Farmers' Organisations in Surface Irrigation Projects

Two Empirical Studies from Gujarat

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In any irrigation system, the institutional arrangements prevalent or projmed to be developed are a prime focus of attention. While the bureaucratic organisation assumes the responsibility of operation and maintenance of the system upto the government outlet, the command area under the latter along with its network of field channels and drams and control structures become the responsibility of the farmers for operation and maintenance. This is the most critical area since under or over-irrigation due to lack of maintenance of community-owned items will affect yields per hectare and generally the performance of the system.

This paper discusses formal or informal farmers' organisation to deal with the problems at the terminal level of maintenance, distribution of water and resolution of disputes. The paper is in three parts. The first part delineates the functions of farmers' organisation in an irrigation project and deals with the essentials of an environment under which these organisations come into their own for efficiently discharging their functions. The second part presents two case studies, one dealing with an old project and the other with a recentone. The last part summarises the discussion and lists some policy conclusions.

RURAL development programmes in India centre around its principal component, namely agriculture, which in turn crucially depends on water, soil fertility and tillage practices. For promoting technologically superior agriculture based on the use of seeds of high yielding varieties and larger doses of chemical fertilisers and the application of pesticides, all of them being greatly influenced by the availability of water, massive investment has now been taking place in the irrigation sector.[1] A major proportion of the investment is towards developing surface irrigation potential

Since the utilisation of the irrigation potential critically depends upon the preparedness of the terminal system which consists of farmers' fields below the government outlet, the command area development authorities (CADAs) have been set up with a view, among other things, to undertake on-faim development (OFD) works. These OFD works include construction of community oriented items such as the earlhem field channels and the related control structures, and land levelling and land shaping. The CADAs initially execute these works on behalf of the farmers and the expenditures are recovered in course of time from the beneficiaries.[2]

Thus, 'the hardware' aspects of technology of the irrigation project and the operational system are well taken care of at various stages of project preparation, appraisal and implementation with enormous application of human and technical inputs by national and international financing agencies. But, what are being ignored or tend to be neglected are the "software" components of technology. These relate to the network of institutions and administrative system, apart from the physical infrastructural facilities such as roads and markets, which provide the framework of productive capacity and hence are just as critical as the technicalities of the project in determining the outcome.[3]

The term institution' embraces a variety of formal and informal human groups, behaviour patterns, social, legal and administrative systems, and established practices in social, political and economic activities that have an important bearing on workings of rural societies. As the non-technical counterpart to the physical production components of the rural .system, these institutional factors condition the reaction of the system.[4]

In an irrigation system, which is planned to introduce technological changes in the agricultural scene of the rural sector, institutional arrangements prevalent or those designed to develop become a prime focus of attention for fostering rural development. While the bureaucratic organisation [i] takes up the task of running the irrigation system by assuming the responsibility of operation and maintenance upto the government outlet, the command area under the latter along with its network of field channels and drains and control structures becomes the responsibility of the farmers for operation and maintenance. This is the most critical area since the inefficiencies of under- or over-irrigation due to lack of maintenance of community -owned items affect yields per hectare and generally the performance of the system.

Formal or informal farmers' organisation to deal with the problems at the terminal level of maintenance, distribution of water and resolution of disputes fall under the description of institutional arrangements which form the subject matter of this paper. The paper is organised into three sections. The first section delineates the functions of farmers' organisation in an irrigation project and deals with the essentials of an environment under which these organisations come into their own for efficiently discharging their functions. The second section presents two case studies, one dealing with an old project and another with a recent one. The last section is a summary of the discusions listing some policy conclusions.

I

Farmers' Organisations

In a surface irrigation project, technicalities of the project determine the location of the dam and construction of the reservoir and the network of the distribution system. The farmers' participation would essentially be one of helping the projcet managament in running the system, The term participation would mean (a) sharing the benefits, (b) sharing in decision-making and (c) sharing in implementation.[1]

Depending upon the capacity and willingness of the fanners to accept responsibilities, the degree of participation varies.[6] For example, at the one end of the spectrum, the farmers in Taiwan display a high degree of sophisticated self-governance even to the extent of sharing the cost of construction of projects to the tune of 50 per cent with the government and responsibilities for operation and management or irrigation and drainage channels and power of control over the management staff such as hiring and firing.[7] At the other end of the spectrum, we have the fanners in the .surface irrigation projects in India expecting that Irrigation Department can maintain the field channels and drains below the outlet just as they take care of the distribution system above the outlet

The Report of the Food Task Force to the Trilateral Commission attributed the inefficient level of operation of irrigation systems to the lack of institutional developments and stressed the need for serious extension efforts to organise the farmers for construction and maintenance of common irrigation facilities.[8] Similarly, the World Food and Nutrition Study of 1977 also refers to the institutional aspects and emphasised further research of inter disciplinary nature taking into account human and socio-economic factors.[9] In the same vein, a Report of the Technical Advisory Committee of the International Development Research Council listed several areas of research among which economic, social administrative factors affecting motivation of farmers in the improvement of water efficiency assume an important place.[10] Finally, the World Bank in its World Development Report observed that wasteful water management and poor maintenance can be blamed in large part on the hierarchy of social relationships among farmers.[11]

