, the fine is nominal. If the mistake is repeated the fine is doubled. Every time the mistake is repeated the amount of fine would keep on doubling.
7. Any member operating the valve and taking water out of the gate without permission of the water distributor is fined about Rs. 25 the first time. If the mistake is repeated the fine would be doubled. The third time his/her water supply would be stopped.
8. If any member tries to take water out of turn his/her turn will be shifted to the last for the next watering.
9. If any member misbehaves with any office bearer he/she has to pay a fine in cash decided by the committee, If the misbehaviour is repeated, the fine is doubled. Thereafter, the cooperative can file a police complaint.
10. A drunken person is not allowed to come to the office or at the pump house. In case the rule is broken, the person has to apologize in public and pay fine to be decided by the committee. Anybody failing to pay the fine would be given further punishment with the consent of committee members.
11. Water chargers should be paid in advance and get noted in the card. Every member is to show his/her card indicating his/her turn for water, to the water distributor. Without the card

water would not be supplied. Demand for water will have to be notified to the cooperative office, 24 hours in advance.

Rules for Secretary

1. He/she should attend all monthly meetings.
2. He/she has to read accounts in every monthly meeting.
3. He/she should work according to the resolutions passed by the cooperative
4. In case of any conflict or problem he/she should call the committee meeting immediately.
5. In the monthly committee meetings he/she has to get approval for next months expenditure.

Rules for Pump Operator

1. He/she should take proper care of the pump and motor.
2. He/she should regularly record electricity meter reading.
3. He/she should not start the pump without the permission of the water distributor.
4. If there is any fault in electricity supply, he/she should get it repaired.

Rules for Water Distributor

1. He/she should follow the sequence on the notice board, for releasing water
2. Soon after starting the pump, he/she should be available at the main chamber for distribution of water.
3. Without producing receipt, he/she should not release water to any member.
4. If there is a fault in the pipeline, he/she should immediately inform the chairperson.
5. If there is any problem in distribution of water, he/she should immediately inform the chairperson.

Salaries of Office Bearers

Different cooperatives have different systems of paying remuneration to the office bearers—mainly the secretary, pump operator, and water distributor. Some cooperatives have an informal system where anybody can operate the pump and handle water distribution. In these cooperatives accounts are kept by the chairperson. These are less successful cooperatives with a small number of beneficiaries. Other cooperatives decide the amount of salary on the basis of their income. Usually salaries are fixed by the executive committee. Some cooperatives pay salaries only for four to eight months when irrigation is required for rabi and summer crops. Salary ranges from Rs.275 to Rs.2600. In successful cooperatives where salaries are reasonably good, office bearers

have taken this as a full time job. Table 5 shows salaries paid to office bearers in the sample LI cooperatives.

Table 5 : Salaries of office bearers in Sample LI cooperatives

LI cooperatives	Salaries of office bearers [in rupees per month]		
	Secretary	Pump operator	Water distributor
Samdhiala	1000 to 2000 depending on experience	2600 he works as water distributor also	Pump operator works as water distributor
Zadaka	1000	500	500
Kajali	2000	2000	2000
Ghanikut	600	550	550
Koliwada	300	275	275
Anjoli	Informal system	Informal system	Informal system
Kathipada	Informal system	Informal system	Informal system
Amla	1000	700	700
Ghodi	600	500	500
Vakol	700	500 (Nov. to Feb.)	500 (Nov. to Feb.)
Kachumber	700	500 (Nov. to Feb.)	500 (Nov. to Feb.)
Kesarpar	850	850 (Nov. to Feb.)	850 (Nov. to Feb.)
Degawada	1350 in rabi and summer & 675 in Kharif	1350 in rabi and summer & 675 in Kharif	1350 in rabi and summer & 675 in Kharif

Source: Field visit 2002

Water Charges

Water rates are decided on the basis of per acre irrigated area or per hour release of water. When water is supplied on the basis of per acre irrigated area, water charges differ every year depending on electricity supply as well as availability of water for irrigation. LI cooperatives have yet to discover the optimum method of charging water rates. The drawback of the acre system is that many times, because of lack of control on time, some farmers over irrigate their fields which results in lesser availability of water for others. In the case of hourly system, tailenders may be deprived of getting their due share of water owing to small size of the pipe or inappropriate slope. Some experts have suggested charging on the basis of volume of water used. This may be an appropriate method to address equity issue and avoid overuse of water. But this is a sophisticated system where water meters have to be installed and regular readings of the meters are required. In case of a breakdown of the system, it may be difficult for remote villages to get the meter repaired in time. However at present in all the sample LI cooperatives members are satisfied with their system of charging water rates. Table 4 indicates rates charged by different LI cooperatives .

Table 6 : Water Charges of Sample LI Cooperatives

LI Cooperatives	Per acre/Per hour per watering charges in rupees		
	Rabi	Kharif	Summer
Samdhiala	40 /acre	70 /acre	70 /acre
Zadaka	40 /acre	40 /acre	40 /acre

Kajali	5 /hour	5 /hour	5 /hour
Ghanikut	200 /acre	200 /acre	200 /acre
Koliwada	170 /acre	170 /acre	200 /acre
Kathipada	25 /hour	25 /hour	25 /hour
Amlı	20 /hour	20 /hour	20 /hour
Ghodi	200 /acre	200 /acre	200 /acre
Vakol	200 /acre	200 /acre	200 /acre
Kachumber	240 /acre	240 /acre	240 /acre
Kesarpar	Rs. 30 /hour	Rs. 30 /hour	Rs. 30 /hour
Degawada	Rs.120/acre	Rs. 160/acre	Rs. 160/acre

Source: Field visit 2002

Note: (1) It takes approximately 8-9 hours to irrigate one acre of land. **(2)** In Samdhiala, Zadaka, and Kajali LI schemes, electricity charges are billed separately, approximately Rs. 280/ year/ acre. Each member has to pay electricity charges according to his/her landholding size in the command area.

