PN-AAT-295

40869

LOCAL ORGANIZATION FOR IRRIGATION IN BANGLADESH

Consultancy Report

Organizational Analyst for Water Management Systems
Project Design Team

July 1 - August 15, 1983
USAID/Bangladesh

Susan Turnquist

Development Sociology
Cornell University

Summary and Recommendations

I. Issues and Current Strategies

1. Agriculture in Bangladesh has not, for the most part, traditionally involved irrigation; traditional irrigation methods, where used, have relied on surface water to supplement rainfall and have been carried out by individual farmers with little or no need to coordinate these activities with other farmers. Farmer organization for irrigation therefore has no traditional precedent, and farmers' experience with water management for irrigated crops has been limited.

2. Most irrigation in Bangladesh in the future will draw on groundwater supplies by means of tubewells. In groundwater irrigation, issues of control over the water capture device (tubewell) and thus the amount of water available at the surface for irrigation precede issues of water distribution. Resistance to organizational efforts has come from farmers for whom control over water has reinforced other types of power. Groundwater has become a newly available asset for which rights have not been defined by tradition nor by law. Access to groundwater depends on access to a tubewell of some kind, most of which are beyond the means of most individual farmers. Farmers who do have access to tubewell water frequently report discrimination in water allocation in favor of influential farmers. Control of water is therefore largely in the hands of larger farmers.

3. Currently tubewell groups are utilizing tubewells far below their expected capacity. While some (unknown) degrees of this "inefficiency" can be attributed to technical, economic, and institutional constraints, other constraints can be attributed to organizational features. The potential number of farmers and of plots included in a single tubewell's technically-possible command area is quite large, involving high transactional costs to water users. Farmers who have been freed by high tubewell subsidies from the need to use water economically are understandably reluctant to increase their transactional costs and the efficiency of their water management, as long as they need not bear the costs of inefficient water use.

4. It is likely that the changes in cropping patterns which commonly follow the introduction of irrigation will increase the complexity of system management for a tubewell scheme. Transactional costs within the group will probably increase as a consequence.

5. Transactional costs between neighboring groups are likely to increase also in areas where the proximity of tubewells begins to interfere with the output of water.

6. An obstacle to informed intervention is the shortage of information about the organizational strategies and problems of existing water users' groups. Research methods have relied on surveys and interviews, which provide a "snapshot" of a group based on one or more members' responses. However, the acting out of a group's rules and roles can best be seen by observation over time, using anthropological research methods.

7. Privatization may be a way for the government to relieve itself of some activities which have been managed less effectively than hoped, although no evidence exists that this will contribute to equity goals for the distribution of irrigation capacities. However, the privatization of tubewell installation and pump sales is creating new needs to be addressed, namely the establishment of enforceable regulations regarding water rights. The absence of these jeopardizes private (including cooperative) investments in irrigation

equipment, as tubewell output is affected by improper spacing between wells. In addition, privatization of tubewells in the absence of equitable and enforced regulations is likely to lead to the rise of "water lords" and possibly to a combined capacity for water extraction which exceeds groundwater supplies in a given area.

8. Cooperative ownership and operation of tubewells by groups consisting of landless and marginal farmers who provide irrigation services to all farmers within a tubewell command area is a promising strategy currently promoted by such PVOs as BRAC and Proshika. These programs, which can be only tentatively appraised as they have operated for just a few years, put control of irrigation management in the hands of a group whose interest is in maximizing the command area, minimizing costs, and satisfying their customers. While many group members derive some direct benefit to the tiny amounts of land they own or operate in the command area, a benefit perceived by them of the greatest importance is the increase in wage labor opportunities on the farms of water users served by the group. It follows from this that the group has a strong interest in satisfying its customers as well as maximizing the area served.

9. Another strategy, currently employed by CARE and IRDP/BRDB, is to provide information and incentives to farmers to increase efficiency of water use. The results of this can also be but tentatively evaluated; CARE is looking for assistance in analyzing its data from this program. This strategy, primarily affecting existing deep tubewells, seems less promising than the cooperative ownership described above because it does not create a pattern of incentives and accountability geared to maximizing efficient and equitable use of groundwater. It is more likely that the outside agents' role temporarily alters the organizational pattern by providing a "warden" or a facilitator to outside resources. However, this may buy some time or opportunities for smaller farmers to establish some strength or linkages to protect their interests.

10. The successful organization of water users' groups is never entirely independent of the personalities of individuals in the group (and, in the case of groups established by intervention, the personality of the agent of intervention). However, the success or failure of a group may well hinge on the structure and processes that develop (or are imposed) for each tubewell. Specifically, likely outcomes of a group's operation over time may be predicted if one can determine the rules, the roles (particularly the dominating roles) and the social groupings which characterize each cluster of tasks in irrigation organization, namely water capture, water allocation, system maintenance, and conflict management. It is worthwhile to note that the success of a group is affected by conditions outside the group such as the group's or some individuals' relations with local officials and with other groups, and by market conditions.