Lack of organisational effort or a common wilt to forge together has thus been attributed to institutional factors by the above mentioned studies which do not fully explain the situation. The conditions precedent for farmers' coming together and to organise themselves for undertaking collective efforts for maintaining the community infrastructure below the government outlet are the reliability and adequacy of irrigation supplies to the fields. If the standard of water service falls below a certain level, there will be predictably a distinctive effect on maintenance effort. If, on the other hand, there are unlimited supplies of water available through the outlet, there will also be disincentive effect leading to poor maintenance since the supplies will be ample enough despite the poorly maintained state of field channels.[12]

Therefore, in addition to the institutional factors, we should have the irrigation system being kept at an effective level, which is in turn influenced by two variables, namely control capacity and control utilisation. Control capacity is a function of structures such as control gates, cross-regulators, measuring devices, canal linings and communication facilities such as telephone and wireless. Utilisation of capacity depends on many complexly interacting factors such as communication system, training of the canal staff, structure of the irrigation bureaucracy and the liaison or otherwise with other canal staff and irrigators.[13]

Unless the irrigation agency effectively maintains the system, assures the farmers of the supplies under conditions of certainty, reliability and adequacy and has effective communication links with them by informing them of supply schedules and other relevant details, the confidence in supplies is not established and as a result, the irrigators do not feel motivated for any group action at the outlet level.[14]

For facilitating such a group action among the farmers, certain approaches and techniques acceptable to the Government and the water users are necessary. The aspects which are to be considered are (a) the type of organisation (b) the size of the organisation (c) the functions and powers of the organisation (d) the leadership (e) the administrative status (f) motivation for fanners who refuse to join and (g) special consideration in regard to weaker sections of the society such as scheduled castes and tribes and small and marginal farmers.

In a command area having no previous experience, the organisation of farmers to start with should be purely on an informal basis. A legal and formal organisation registered under law may not be appropriate, since at the beginning relationships among the farmers and sharing in the responsibilities are at best regulated by understanding and sympathy rather than by legal sanction and restrictions.

The size of the organisation is directed by various considerations. An area covered by a government outlet (say, not exceeding 40 hectares) would be operationally ideal comprising all the irrigators in its command. If the area has been under rotational water supply and if the sub-groups have been formed for each day of the week and if each sub-group has an elected leader, there would be sub-group leaders for each outlet, who would elect the outlet group leader. Thus, each outlet group would have a leader and sub-group leaders not exceeding seven in number with hundred per cent membership of the farmers. This group can convert itself into an irrigators' association for the outlet

As the rural society often happens to be a village based society, it is better to have village association of irrigators formed by the irrigators of all outlets falling within the village boundaries. For example, if there are eight outlets whose area falls within the boundaries of a village, all the irrigators will form the village associations. The executive committee of such an association will comprise all the group leaders of the outlets, who will then elect a president. But, if the villages are well connected by roads and if there are communication facilities such as bus transport, it would be far easier to have an association of outlets on canal basis. However, one should be aware of inter-village rivalries, and if such rivalries are present, it is better to be cautious and to start associations on the village lines.

Irrigation systems on a distributory basis, say, a sub-minor or a minor are hardly coterminus with the village boundaries. A sub-minor may cover three or four villages and a minor seven or eight villages. Therefore, a critical level of federation of the outlets would be one that is canal based, either a minor or series of sub-minors. At the canal level we can have a federation of village association leaders. At the apex level, these various canal federations would form a federal body of the command area irrigators.

Since we visualise at initial stages informal associations at the three levels, their functions can only remain simple. The outlet level association would maintain the on-fann infrastructural facilities at the outlet level such as field channels, field drains, and control structures once installed by government at the cost of the beneficiaries; and they would also help the authorities in the equitable distribution of water by facilitating a strict observance of the rotational water supply (Warabandhi) and promoting liaison with water users and the bureaucracy. If the experience proves favourable over time, the outlet associations can grow into a water co-operative with jurisdiction over a minor or sub-minor

TABLE 1: COMMAND AREA UNDER THE KHARI SLUICES IRRIGATION SCHEMES IN THE KALAMBANDHI VILLAGES

Name of Village	Area in Hectares under Irrigation	Number of of Irrigators
Naika	646.39	379
Bherai	149.77	102
Govindpura	77.33	51
Pansoli	139.27	94
Navagam	298.29	373
Chalindra	244.91	240
Kathwada	179.80	175
Kanera	214.90	188
Pinglaj	136.84	106
Malarpura	92.37	71
Dharoda	2.47	2
Total	2181.34	1783

TABLE 2: FREQUENCY DISTRIBUTION OF IRRIGATORS BY SIZE OF LAND HOLDING: NAVAGAM VILLAGE

Area (Hectares)	Number of Irrigators
0.0 to 0.5	114
0.5 to 1.0	73
1.0 to 1.5	61
1.5 to 2.0	26
2.0 to 2.5	20
2.5 to 3.0	9
3.0 to 3.5	5
3.5 to 4.0	2
4.0 to 4.5	3
4.5 and above	0
Total	313

comprising of several outlet associations. The functions could become more complicated such as buying water at discounted rates from the government in advance for each season and retailing it among its members. The co-operative can also undertake several promotional activities such as extension advice, sale of fertilisers and pesticides, custom hiring of vehicles and implements and even marketing of produce,