Most LI cooperatives do crop planning before every agriculture season. In this method farmers have to give their cropping plan to the executive committee and on the basis of availability of water the final plan is prepared and communicated to members. This helps the cooperative to calculate its estimated income and prepare a plan for expenditure. In the study areas usual requirements of water for main crops are follows(see Table 7)

Table 7: Number of Waterings Required

Crops	No. of watering required
Wheat	6
Mung	4
Summer groundnut	8
Bajari	6
Cotton(support irrigation)	2
Pigeon pea (support irrigation)	2

Source: Field visit

Maximum irrigation is required in the rabi season. About 43 per cent of the gross irrigated area is covered in rabi with 6 to 8 watering. In kharif, 39 per cent area of the gross irrigated area is covered but with only one or two waterings. In summer because of less availability of water, only 18 per cent area can be irrigated. Similarly maximum water charges are collected in rabi and lowest in summer. This indicates that Rabi is a busy season for any irrigation cooperative. Table 6 shows season- wise irrigated area and collection of water charges.

Table 8 : Season -Wise Use of Water

Cropping seasons	Irrigated area	Collection of water charges	Number of watering
Rabi	43%	63%	6 to 7
Kharif	39%	25%	1 to 2
Summer	18%	12%	8 to 9
Total	100%	100%	5 to 6

Source : field visit 2002

Water Distribution

In all LI cooperatives, rules have been formed for equitable distribution of water. The following methods are used for water distribution:

1. In some cooperatives a lottery is drawn to decide the order for supplying water. Besides this a justice committee gives priority to those who are in urgent need of water.
2. Some LI cooperatives distribute water on first-come first-basis. In this system the farmer who registers his/her name first and deposits the charge first gets water first.
3. In some cooperatives the turn system has been introduced. In this system farmers register their name for their turn. While registering they pay 50 per cent of water charges. They get a receipt on which his/her number is written. When water is released from the main chamber they show the receipt to the water distributor and he/she opens the valve of the chamber going towards the farmer's field. In this system if a tailend farmer deposits charges first, he/she will get water first regardless of the location of the field.

The turn system is flexible. In case some farmer's turn could not come after registering but if the crop is drying, water is released first in his/her field with the consensus of all members. In some cooperatives a committee is formed to inspect the land under each chamber to decide the urgency of watering of each plot. To ensure unbiased decision, the task of inspection of plots is assigned to members whose fields do not fall under a particular chamber. When there is shortage of water, supply is uniformly cut, preference being given to small farmers. In kharif all members who apply for irrigation would be given water for one acre, if water is still available it is offered for 50 per cent of the remaining land.

Equity in Water Distribution

During field visits more than 90 per cent tailender farmers expressed satisfaction as far as water distribution was concerned. Location of fields is not an obstacle to get due benefit of irrigation. Only in two LI cooperatives there are problems faced by tailend farmers. In the Amali LI scheme, water is supplied on hourly basis. Some tailenders complain that at the tailend the diameter of the pipe is small and therefore in one hour they get less water than farmers at the head. In Kesarpur village of Dahod, water is supplied on hourly basis and tailenders face the same problem. But the problem has been resolved with mutual understanding. In this LI cooperative tail-enders pay water charge for one hour of supply while water is supplied for one hour and ten minutes or a little longer till their land is fully irrigated. It is estimated that it takes six hours to irrigate one acre of land. If a tailender farmer has one-acre land he/she will get water for seven hours but will pay for only six hours. This is not a written rule but members follow it informally.

In Kachumber village, when water is supplied, farmers at the head (located near the chamber) divert water to their fields, when it is the turn of tail farmers. Many times electricity is supplied in the night (may be after 12 midnight), therefore water pump could be operated in the night only. In this situation it is very difficult for tailenders to move back and forth to the chamber and their farms to ensure water supply to their fields. Till now nothing has been done to solve this problem. There is no clarity of rules and regulations among members and therefore, it is difficult to punish defaulters. .

Resource Mobilization

Capital cost of LI schemes comes from different sources. In non-tribal areas the District Rural Development Agency (DRDA) provided 45 per cent subsidy for the Samdhya and Zadaka LI schemes and the balance in the form of loans from the nationalize banks. Though Degawada is a non-tribal village, the villagers managed to acquire funds from different government sources.

In tribal areas, 75 per cent of the cost of a LI scheme is provided by the government as subsidy and 25 per cent is people's contribution which they either acquire from a bank as loan or provide labour and in kind. In the case of NGO support, people's contribution is dependent on the policy of the NGO. Often NGOs establish LI schemes free of cost through their own sources of funding. NGOs usually get funds from foreign funding agencies. Sometimes some Indian donors establish their own foundation and give support to NGOs. NGOs help villagers to acquire funds from different sources particularly government. Table 7 indicates sources of funds for construction of LI schemes.

Table 9 : LI cooperative wise Sources of Funds for Building LI Schemes

LI Cooperatives	Year of completion	Total expenditure (in '000Rs.)	Government Subsidy (in '000Rs.)	NGO/funding agencies (in '000Rs.)	Contribution by people (in '000Rs.)
Samdhiala	1986	664	272	0	378
Zadaka	1988	1200	820	0	380
Kajali	1987	1300	1300	0	0
Ghanikut	1995	1000	500	500	0
Amlı	1999	1100	1100	0	0
Koliwada	1995	700	525	175	0
Ghodi	1989	1200	840	0	360
Kathipada	1992	700	700	0	0
Anjoli	1990	460	460	0	0
Vakol	1994	670	502	167	0
Kachumber	1995	951	713	237	0
Kesarpar(old)	1980	250	250	0	0
Kesarpar	1996	475	356	118	0
Degawada	1995	2917	2917	0	0

Source: NGOs and Government records

Income and Expenditure of LI Cooperatives

Income from collection of water-charges forms the largest part of cash inflows of LI cooperatives. However, some cooperatives also make a fair share of money from sale of agriculture inputs like seed, fertilizers and pesticides, interest from fixed deposits of their corpus fund which is generated from the membership fee; and people's contribution in cash. Major portion of the expenditure is towards paying electricity bills, salaries of office bearers, and maintenance and repair of the scheme equipment. Payment of electricity bills on time is essential otherwise the cooperative has to pay interest at the rate of 18 per cent on unpaid bills. Table 10 shows LI cooperative-wise average annual expenditure on electricity. Table 11 shows the income and expenditure of a typical LI cooperative.

Table 10 : Average Annual Expenditure on Electricity

LI cooperative	Capacity of pump	Average expenditure on electricity (in Rs.)
Samdhiala	Two pumps of 35 HP	42,000 [but gets rebate of Rs. 5,000]
Zadaka	Two pumps of 35 HP	42,000
Kajali	Two pumps of 80 HP each	94,000
Ghanikut	15 and 10 HP	50 paise per unit
Koliwada	Two pumps of 20 HP each	8,174(50 paise per unit)

Anjoli	Permission for 15HP, used 10 HP	9,000 [flat rate]
Kathipada	Permission for 15 HP, using 10 HP	9,000 [flat rate]
Amla	Two pumps of 20 HP each	16,328(50 paise per unit)
Ghodi	Two pumps of 40 HP	24,000(50 paise per unit)
Vakol	Two pumps of 15 HP	35,000 (50 paise per unit)
Kachumber	Two pumps of 15 HP	40,000 (50 paise per unit)
Kesarper	one electric of 15 HP & one diesel	8,000(50 paise per unit) & Rs. 1000 for diesel
Degawada	Two pumps of 50 HP	15,8000(50 paise per unit) ??

Source : Records of LI cooperatives

Table 11: Income and Expenditure of Amali LI Cooperative from April 1, 2001 to March 31,2002

INCOME		EXPENDITURE	
Components	Amount (in Rs.)	Components	Amount (in Rs.)
Water charges	74835	Salary of office bearers	28520
Bank interest	7410	Electricity bill	16328
Peoples contribution	370	Pump repairs	10516
Total income	82615	Pipeline repair	2990
Total expenditure	77191	Replacement of depreciated parts	9845
Net profit	5424	Travel	3592
		Stationery	1944
		Communication (phone & postal)	1258
		Snacks for AGBM	800
		Insurance of pump	582
		Other expenses	816
		Total expenditure	77191

Source: Record of Amali LI Cooperative

Most of the LI cooperatives keep reserve fund as a safety measure. The sources of reserve fund are share capital, membership fee, revolving fund for loan, savings, people's contribution, and donations from funding agencies. Table 12 is an example of reserve fund of a LI cooperative.

Table 12 : Reserve Funds with the Amali Cooperative

Reserve Funds	Amount (in Rs.)
Share capital	1200
Savings bank account	29740
Fixed deposit	50001
Revolving fund for loan	15893
Reserve for repair and maintenance	9151
Total	105985

Source: Records of Amali LI cooperative

Achievement of Irrigation Potential

About 35 per cent LI cooperatives have achieved less than 50 per cent of the irrigation potential. Another 35 per cent have achieved targets between 51 and 80 per cent. Only 30 per cent LI cooperatives were able to meet the targets of 100 per cent irrigation. There is no significant correlation between year of establishment and achievement. It was observed that those cooperatives which came up after 1995 were performing very well. It is important that some new LI cooperatives should achieve maximum potential in order to become financially sustainable. Increase in irrigation potential will lead to more membership and in turn more income from water. Table 13 indicates higher achievement leading to higher membership of LI cooperatives.

Table 13 : Potential/Actual Irrigation and Membership of LI Cooperatives

LI cooperative	Year of commissioning	Command area (in acres)	Potential area (in acres)	Actual irrigation (in acres)	Percent to potential	Membership
Samdhiala	1986	190	160	160	100	62(2 women)
Zadaka	1988	125	100	80	80	32
Kajali	1986	300	300	210	70	140
Ghanikut	1994	200	160	73	46	52
Koliwada	1995	120	60	20	33	32(2 Women)
Anjoli	1990-'98	150	120	50	42	11
Kathipada	1992	65	60	20	33	13
Amla	1994	205	190	100	53	115
Ghodi	1989-'99	300	240	240	100	101
Vakol	1994	132	108	108	100	86
Kachumber	1995	216	162	162	100	62
Kesarpar	1980	50	30	10	33	11
Kesarpar	1996	133	100	80	80	160
Degawada	1995	350	300	250	84	190

Source : Records of LI Cooperatives

Impact On Social, Economic, And Physical Environment

Changes in Cropping Pattern

Table 14 indicates that before lift irrigation schemes materialized, farmers were taking only kharif crop. In case of delay in rain or non-occurrence of last one or two showers, there used to be 25 to 50 per cent loss of the kharif crop. After lift irrigation became possible, farmers are able to save their kharif crop since they get support irrigation. Owing to availability of irrigation in time, production of kharif crop has increased. Farmers started taking wheat and vegetables in the rabi season and groundnut, green gram, black gram, and vegetables in summer. In some places farmers have started taking chilly crop which is a very high value crop but exhausts the fertility of land. Therefore farmers grow chillies every second or third year. In Bharuch district, after introduction of lift irrigation, farmers started growing vegetables, particularly a variety of French beans (locally called *papadi*) which is a delicacy for Gujaratis. This crop provides per acre annual income of Rs 10,000-12,000.