The leadership at the outlet level, village level or at the canal level and at the apex level has to reflect an equitable representation. At the outlet level, the outlet association leadership may be lotating each year but at the more complex levels, the president has to be elected following the democratic norms of periodical elections. Once a leader is elected or an executive committee is formed, he or it has to represent the interests of all the fanners, big or small

In fact, it may happen that the small and marginal farmers as well as weaker sections may hesitate to Join the association under the impression that their interests would be best served by remaining outside the association and their interests would be well protected by the government bureaucracy rather than by the leaders of the association. Such a situation can be corrected by the presence of an enlightened leadership which can persuade them successfully. Alternatively, a more equitable graduated voting scale to reflect the interests of both groups of users *in* the organisation could be introduced.

While certain generalisations can be made on the above lines, continuous research is needed in this area. Two empirical studies from Gujarat State are presented in the next section. One relates to an old protective irrigation project and the other to a more recent one, a project partly financed by the World Bank with perennial irrigation as an objective.

II

Two Studies from Gujarat

Gujarat has low irrigation facilities as compared to the national average. The net area under irrigation expressed as a percentage of net area under cultivation is only 14 as against the corresponding figure of 25 per cent for the country as a whole. The area under surface irrigation in Gujarat is about fifty per cent of the total area under irrigation, and the other fifty per cent area is covered by groundwater resources such as wells and tubewells.

The first case study deals with an ancient surface irrigation system known as the Khari sluice irrigation under which the farmers in eleven villages (Table 1), originally known as the Kalambandhi villages,[15] were irrigating their lands by constructing earthen bunds across the river Khari and diverting the water from temporary sluices. The river Khari rises in the north-eastern Sabarkantha district of the State and flows through the district of Ahmedabad and finally enters the district of Kheda in the south-western part of the State before it joins the sea. The eleven villages are situated at the tail part of the river's course before it enters the sea. The liver was known to be a perennial system until 1815 when the people started complaining that the Bow of water in the river was decreasing because that the people of villages in the northern district of Ahmedabad were lifting water thereby denying the age-old rights of irrigation they were used to enjoy. There were constant quarrels between the people of the eleven villages in the south and the people of the villages in the north. In 1843, a panch consisting of some civilian officials and the people's representatives sat together and came to a settlement that the eleven villages were entitled to draw water from the river beginning from the Kharif (the *wansoon)* season.

Subsequently in 1878, the Kharicut canal which was a canal taking off from the river at Raipur village up in the northern Ahmedabad district was built. This caused considerable distrust in the tank three miles south of Ahmedabad. This caused considerable distinct in the minds of the people of Kalambandhi villages and they again started complaining that the water in the Khari river was being abstracted out for the Kharicut. After a long drawn out legal battle towards the end of the 19th century the High Court of Bombay gave a judgment in favour of the Kalambandhi villagers that they had the right of riparian owners to the waters of the Khari river accruing from the natural sources and that the Secretary of State for Irrigation should be enjoined from diverting to the Kharicut canal, the Khari river water which had not been put Into the river by artificial means so long as water was required for the Kalambandhi villages.

In 1948 the Government of Bombay approved a new irrigation scheme known as Meshwa project by which it was decided to divert the waters from the Meshwa river into the Khari river for supplying water to the Kalambandhi villages and to divert all the waters at Raipur for the Kharicut canal for irrigating lands in Ahmedabad district. A meeting was held by the officials with the representatives of the villages and an agreement was arrived at by which the riparian owners agreed to give up their riparian rights to waters of the Khari subject to certain conditions. The conditions were that the government of Bombay would supply, and the riparian owners would during the Kharif season accept and not insist upon more than a minimum discharge of 70 cubic feet per second flow of water at Pingalaj from the Meshwa canal and if the water available in the Meshwa canal was not sufficient to give the said minimum discharge of 70 cusecs the deficit in supply would be made good with natural waters of the Khari river. Further, it was also agreed that if in the years of drought water was not available both from the Meshwa and the Khari rivers for the minimum discharge of 70 cusecs at Pingalaj, the villagers would accept whatever lesser discharge was available both from the Meshwa canal and the natural waters of the Khari.

TABLE 3: FREQUENCY DISTRIBUTION OF IRRIGATORS BY CASTES: NAVAGAM VILLAGE

Caste	Number of Irrigators
Patel	210 (67.09)
Brahmin	12 (3.83)
Thakor	44 (14.06)
Carpenters and barbers	9 (2.88)
Christian	1 (0.32)
Scheduled caste	35 (11.18)
Rabari	2 (0.64)
Total	313

Note: Figures in parentheses denote percentages to total.

TABLE 4: FREQUENCY DISTRIBUTION OF IRRIGATORS BY SIZE OF LAND HOLDINGS: RAVALAPURA SUB-MINOR

Area (Hectares)	Number of Irrigators
0.0 to 0.5	141
0.5 to 1.0	79
1.0 to 1.5	34
1.5 to 2.0	12
2.0 to 2.5	10
2.5 to 3.0	6
3.0 to 3.5	0
3.5 to 4.0	4
4.0 and above	0
Total	286

Thus, from 1948 onwards till today the farmers in the Kalambandhi villages have been assured of minimum flow in the river during the good years during the kharif season. Sluice gates which were temporary in the earlier years were made permanent and were operated by the Irrigation Department. The distributary system and the field channels were maintained by the farmers. Major repairs were attended to by the Revenue Department which was in charge of the system. Detiled procedures[16] were prescribed for rotating the *system* of distribution during the kharif to cover a total area of 2181.34 hectares as given in Table 1. Since the maintenance of the whole system was the responsibility of the riparian owners and the major repairs were the responsibility of the Revenue Department, no separate irrigation rates were charged for use of water but only a portion of land revenue was additionally charged as right to water. This was known as himayat. This system was continued upto 1967.

In 1967 an agreement was again entered into by the Government with the Kalambandhi villagers. By this agreement it was decided that the ID would take over the distribution system upto the government outlet declaring the project as a class one project and that regular rates as applicable to under normal rules would be levied and that the old system of linking with land revenue would be discontinued. By this agreement the responsibility of maintenance upto the government outlet was shifted Irorn the farmers to the ID but the maintenance of field channels has continued to rest with farmers.

The leading village among the Kalambandhi villages is Nawagam which was subject to an intensive study. The area is in the medium rainfall zone with 864 mm as average rainfall. The maximum rainfall recorded so far is 1,643 mm and the minimum 427 mm. The village has 27 wells, but the water is brackish since the area is close to the sen. The inland salinity is a major problem and, therefore, the dependence on sweet water (lowing in the river is inescapable. Further, there is no flow in the river once the monsoon season is over. This explains the keenness of the farmers in the village to irrigate as intensively as possible once the Khari waters arc available during the kharif season. Therefore, the farmers have set up a seven member management committee which is now in existence since the last fifteen years for carrying out maintenance work in the field channels just before the kharif irrigation starts. The committee is purely an informal affair, mainly due to the leadership of Shri Gordhanbhai Shambhubhai Patel, who has a record of public leadership extending over three decades in various capacities such as the President of the District Panchayat, Member of the Legislative Assembly and Minister of Irrigation in the State Government

The committee solicits help in terms of man power which is calculated as one male person per household. Thus, human efforts arc spent *on* clearing the weeds from the held channels and their repair work just before the month of June each year when the kharif season starts. If a household is not able to send any male person for maintenance work, a fee of Rs 5 is levied and the funds so collected are used for buying the snacks to the willing cultivators who come up for work.

The informal committee also advises the officials of the ID in regard to the scheduling of rotation of the canals and sluices to synchronise with crop-water requirements during the season. Thus, the functions of the committee are two-fold : (a) to maintain the irrigation system below the outlet and (b) to act as liaison between irrigation engineers and the farmers.

Due to the active functioning of the informal committee, the area under irrigation has been keeping steady during the kharif season. The crop generally grown in the kharif is paddy and the crop under dry conditions during the rabi season is wheat. The farmers are very proud that they have assured water supply during the kharif season and that they maintain their field channels whilst there is a tendency of general neglect of the infrastructure below the outlet in major projects which have perennial irrigation prospects.

It is worth noting that each of the eleven villages have an informal association but there is no federation at the apex level. Such a general organisation existed once in a while but it was only when situation demanded such as the need for negotiations with the government officials. The last one was at the time of negotiations with the Government to reach the agreement of 1967 referred to earlier.

An analysis of the size of holdings of irrigators shows that the largest percentage of irrigators falls into category of 1.0 to 1.5 hectares (Table 2). The weighted arithmetic mean of the holding size is 0.99 hectares. In the absence of an aggregate income of assets data for each household, the holding size is a good indicator 'of the economic position of irrigators. It is obvious that Nawagain village is dominated by the small farmers :md for them access to irrigation supplies during the kharif is vital.

The irrigators are also classified according to castes (Table 3). The dominent caste is Patel (67 per cent) followed by Thakors and Scheduled Castes. The latter are generally categorised as weaker sections. Patds in Gujarat have been traditionally the land owning and self-cultivating peasants. In the district of Kheda, the situation is no different and it may well explain their big say in regulating the village affairs due to their predominance among the peasantry in the rural sector.

TABLE 5: FREQUENCY DISTRIBUTION OF IRRIGATORS BY CASTES: RAVALAPURA SUB-MINOR

Caste	Number of Irrigators
Patel	156 (54.55)
Brahmin	9 (3.15)
Thakor	21 (7.34)
Carpenter and barber	12 (4.20)
Christian	22 (7.69)
Rajput	37 (12.94)
Muslim	13 (4.54)
Scheduled caste	15 (5.24)
Rabari	1 (0.35)
Total	(286)

Note: Figures in parentheses denote percentages to total.

The foregoing details of the empirical study show that the asuranc- of irrigation supplies, though during an extremely limited period of the year namely the kharif season lasting about three and a half months, through the establishment of the riparian rights in the last century and though an administrative arrangement of a mini, mum flow in the river in the later part of the current century has been the chief motivating force for group action. Further, the area suffers from the inland salinity problems giving rise to brackishness of ground water resources. Therefore, there is a critical dependence on surface irrigation supplies. Thus, the scarcity of sweet water and certainty in supplies, though for a limited period, have brought home the need for unity and community action under adverse conditions.