Table 14 : Changes in Cropping Pattern and Per acre Yield (in qt.)

Crop	BHARUCH		DAHOD		JUNAGADH	
	Yield/ acre (in qt.)		yield / acre (in qt.)		Yield/per acre (in qts)	
	Before	After	Before	After	Before	After
KHARIF						
Paddy	7	12	10	12	0	0
Jowar (sorghum)	4	8	0	0	0	0
Cotton	3	6	0	0	0	0
Pigeon pea	1	3	1.5	2	0	0
urad(black gram)	3	0	1.5	2	0	0
Soyabean	0	5	0	0	0	0
French beans	0	180	0	0	0	0
Groundnut	0	0	0	0	6	10
Bajara I (pearl millet)	0	0	0	0	3	0
Maze	0	0	13	15	0	0
RABI						
Wheat	0	8	0	13	0	20
Horse gram	0	2	0	7	0	0
Bajara (pearl millet)	0	4	0	0	0	0
Vegetables	0	10		20	0	15
Maize	0	0	0	13	0	0
SUMMER						
Groundnut	0	8	0	14	0	12
Mung (green gram)	0	3	0	2.5	0	6
Urad (black gram)	0	0	0	0	0	6
Vegetables	0.25	5	0	20	0	50
Fodder	0	200	0	300	0	250

Source : Field visit 2002 [*which record in the field*] ?

When farmers do not grow long duration crops like cotton and pigeon pea in kharif, they grow wheat in rabi. Duration of cotton and pigeon pea is six to eight months. When these crops are harvested sowing time for wheat is over. But after cotton and pigeon pea are harvested, farmers grow groundnut and green gram in summer. After the wheat crop, land is kept fallow for regeneration of its fertility.

Summer groundnut is a high value crop. Timely and right amount of watering result in good yield and good quality of crop. Summer groundnut fetches 20 to 30 per cent higher prices than kharif groundnut. If farmers can take summer crop their income goes up remarkably. Increase in production of vegetables has significantly contributed to increase in income.

It is important to mention here that, owing to access to irrigation, crop intensity has increased. Many farmers could not handle larger land holdings, therefore, landless villagers take land from them on rent and cultivate. Landless villagers turning farmers has become a common phenomenon in the command area of LI schemes.

Increase in Expenditure on Agriculture Inputs

As farmers have assured supply of water they do not hesitate to invest on agriculture inputs. Table 15 shows that, after introduction of lift irrigation schemes, expenditure on inputs has increased five to ten fold. Farmers started using quality-certified seeds and chemical fertilizers. Expenditure on chemical pesticides is increasing at an alarming rate. Farmers spend Rs 600 to Rs. 20000 on pesticides depending on the intensity of pest attacks. Maximum quantity of pesticide is used for cotton and vegetable crops. Farmers complain that pest attacks have become more frequent as land remains wet for a longer period, which is a favourable condition for pests. Another reason is that since farmers have money, even for a small size pest attack they use high doses of pesticides instead of using eco-friendly methods of pest control. Maximum quantity of pesticides is used for groundnut, cotton, and vegetable crops. In Dahod, present use of pesticides is low but if farmers get proper information they might increase use of pesticides. NGOs have to play an important role in protecting farmers from the negative effects of irrigation. Expenditure on labour, particularly for weeding, has increased.

Table 15 : Change in Expenditure on Inputs (in Rs.)

Inputs	Average Per acre expenditure on inputs (in Rs.)					
	BHARUCH		DAHOD		JUNAGADH	
	Before	After	Before	After	Before	After
Seeds	100	1350	100	800	1000	2300
Fertilizer	0	700	0	500	220	930
Pesticide	0	3000	0	600	1000	8000
Water charges	0	1600	0	1200	0	1500
Labour	450	6000	400	4000	700	9000
Plough / Tractor	500	1500	500	1500	500	1000
Transportaion	200	700	150	1000	200	1500
Total	1250	14850	1150	9600	3420	22730

Source: Field visit 2002

Note: Value of inputs is calculated on the basis of prices in 2002

Increase in Income

There is a three to four fold increase in net agriculture income after the LI schemes were started. Income ranged from Rs. 5000 to Rs. 6000 per acre *earlier* but after lift irrigation, this has increased to Rs. 20000 - 25000.

Table 16 : Change in Net Income from Agriculture

Items	Net Income (in Rs.)					
	BHARUCH		DAHOD		JUNAGADH	
	Before	After	Before	After	Before	After
Output	6400	36000	7800	32000	9240	47400
Input	500	14850	1150	11400	3420	22730
net benefit.	5900	21150	6650	20600	5820	24670

Note: Gross output has been calculated on the basis of interviews with farmers and by converting agriculture production in rupee value using 2002 wholesale local market prices.

There is inconsistency in crop yield and actual agriculture income. The reason for this is that farmers do not grow all crops in all seasons. Therefore for calculating gross income, value of all crops cannot be added. For example, in Bharuch district if cotton and pigeon pea, which are six to

eight month crops, are grown in kharif, wheat and gram cannot be grown in rabi. In this case farmers take groundnut and mung (green beans) in summer. If paddy and maize are taken in kharif, wheat and gram are grown in rabi. During the field visit crop cycles were studied and based on that output has been calculated. In the study area as a mixed cropping pattern is practiced. On an acre plot, farmers grow different crops according to market value and their requirements.