The farmers' organisation is village based. Though there is an identity of interest among all the farmers in the Kalambandhi villages, it is obvious that they thought that they could function better in day-to-day maintenance operation through an informal arrangement on a village basis rather than on the entire sluice area basis. Perhaps, the geographical area of a village is more appropriate for realising better economics of scale in maintenance operations. More important is the fact that farmers in a given village feel more homogenous as they know each other fairly well and that a farmer in another village is after all a stranger. But when the need arose such as for negotiations with the government as in 1967, the farmers of the eleven villages formed a mandal, a loose federated body of village associations and once the purpose is over the mandal was dissolved. The association formed at the village level is on an informal line and there were no separate committees formed at each of the outlets served by the distribution system in the village. Further, though the association is said to comprise all the irrigators, only the committee of seven members is taking active interest in the irrigation affairs and the villagers seem to be happy with the exercise of powers. This arrangement of exercise of informally delegated authority by the committee seems to have worked to the satisfaction of all only because of the limited nature of functions, namely, maintenance of infrastructure and liaison with irrigation bureaucracy. Perhaps, if the functions had extended to distribution of water, settling disputes and other such activities of complicated nature, a more democratic set up of arrangements would have been necessitated. Further, the powers of the committee are restricted only to collect a nominal fee from each member in case he is unable to provide human labour towards maintenance. Beyond this the committee has no coercive powers,

The leadership has been in the well tested hands of a local leader who has had experiences at the district level as well as at the State level as an office holder. Such experiences are rare for any person and hence the role of leadership in the village has naturally gene to him. Looking to the limited nature of the functions he had wisely kept the status of the association purely on an informal basis without any coercive powers. Perhaps, this would explain the reason that all the farmers have accepted the arrangement without any protest despite the dominance of the Patels in the committee. Since access to water as a scarce resource is so critically important for all the farmers whose average size of the holding is just a hectare, the weaker sections of the farming community did not have any misgivings and there was ready support to the committee. Thus, economic interests have been more or less identical despite the caste divisions in the community. However, the latter have not created any conflicts in the committee's functioning since it is apparent that the ceo. nomic interests of the weaker sections have been well cared for.

The second empirical study pertains to the Mahi-Kadana Irrigation Project of recent origin with which the author is closely associated, Prior to the completion of the dam in 1978 across the river Mahi at Kadana, a diversion weir was primarily responsible for the kharif irrigation in about 60,000 hectares each year. After the dam was constructed, the area under kharif irrigation for different crops was expected to go up to 100,000 hectares. However, there has r-een a short fall and the reason has been that the kharif crops were generally monsoon dependent with low intensity of water use such as pearl millet and that the proposed cropping pattern of increased area under paddy has not yet taken place since the farmers were not keen to spend on irrigation and go for water intensive crops such as paddy.[17] Only when the monsoon failed or when it was erratic and it was necessary to save crops, they had to go in for irrigation.

But in the winter season (the rabi), when there is hardly any precipitation, the farmers have to depend upon surface irrigation. Earlier the area under the weir irrigation was just about 20,000 hectares and once the dam and reservoir were ready, the area was anticipated to go up to 120,000 hectares. But, new construction works undertaken from time to time such as additional spill ways, repairs to canals and lining of canals disrupted the rabi schedule of irrigation. Closure of canals due to the constructional work has caused such uncertainties that confidence was totally lacking in irrigation supplies during the rabi. As a result, the area under irrigation during the rabi since 1978, when the dam and reservoir were completed has not exceeded the pre-dam stage figure of 20,000 hectares.

For these reasons, infrastructural facilities constructed below the outlet level at the cost of the farmers have not been fully utilised except during the kharif season when the area irrigated was relatively larger tha in the rabi. Further, those farmers who resorted to surface irrigation were not fully satisfied since the flow at the outlet was of doubtful capacity. Added to the problem of less than the estimated flow of one cusec, the farmers were scrambling for water all at the same time with the result that no one was getting water in adequate quantity for his field at any time. Such an indiscidlined way of irrigation was nothing unusual in any surface irriga-

tion project in India in the absence of a roster system below the outlet level,[19] Apart from affecting the yields of crops due to inefficient application of water, it has also adversely affected the team spirit and morale of the farmers which are so critically necessary for any collective action. Add d to these, farmers have been receiving instalment notices for repayment of cost of construction of field channels find land levelling, which have caused unrest among the farmers. They alleged about the inadequacy of those facilities in terms of quality and efficiency, little realising that in the absence of constant maintenance, these works tend to get deteriorated de-pite the maximum care in preparing them at the first year of construction.

The command area development authority and its irrigation engineers were aware that the solutions to the problem of uncertainties in irrigation supplies to the farmers lie in upgrading the distribution system both above and below the outlet. Above the outlet, for managing the main system certain additional investments wore found necessary such as control regulators, measuring devices, drop structures and Rates. Further, an appropriate rotational scheduling of distributaries from the main branches with a view to ensure adequacy in supplies was found wanting. While the former involved heavy financial outlays, the latter required detailed plans of rotation of outlets on each of the subminors, minors and branches since the basic structuring of canal rotation schedules depends on how such a roster is determined at the outlet-level. At the outlet level, the rotation of supplies depends on the prevalent cropping pattern, the crop-water requirements as dictated by soil characteristics and the intervals at which the crops require water and the capacity of the outlet and the area commanded by the outlet.