Increase in Assets

After lift irrigation there is significant change in assets. Earlier majority farmers used to live in thatched huts; now they have built cement concrete houses. They also have invested in gold and silver ornaments, utensils, fan, furniture, and vehicles. There is remarkable improvement in food content.

In the Junagadh area, as a result of lift irrigation schemes, land value has increased in the command area from Rs. 25000 to 30000 per acre [before irrigation] to Rs. 2 to 3 lakh per acre after irrigation. Many small farmers have sold their land in the command area and purchased larger pieces of land outside the command area. With surplus money they have dug open wells. On the other hand large farmers have purchased more land adjacent to their fields to consolidate their holdings at one place.

Increase in Food Intake

There is both qualitative and quantitative change in consumption of food. Earlier, marginal and small farmers hardly used to manage two meals a day, particularly in summer and rainy seasons. Now they get full nutritious food, which contains wheat, pulses, and vegetables. Their intake of sweets also has increased. Many farmers are producing small quantities of vegetables, purely for home consumption. Thus, their diets now comprise a much greater quantity of green vegetables. In addition, vegetables are available almost year round in most of the villages and at lower price. So, even non-beneficiaries have access to better food.

Reduction in Migration

The major impact of lift irrigation is on out-migration, which has been curbed. Prior to lift irrigation rainfed agriculture caused land to be cultivated in only one season. Thus, when the kharif season came to an end, villagers were forced to migrate. With the introduction of lift irrigation, farmers are able to cultivate their land in two to three seasons. Since they have a regular income for most part of the year, migration for labour is no longer a compulsive option. People do still migrate to earn some money but for lesser number of days. Earlier people used to migrate for 120 to 150 days in a year; Migration has reduced to 30 to 40 days in a year now and majority time they stay back and work on their fields for rabi and kharif crops. At present, migration is a choice and not out of a necessity.

Change in Occupation

In the Junagadh area, after harvesting kharif crop people sought employment in other areas. Now they spend majority of their time in improvement of their fields.

A peculiar feature has been that some landless villagers have started farming. With availability of irrigation facility crop intensity has increased and it has become difficult for large landowners to handle large holdings located in different places. As a result they started leasing out land to landless for share cropping.

In the villages even people from outside the command area are getting indirect benefits from the schemes through availability of labour work at a higher rate within the village and availability of agriculture products such as grains and vegetables at cheaper prices. With increase in agriculture produce, agriculture residue is available as fodder either free of cost or at a cheaper rates which led people to adopt animal husbandry as secondary occupation.

Drought Proofing

Failure of the monsoon continuously from 1999 to 2001 has resulted in acute drought conditions in Gujarat. This has worsened the economic condition of farmers. Majority of kharif crops failed and very little area was covered under rabi crops as a result agriculture income decreased by 70 to 80 per cent. In the drought condition while non-beneficiaries had to migrate or look for other sources of income, LI beneficiaries could sustain themselves. Marginal and small farmers of the command area also migrated but for lesser number of days than non-beneficiaries. Most farmers are suffering from food shortage and are migrating to other places in search of employment. However, the situation is comparatively better in villages with LI cooperatives. Though most LI cooperatives either could irrigate very small areas or could not function at all, LI beneficiaries by and large were able to face the drought situation in a better way. Some had food grains saved from the previous years while others had enough capacity to buy food grains from their savings or from the credit availed on account of increased credit worthiness because of owning irrigated land.

Policy Implications

Acquiring Permission for Water Lifting

Water cannot be lifted from a notified river without permission of the government. The Irrigation department has authorized superintending engineers (SE) in different parts of the state to give permission to lift water from notified rivers. For every season permission has to be obtained for lifting water. In good rainfall years lifting permission can be acquired in two to three visits but in low rainfall years more visits have to be made even to get permission for support irrigation for the kharif crop. In drought years no permission is given. The lift irrigation cooperative has to get permission every year. In Gujarat 1999-2000 and 2001-2002 were declared as drought years and water could not be lifted by LI cooperatives.

The rate for lifting water for a LI scheme is 33 per cent of the rate charged by the government for canal irrigation. In Gujarat canal irrigation charges are Rs. 134 per hectare, therefore for lift irrigation per hectare charge is Rs. 44.

Earlier permission was not given to lift water from the reservoir of any irrigation project. But the long struggle for 15 years by Sadguru brought fruits of success for the underprivileged oustees and people living near the reservoirs. Sadguru struggled for the rights of the people living around the reservoir of the Macchan river medium irrigation project. In 1977 the Sadguru sought permission to build five lift irrigation projects on the banks of the reservoir for people who were affected by the irrigation project. Permission was not given on the ground that there will not be surplus water after providing water to the command area. This was the view while major canal work had still to be undertaken. The superintending engineer told Sadguru that in 15 years the project will achieve 100 per cent of its potential. In reality till now none of the medium irrigation projects has achieved more than 70 per cent of its potential. Sadguru waited for 15 years in this period and the irrigation project did not achieve 100 per cent of its potential. In 1993

Sadguru got permission for lifting water for five lift irrigation projects. After this many more lift irrigation schemes were built on other reservoirs.

Electricity Issues

Acquiring Electricity Connection

The feasibility of any lift irrigation scheme depends on getting electricity connection. In the past it has taken two to three years to obtain electricity connection after the papers were filed. This is despite the fact that LI cooperatives have been willing to pay the entire installation charges in advance. For example, the Kuyala LI cooperative completed work on its lift irrigation scheme in June 1990. By the time it had completed the application process for electricity connection it was April 1991. The connection was finally given in June 1993 (Parekh Sheel). This is the case with many LI cooperatives. Delay in getting electricity connection affects the lift irrigation scheme in several ways. First it puts on hold the whole irrigation process. As a result there is delay in harvesting benefits from the LI scheme and, in turn, delay in earning extra income from rabi and summer crops. This becomes an obstacle on repayment of bank loans in time and accumulation of interest. One of the reasons for the failure of the Zadaka LI cooperative was the delay in commissioning the scheme owing to delay in getting electricity connection. While delay in loan repayment is caused by other factors, issues like electricity connection and supply could always be solved through better management and understanding of rural problems.