Below the outlet level, the repairs required were equally substantial. First, the gated turn outs were found to be of utmost necessity. Secondly, the lining of initial ten to fifteen meters of the field channel from the outlet was also found advisable so that the flow from the outlet was kept even without flowing over the banks of the channel. Maintenance of the earthen channels which has been ignored by the farmers had also to be attended to since the capacity of flow of water received at the head of the outlet has to be kept up conceding the minimum trans-evaporation losses until it reaches the fail of the outlet command area. Various control structures such as diversion boxes, siphons, and road crossings have also to be kept in good repair or replaced.

While the expenditures below the outlet were clearly ruled out by the Government since they happened to be the responsibility of the farmers, the expenditures of maintenance and replacement above the outlet which arc the responsibility of the Government could not be met since the funds were grossly inadequate. New investments of the kind referred to were not looked upon favourably since thev were considered as components of modernisation on a project which was recently completed.

In these circumstances, an exogenous push to improve the systems management was felt when lienor, a Consultant to the World Bank and his associates came on the scene in 1978 to suggest the introduction of rotational water supply (KWS) at the farm level on a pilot basis. Their concern centered around two chief objectives: (1) to ensure equity in the distribution of water to all the lands situated in the command of the outlet regardless of its location either Kt the tail or on the upper reaches of the outlet and regardless of the owner's economic position or social status and (2) to apply just the right amounts of water required for crops at the predetermined intervals which were made known well-in-advance to the farmers so that the latter could plan their agricultural operations with full assurance of irrigation supplies.

The World Bank held out a promise that if the pilot project experiment proved successful, a massive investment programme for RWS would be financed by a soft loan through an IDA credit. Government seized the opportunity and directed the command area development authority to start a pilot project in the rabi of 1978-79.

The area under the Ravalapura subminor (of 15 cusec capacity) Inking off from the Petlad branch was chosen as the area for experimenting rotational water distribution. The area measuring 206 hectares in three villages of Ravalapura, Samarkha and Sadanapura, is served by fifteen outlets. The chief crop generally grown in the area during the rabi is wheat and the second important crop is tobacco. Crop water requirements and the intervals of irrigation for two crops were ascertained from the agronomists at the nearby campus of the Agricultural University. Taking into account the flow of water at one cusec from the outlet, per hectare water hours were worked out and each of land as denoted by the survey number in the land records was assigned a specific time on a specific day. While working out individual land's irrigation time, their location also influenced the time assigned since the losses due to trans-evaporation in the field channels were specifically taken care of. In other words, a given area in the tail part of the command area of an outlet had more time for irrigation than its counterpart located in its upper reaches. The irrigation schedules for each piece of land were displayed on a board fixed at the head of each ontlet

Overseeing the observance of the rotational schedule and resolution of any disputes were left to the irrigators themselves. For each outlet command area, farmers were encouraged to form an association which proceeded *on* the following lines : In each outlet, farmers of, say, Monday-group to whom irrigation supplies were to be made available over a 24-hour period were a ked to form a sub-group with an informally elected leader. Thus, in an outlet there may be two to four sub-groups on an average, not exceeding seven sub-groups signifying the days of irrigation schedule and these sub-groups will have as many sub-groups leaders as there are sub-groups. These sub-groups leaders would form the outlet committee with an elected leader as the committee leader. The outlet committee provides leadership at each outlet and facilitates communications between irrigators and the irrigation officials.

Apart from a high degree of intensity of application of technical and human inputs in preparing the schedules for each outlet, physical investments were also made for each outlet of the order mentioned earlier such as measurement device to assure that the flow is of estimated capacity so that the irrigation time schedule is meaningfully maintained, initial lining and improving the field channels and replacement of structures wherever needed. Similarly above the outlet level, the sub-minor was fully cleared of the weeds and control structures were improved to rotate and regulate water supply at one cusec from each (f the outlets. For ensuring the latter, the take-off portion of the sub-minor from the Petlad Branch was also lined and a measuring device was also fixed at the head to keep a watch on the flow of water in the sub-minor so as not to fall below the capacity level of 13 cusec.

The pilot scheme proved immensely successful. An impact study showed

that introduction of RWS at the outlet level was indeed a technological improvement as it signified an upward shift in production function. A survey of farmers' attitudes revealed that farmers preferred the RWS for various reasons, the most important reason being that the farmers were getting water for the rabi season without any quarrel among themselves for the first time.[19]

The pilot project continued for yet another rabi season of 1979-80 with a much wider area of operation bringing three more sub-minors under it. The Ravalapura sub-minor experiment was also extended for another season and the gains from RWS had come to say. The farmers were convinced that the irrigation supplies were certain and that the authorities were bound to maintain the level of one cusec flow at the outlet since the system above the outlet had also been ensured to provide an adequate and reliable flow during the season. Thus, RWS has emerged to be a morale booster for the command area authority since the irrigation engineers had trust in their supplies which in turn, created confidence among the farmers in the Irrigation Department.

This climate of confidence in the Ravalapura sub-minor enabled the farmers to come together for the first time to take steps for maintenance of the infrastructure facilities below the outlet level. It should be stated here that the farmers in the Ravalapura were not specifically told that they were to pay for the additional infrastructural facilities .such as lining of the initial 10 to 15 metres, the measuring devices and replacement of old structures though they were aware that they had to pay for the earlier provision of field channels and community items. But, deliberate silence on the part of the command area authority was eloquent enough to convey the message that the expensive additional infrastructural facilities provided at the Government cost would be able to give returns each year only if they are well taken care of.

Without any effort on the part of the authorities an informal executive committee of farmers came into existence in May 1980, after two years of RWS experiment. The chief objective behind the formation of the committee was to maintain the assets created for irrigation at the outlet level. It consisted of four farmers and the chowkidar, the lowest ranking government servant of the irrigation department. All the farmers in the committee are Patels and the leadership was provided by Bhikhabhai Dahyabhai Patel who is also the chairman of the Ravalapura village Milk Co-operative Society. The functions of the committee covered only maintenance of the infrastructure -and keeping liaison with the irrigation department on behalf of the farmers.

The committee collected subscriptions from the farmers at the rate of Rs 5 before each agricultural season for carrying out maintenance work by hiring agricultural labour. Originally only two outlets were taken up for repairs but the response from farmers in other outlets was spontaneous and the committee decided to enlarge its operation for the entire Ravalapura sub-minor which covered three villages. Since the time schedule for irrigating each field was fixed and made known to all the farmers in an outlet, and the time schedule could not be extended or altered, each farmer was keen to get the maximum flow in the given time schedule for which the channels have to be kept in top condition. This particular anxiety made them acutely aware of the need for their maintenance.

The frequency distribution of irrigators in the Ravalapura sub-minor by size of land holdings shows that 77 per cent of farmers were small farmers owning land upto one hectare (Table 4). The weighted mean size of the land holding was 0.74 hectares. Thus, it is obvious that the small farmers dominated the scene at the pilot project.

As regards caste position, the Patels were 55 per cent of the irrigators followed by Rajputs and Thakors (Table 5). Because of this position, the committee mainly consisted of representatives from the dominant Patel group as was seen in Nawagam village study.

In the above case study relating to a modern surface irrigation project, certainty and adequacy of irrigation supplies, as in the case of the old Khari sluice irrigation project, have emerged as the chief motivating factors for group action at the outlet. Such an assurance of supplies was made possible because of the introduction of RWS as a pilot project. The irrigators made it sure that it was not a freak occurrence and only when the experiment was extended to other areas and the pilot project came to stay, did they start taking action in maintaining their water courses.

The original jurisdiction of the informal association was to cover only area under two outlets But soon the entire pilot project area under a minor came to be covered by the association as the farmers in other outlets felt it worthwhile to come to an understanding, The pilot project area cuts across the boundaries of their villages. Thus, the informal association is canal based rather than village based unlike in the earlier case.

However, the executive commiittee of the informal association consisted only of four farmers, though under the strict requirement of federated body at the canal level, the committee should have consisted of all the outlet group chairman. Thus, it is obvious that the group chairman of the outlets have felt that their interests are adequately served by the executive committee despite the absence of some of them in the committee. This is because of the reason that the functions are extremely limited in nature and confined only to water course maintenance and liaison with irrigation officials. If the functions are a little more complicated, they would have asked for full-fledged representation.

As observed in the earlier case, all the four members of the executive committee belonged to the Patel caste which was the major community in the three villages covered by the canal. However, the rest of the farming community felt that their interests insofar as they cover the maintenance and liaison with bureaucracy were well under protected by the committee. Further, it is also worth noting that the economic interests are also identical in that the average size of the holding is less than one hectare and for them access to irrigation supplies is critically important for survival.

The leadership came from the traditionally land owning, and self-cultivating class of Patels. Further, the leader of the committee has also a background of social and economic service in that he has been the president of the local village milk co-operative society which collects milk and sends to the co-operative milk processing plant. The past record of service to the village naturally helped him to assume stewardship in irrigation infrastructure maintenance and the villagers seemed to have rallied around him. Though he has no plans of enhancing the limited role of the informal committee beyond repair work, he is not averse to assume major responsibilities. But he would like to wait for at least one more year before he would advocate taking up functions of complex nature. His cautious approach can very well be appreciated since this is the first time in the command area of the project that the farmers have felt the need for collective maintenance.

As regards socially disadvantageous

sections of the community who were in the minority, no special consideration was shown. They along with other farmers have to contribute a nominal ice of rupees five for labour charges for them but as the functions of the committee were minimal, there was no basic opposition from them to the initiative displayed by the committee.

Farmer's participation in irrigation management essentially consists of maintenance of the terminal level of the system, distribution of water and resolution of disputes. Though the institutional factors largely determine the formation of farmers' association, the condition precedent for farmers to assume the initiative is that they should have confidence in the irrigation supplies. The adequacy and certainty in water distribution in the main system and, below the outlets is, therefore, critical in creating a climate of faith in .surface irrigation.