Timeliness and Electric Supply

Farmers do not have any complaint against the water distributor or valve-man about the timeliness of water supply; however, they reported that owing to uncertain supply of electricity water is not available on time and in adequate quantity. Water lifting pumps can operate only on three phase electric supply. Due to the power shortage rural areas do not get regular supply of three phase electric power. At present rural areas of Gujarat get eight hours electric supply in 24 hours. In the peak-cropping season, it is very difficult to lift sufficient water in eight hours to meet the requirements of all farmers. The sad part is that even this eight hour electric supply is not assured; it varies from three to eight hours in 24 hours. Besides this, due to frequent faults in the feeder, power does not reach the rural areas. All these lead to failure of crops. In the Kabaripathar LI of Bharuch owing to non-supply of electricity continuously for 10 days, farmers could not give last watering to their summer crop of groundnut and mung (green gram). This resulted in the failure of the summer crop and even the input cost could not be recovered. and about one fourth of the wheat crop failed because of non-availability of water on time.

The deputy engineer of Gujarat Electricity Board (GEB) in Dahod told that government policy is that during the paddy season electricity will be supplied two to three hours more than the allocated quota in case of failure of rain. This policy has to be made applicable to all major food crops of rabi and summer.

Reasons for Low Priority to Rural Electricity Supply

One of the main reasons for giving low preference to rural/agriculture supply over industrial supply is that the urban industrial feeders have shorter length but consumption is high. Consumption is also constant throughout the year. The GEB earns more when it supplies power to industry than agriculture; therefore, industry sector gets higher attention. According to the deputy engineer of GEB in Dahod, a feeder which goes to the urban industrial area is only 6 km. in length, while consumption of electricity is more than three lakh units a year which is billed

at Rs 4 per unit. On the other hand a rural feeder is 125 km. long which supplies three phase electricity to 45 villages. On this feeder electricity consumption is 20,000 to 30,000 units in a year which is billed at the rate of 50 paise per unit. Another feature of electricity consumption in agriculture is that the demand for power is not constant; it varies according to the agriculture season. Maximum consumption of electricity in agriculture is in the rabi season. It is very difficult for the electricity board to distribute the load during different seasons.

During field visits the LI cooperatives reported that power supply varied from 3 to 8 hours in 24 hours. The deputy engineer confirmed that electric power was supplied eight hours a day through the rural feeder. Because of leakages or faults on the way power does not reach the rural areas. He added that since rural feeders were very long it was difficult identifying and repairing the fault immediately. Since the lineman has to travel long distance, he avoids going in the night or in bad weather. Faults in urban-industrial feeders are repaired immediately because they are located in the urban areas and the travelling time is less.

In the case of failure of regular supply of electricity there is a danger of small and poor farmers being deprived of irrigation. In LI cooperatives usually the turn system is practiced. The farmer who deposits water charges first or registers his/her name first gets first preference. If the first registered one has larger land holding and the next is a small farmer, the small farmer will get water only after the large farmer completes watering his/her land even in critical situation like low supply of electricity and failing crops. In this system the equity issue is not addressed. There should be such a provision[such] that, in critical situations, in the first round all farmers should get water to irrigate a certain part of landholdings, say one acre of land. In the second round remaining land could be irrigated. This way all farmers would save some crop. This system is being practiced in the Samdhiala LI cooperative.

Inconsistency in Electricity Supply

Owing to power shortage, electricity is never supplied for more than eight hours in 24 hours. But members expect at least eight-hour supply to be regular and continuous. They also expect quick fault repairing during the peak agriculture season. During the eight-hour supply, there are frequent power cuts, which disturb the working system. Often power cuts last three to ten days owing to faults. A study by Sheel Parekh has shown that electricity power was not available for 63 days during the rabi season of 1991-92 in the Ghodi LI scheme (see Table 17). Surprisingly the situation has not improved even in 2002. In 2002, there was major loss of the rabi crop owing to frequent power failures.

Table 17 : Number of Days of Power Cut in Ghodi Village of Bharuch

Month	1991-1992*	2001-2002**
October	11	12
November	14	11
December	11	13
January	11	12
February	10	14
March	09	11
Total	66	73

Source: * Sheel Parekh

** field work by the author

Timings of electricity supply change every fifteen days. Many a time electricity is supplied between 12 midnight and 4 am. In this case farmers and pump operator have to remain awake whole night.

Uncertain supply of electricity is one of the major reasons for the failure of smooth operation of LI schemes. Even LI schemes supported by the irrigation department face the problem of uncertain electricity supply. According to officials of the Karjan river development project, [without the cooperation of the electricity department,] lift irrigation schemes cannot work successfully. without the cooperation of the electricity department. It is thus important to make the electricity department also accountable for the success or failure of lift irrigation schemes.

Increasing the Efficiency of Rural Electricity Supply

It is essential to sensitize the officials (from chief engineer to lineman and helper) of the electricity board towards the importance of timely supply of electricity for agriculture. According to the deputy engineer of GEB of the Dahod area at least two training programmes in a year should be organized for the field staff to make them aware of agricultural seasons and their contribution toward increasing agricultural production. Higher staff needs to be made aware of how timely repair of small faults in feeder lines or poles can save agriculture crops of thousands of rupees. It is crucial to make them feel important in the chain of agriculture production.

On the other hand, LI cooperatives should build good rapport with officials of the electricity board. They should give them due respect and invite them to their functions. Exposure visits for officials, particularly for the field staff of the electricity board, could be organized to explain how LI schemes work and the impact they have on agriculture production. It can also be explained to them how failure of one watering can cause significant damage to the crop. Once the staff get the holistic picture, they may start responding positively towards the problems.

Sadguru is using the above technique of building good rapport with different government officials. The organization frequently invites government officials to its functions or at its working sites. As a result government officials have positive attitude towards the organization. LI cooperatives formed by Sadguru have comparatively fewer problems in getting electricity faults repaired. The Samadhiyala LI Cooperative has adopted a similar approach. In the annual function the cooperative invites officials of the electricity board, irrigation department, and financing bank as chief guests.

In Dahod, some LI cooperatives have kept diesel pump sets as standby. But diesel is an expensive substitute for electricity. To irrigate one acre land, minimum 15 liter of diesel is required costing about Rs. 300 while electricity may cost about Rs.100.

Factors Affecting Success or Failure of Li Cooperatives

There are several factors which contribute to the successful functioning of any LI cooperative. At the same time there are certain management and functional issues which cause difficulties in the normal functioning of LI schemes. It is important to review these factors and learn lessons from them.

Drought Conditions

Failure of crops owing to drought and in turn inability to pay water charges have negative impact on the successful functioning of a LI cooperative. Continuous drought from 1999 to 2001 has hampered the successful functioning of many LI cooperatives.

System for Collection of Water Charges

Absence of a proper system for collection of water charges and account keeping leads to malfunctioning. In one case the secretary did not give receipt to members at the time of payment of water charges. Therefore the secretary cannot be held accountable for money collected from members. The secretary tends to make many mistakes in keeping track of how much money each farmer owed. In successful LI cooperatives receipts are given immediately. This has led to increased confidence and efficiency amongst users. In one of the less successful LI cooperatives, farmers did not get receipts causing discontentment and misuse of funds. As a result the committee was not able to handle various water-related problems.

System for Repair and Maintenance

Proper repair and maintenance of lift irrigation pumps is vital to the success of any LI scheme. In the absence of proper maintenance of pump, repair cost increases which may be difficult for the cooperative to bear. There has to be regular greasing of the pump and immediate repair of minor faults. Stabilizers have to be installed to cover the risk of fluctuation in electricity voltage. Ghodi and Koliwada LI cooperatives are examples of low successful LI cooperatives because of lack of system for repair and maintenance.

Good Leadership

Strong leadership and social cohesion are very important contributing factors to the success of any LI cooperative. A capable leader always gives proper guidance to the cooperative. In the case of the Samdhiala Kajali, Ghanikut, Degawada, and Vakol LI cooperatives strong leadership has helped the cooperatives to be run successfully. These leaders make extra efforts to solve administrative problems and social conflicts. In the case of Ghodi, Koliwada Kachumber, Kathipada, and Anjoli LI cooperatives, weak leadership, and management have led to lower success rate. But leadership qualities can also be developed. Weak leadership should not deprive villagers from participating in development activities. Many NGOs hold leadership-training programmes which are able to provide good leaders to run people's organizations. Training programs are based on the requirements of development related organizations of the people.

Documentation

Proper documentation of records is very important. Records are very useful for monitoring the progress of the cooperative and help improve weak areas. It is very important to update records for proper monitoring. Good record keeping ensures transparency in the working of the cooperative and thus help develop trust among members and committees. Proper documentation also helps to acquire further funds from government agencies.

Owing to low literacy level or less exposure to record keeping systems, village level cooperatives fail to keep records in the prescribed and useful formats. One or two training programmes can help them achieve the required level of competence. With growing awareness about development of village institutions many NGOs and academic institutions have developed training modules for

village level workers in very simple and easy to understand language keeping their limitations in view.. Complicated and large bulk of information discourage village workers to collect as this becomes a time consuming process. During the field study it was found that successful LI cooperatives have developed their own systems of record keeping. However there is plenty of scope for improvement which can be brought about through frequent training programmes.

Attendance in Meetings

Regular and high attendance in meetings is a must for successful functioning. Meetings provide a platform where all water- related issues could be settled. In less successful LI cooperatives, members do not give importance to meetings and generally attendance is very low ,leading to mismanagement.

Member Awareness

When members are aware of their rights and the importance of the cooperative in their lives they will ensure that the system functions well and on time. In successful LI cooperatives members are aware of all rules and regulations. There were occasions when they demanded fair services from office bearers; at the same time, they paid penalties when they were found guilty of breaking the rules. On the other hand, members of less successful LI cooperatives are not very well aware of the working of LI cooperatives. Owing to low awareness about rules farmers at the head in Kachumber could steal water meant for tailend farmers.

Work Efficiency of Office Bearers

Efficiency of office bearers is reflected in the success or failure of any LI cooperative. In Samdhiala the pump operator and water distributor is very efficient in his work. His updated technical knowledge helps in prompt location of technical faults in the system and getting them repaired as soon as possible. He can repair small faults himself. Similarly, the secretary of the Ghanikut LI cooperative is very efficient in record keeping. Secretaries and pump operators of the Koliwada and Kathipada LI cooperatives are not very efficient in their work. It is important to train office bearers in order to achieve good results. Sadguru regularly organizes training programmes and refresher courses for office bearers to update their knowledge.

Linking with Federation

The federation of LI cooperatives plays a crucial role in improving the working of LI cooperatives. Working efficiency of the member LI cooperatives of the Jhalod federation has improved after they were linked with the federation. Their expenditure on essential services has decreased; in addition, technical support helped in reducing the frequency of breakdowns in pumps.