III
Summary and Conclusions

Two empirical studies from Gujarat showed that certainties in irrigation supplies from the gated turn outs were chiefly responsible for group-action among the farmers. Secondly the relatively egalitarian structure of the community denoted by the size of the land holding and the "equal" interest have access to efficient water supplies arc also .significant factors influencing farmers' coming together. Thirdly, the leadership has to come from the tested hands in the community in whom there is trust and confidence. Such a person or a group of persons who acts as a steering committee has to prove their worth by their past performance or by their present occupation as a local self-government leader such as the president of the village panchayat or chairman of the cooperative society. Similarly, the leader should also be an irrigator and share the same egalitarian structure and interests with other irrigators. Only such a combination would convince the weaker sections of the community of the bonafides of the initiative.

The form of co-operation in both the cases was a central committee comprising of a small number of fanners to whom the general body has informally delegated the functions and powers of a limited nature. The functions were maintenance of the water courses and the community assets and keeping liaison with the irrigation bureaucracy. The powers were restricted to collect fees in lieu of labour in the first case and fees towards labour charges in the second case. If the functions were to include distribution of water, resolution of disputes and the like, the form of organisation has to be more complex giving rise to the questions of representation to different sections of the community and the procedure of appointing members to the committee through periodical elections and the like. Further, the question of registration of such an association under the prevailing law may also come up. For example, if the association desires to buy water in bulk at a discounted rate from the Government and to retail water to its members, it has to be registered under the Registration of Cooperative Societies Act and has to observe the formalities under the law.

Thus, so long the functions are minimal and only confined to periodical maintenance and liaison work with the irrigation department, the present informal arrangements would suffice. But once the farmers decide to forge ahead and take up more extensive functions, the association has to assume a formal character and the structure of the organisation would also become more complex.

Notes

1 The objective behind the planned investment is to raise the proportion of gross irrigated area out of the pass .sown area from the present level of 23 per cent to 52 per cent by 2025. In absolute terms the Kross irrigated area is targerted to Ro up from 38.5 million hectares to 110 million hectares in 2025 and the gross sown area from 165,1 million hectares to 210.0 million hectares. For greater details, .see Governrnent of India, Report of the Rational Commission on Agriculture (New Delhi, 1977), Part V, 41-45.

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3 J P Melnerny, 'The Technology of Rural Development" (World Bank, Washintrton, DC, 1978) 2

4 *Ibid* 17.

5 J M Cohen and N T Uphoff, "Rural Development Participation", (Cornell University press, 1977), 10-15.

6 J Howell, "Assessing Management and Organisations for Agriculture Development Projects", Institutions, Management and Agricultural Development (Overseas Development Instilute. London, 1979), 20.

7 A F Bottrall, "Evaluation of Irrigation Association in Taiwan", *Agricultural Administration,* Volume 4, *4* (1977) 245-250.

8 U Colombo, D G Johnson and T Shishido, "Reducing Malnutrition in Developing Countries: Increasing Rice Production in South and Southcast Asia Report of the — North South Food Task Force to the Trilateral Commission (New york, Trilateral Commission, 1977), *z8.*

9 Nationai Research Council, The World Food and Nutrition Study" (US National Academy of Sciences Washington, DC 1977), Vol 2, 129

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11 World Bank, "World Development Report (World Bank, Washington DC, 1978), 40.

12 R Chambers and R Wade, "Managing the Main System: Canal irrigation's Blind Spot", (Mimeo) (Institute of development Studies, Sussex, 1980).

13 *ibid.*

14 C V Meer and C Radoscvich, "Report of the Committee on Agency Farmer Relations" in W J Staub (ed), "Proceedings of a Workshop on Implementing Public Irrigation Programmes", (Fasl West Centre Press, Honolulu, 1977) 14.

15 The world Kalambandhi in Gujarati means "legally bound". II signifies here that these eleven villages enjoy a right to natural waters of the river khari as ratified from time to time by the orders of the government.

16 Collector of Kheda, Handbook of Khari Sluice Irrigation, (Government Printing Press, Bombay, 1915).

17 T K Jayaraman, "Multiple Cropping and Crop Diversification in Mahi-Kadana Project' *Commerce,* Annual 1979 (Commerce Limited, Bombav 1979), 87-94.

18 A kind of rotational water distribution has been in vogue in the northern states of India for quite a long time. Under this a farmer is provided a share of available water supply according to the number of the acres owned by him. But he has no control over the timing and quantity of this water; he does not know when he would receive his share nor how much of his total share he would receive in any given time. Such a system of rotation with no concern for crop-water requirement gives rise to substantial degree of uncertainty in water supply which leads to disappointing performance with respect to yields and utilisation of irrigation potential. See for greater details, R B Reidinger, "Institutional Rationing of Land Water in North India: Conflict between Traditional Patterns and Modern Needs", *Economic Development and, Cultural Change,* Volume 23, 1, (1974), 80-84.

19 T K Jayaraman, "Impact Study of An Experimental Rotational Water Distribution at the Farm Level in Mahi-Kadana Irrigation Project in Gujarat State, India", *Agricultural Administration,* Volume 8. 1 (University of Reading, 1981) forthcoming.