Regular Supply of Electricity

Regular and timely electricity supply plays a crucial role in the successful functioning of LI cooperatives. Members of all the sampled LI cooperatives expressed their dissatisfaction regarding timely and adequate supply of electricity. They indicated that if electricity supply remained same as it is now they may not be able to function according to expectations. It is very important to pursue this matter seriously and bring changes in the policy. Supply of electricity to rural areas during peak agricultural season is as important as supply of electricity to industry. Supply of electricity for agriculture cannot be ignored because of the low rate for rural electric

supply. Some mechanism has to be developed for regular supply of electricity during the period of irrigation.

Sustainability Of Li Cooperatives

It is not enough to say whether a LI cooperative is working successfully or not. On the other hand, it is very important to have some measurable indicators to assess the level of success of a LI cooperative. This will help improve weaker areas of the institution and its operational parts. This will make the LI cooperative much stronger and productive. Even successful LI cooperatives have weak areas which apparently are not visible unless some analysis is carried out. Sometimes very weak looking cooperatives have potential to grow with some essential inputs. Some parameters on the basis of which level of sustainability could be measured are given in Table 18.

Table 18: Performance Rating Parameters for a LI Cooperative

INDICATORS	PARAMETERS
Participation In decision making operation and maintenance	Number of farmers attending meetings
	Number of farmers contributing in cash and kind
Access to information	Number of members who aware of rules and regulation
	Number of farmers aware of decisions taken in committee meetings
Timeliness of water distribution	Number of farmers receiving water on time
Reliability of water availability	Number of farmers receiving water on their turn/due time.
	Number of farmers received water according to their given needs
Access to opportunity	Number of member farmers to total farmers in the command
Efficiency and system performance	Percentage of area actually irrigated
	Number of farmers using water efficient techniques
	Number of farmers completing weeding operations in field channels
	Leakages in pipeline
	Types of crops grown and their water requirement
Maintenance	Number of days the system was interrupted owing to technical faults
	Number of times servicing/greasing of pump is done
	Number of times the mechanic is called for repair of the system
	Amount spent on repairs
Institutional development/discipline	Number of farmers paying water and other charges on time
	Quality of records e.g.: membership, minutes of meetings, accounts development work
	Liaisoning with government departments e.g.: irrigation, electricity, agriculture, cooperatives

	Number of days system was interrupted owing to problems in electricity (supply & fault)
	Reserve fund
	Overdue bank loans
	Timely payment of electricity bills
Economic sustainability	Payback period of the scheme
	Cost benefit analysis (technology costs in relation to increased benefits
	Agriculture input and output ration
	Increase in employment
	Decrease in migration
Food security	Increase in availability of food
	Increase in availability of milk

Based on indicators developed by Saini, Harmeet (1997) “Towards Sustainability of Irrigation Cooperatives” .

Conclusions

It has been observed that farmers understand the importance of irrigation for agriculture and working together. During the field visits it was found that the net income from agriculture has increased by three and four folds. Farmers found that the cooperative irrigation system is much cheaper than individual private irrigation systems. Cost of private irrigation per acre is three to four times that of cooperative irrigation. In addition, farmers are free of hassles of repair and maintenance, getting permission for water lifting etc. Farmers showed their interest in continuing LI cooperatives and giving contributions in terms of cash and labour. On many occasions they have demonstrated this by reinstalling the system at their own cost.

During the 1994 floods, five lift irrigation schemes supported by AKRSP (I) were damaged. Members of the cooperatives contributed more than 1,500 person-days of what amounted to free labour for repairs. Members of one LI cooperative retrieved the motor and pump worth Rs. 50,000 from the flood water. Members of Sadguru supported LI cooperatives desilt the command area of check dams before the monsoon to conserve more water. These examples indicate that besides building the structure it is very important for government agencies or NGOs to work on increasing awareness about the benefits of working together, skill development, and empowerment.

In Gujarat NGOs have long experience in participatory approach to development. Rich experience of NGOs should be used for wide scale implementation of IMT. It is very important to give proper attention to the process of institutional development with people’s participation with the help of NGOs. Rules and regulations should be formed with the consent of members. LI cooperative office bearers and members have to be made aware of their duties and rights. All members should have equal opportunity to participate in the activities of LI cooperatives.

Looking at water scarcity, it is desirable that maximum number of farmers get benefit from the available quantity of water. This is possible only when farmers are sensitized and learn to make judicious use of water. Farmers should be encouraged to adopt balanced cropping pattern, which can grow combination of crops with low to medium requirement of water. Use of chemical fertilizer may be discouraged as it leads to increased consumption of water.

Timely and regular supply of electricity is a major issue for successful operation of LI cooperatives in Gujarat. It is necessary for Gujarat Electricity Board to provide reliable electricity supply to the rural sector. Increasing agriculture production, particularly food crops, is a national priority and responsibility of every citizen of this country, which includes the electricity department. During the field visits it was found that farmers do not mind paying more, provided supply of electricity is reliable and assured. High subsidy on rural electricity is useless for farmers, if it leads to failure of their crops.

It is observed that all officials of the irrigation department have very positive attitude towards IMT and give full support to LI cooperatives. A major obstacle in the successful implementation of IMT in Gujarat is weak linkages of the irrigation department with other connected departments such as electricity, agriculture, cooperative, and land development. Some mechanism has to be developed to bring all the relevant departments on the same working platform.

Looking to the positive trend of functioning of LI cooperatives, it is advisable for the government of Gujarat to frame favourable policies for funding of LI cooperatives, people's contribution, organization development, judicial use of water, equity in water distribution, water rates, and assured supply of electricity.

Subsidy to the GEB for regular and reliable supply may be considered through the LI cooperatives at the time of payment of bills by signing a value certificate.

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