II. Recommendations

Organizational considerations suggest that irrigation development in Bangladesh should emphasize:

1. low-cost technologies which do not require the formation of large, transaction-costly farmers' groups,

2. increased research and extension for crops with low water requirements or high resistance to water stress, so that organizationally problematic deep tubewells are not the only viable means for improving agriculture in areas with deep water tables, and so that profitable alternatives to water-demanding HYVs can be incorporated

into cropping patterns in areas where HYV agriculture places demands on the groundwater supply which cannot be met.

3. DTWs only in areas where no other options are feasible. In such cases, a strong commitment to creating a sustainably equitable organization will improve productivity. The lack of knowledge about organizational design requires a "learning process approach" to finding appropriate designs.

4. policies which encourage patterns of group efficiency and accountability in irrigation management, such as support for the formation of landless farmers' groups to provide irrigation management services, and research and extension to these groups so that they will understand the relationships between total water requirements of different cropping patterns and not commit themselves to more than they can supply.

I would like to express my appreciation to the other members of the Project Design Team, Hammond Murray-Rust (coordinator), Harry Blair, Joseph Campbell, H. R. Khan, and Leslie Small, for their assistance and contributions to my education; to Charles Antholt and H. Sherry Plunkett of the USAID/Dhaka Mission; and to Latifur Rahman for tireless translations and cheerful companionship. The views expressed herein are my own and are not necessarily shared by USAID.

INTRODUCTION

Bangladesh presents a unique context for irrigation development. As a delta country, the flatness of its terrain, the wanderlust of its riverbeds, and the cyclical deluge/drought seasons have limited the success of efforts to control the supply and flow of water. Traditional irrigation has been confined to areas with surface water supplies during both the dry season and dry periods in the monsoon. Yet groundwater reserves offer tremendous potential for the expansion of agriculture in the dry season, thus increasing employment, income, nutritional variation and national production.

Irrigation is an important element in the plans for agricultural development. However, irrigation development itself is a complex process, involving the development of extension information and training, institutional structures for information flows and decisions, economic incentives, organizational capacity at the water user's level, and engineering expertise. This section provides a brief outline of the Bangladesh context in which irrigation development is taking place. A full treatment (from which this is abbreviated) may be found in H.R. Khan's 1982 report, Study of Water Sector in Bangladesh, volume 1 (Dacca: UNDP).

Topography. Most of Bangladesh is a delta less than 60 feet above sea water. The apparent flatness in the dry season does not reveal the important slight differences in land elevation which become clear in the monsoon. Low lands become deeply flooded, medium lands more or less flooded, and high lands remain above the flood water. Cropping patterns have developed to fit the land/water situation of any given plot, so that plots quite close to each other may have different cropping possibilities. High lands, deprived of the silt brought by flood waters, may have less natural fertility. Low lands may have drainage problems. The micro variations are important to any plan to organize farmers to cooperate in the use of a single and costly source of irrigation water.

Rainfall. Seasonal fluctuation in rainfall is an important feature of Bangladesh. About 90% of the rain falls in the five months of the monsoon (May to September). Regional variation is also important, with the east and north receiving over three times the average rainfall of the west. Variability in the onset of the monsoon is of critical importance to the success of the aus crop. Irrigation provides flexibility in the planting or transplanting of aus, and supplements rainfall as needed for healthy aus and aman crops. Winter crops require irrigation for all their water needs, as little rain falls in the winter.

Hydrology. Surface flow fluctuates seasonally with the monsoon. The abundance of water in the rainy season reduces to a trickle in the winter. The little water which is available is needed not just for irrigation but also for water transportation, fishing, household consumption, and impeding sea water from penetrating too far inland. The scarcity and competing uses of surface water limit its potential for irrigation.

Groundwater, however, is relatively abundant and close to the surface. Aquifers are recharged annually during the monsoon, and it has been estimated that groundwater reserves could irrigate about three-quarters of all cultivated land (USAID, 1976). Extracting and using this groundwater raises a host of issues which are important in organizational considerations. Among these is choice of technology.

Irrigation Technologies. The technologies used in groundwater irrigation range in size and cost from hand pumps to deep tubewells. For our purposes they will be grouped into three types: manual pumps, shallow tubewells (STWs) and deep tubewells (DTWs). A comparison of characteristics of these can be found in Biggs, Edwards, and Griffiths (1978) and need not be elaborated here. Several points must be made, however.

The first is that "technology" is neither value-free nor contextually independent. It is designed to satisfy certain needs in a given social, political, and economic environment. It comprises both hardware and software (plans or requirements for information, training, and organization) which must cohere if the technology is to perform up to its engineered capacity.

Shallow tubewells and deep tubewells, technologies which were designed in another context and imported into Bangladesh, are appropriate for the task of lifting water from depths too great for human power, and in this sense they fit the hydrological conditions of those areas in Bangladesh where the water table is deep. They do not fit as easily into the institutional, economic, and social environment, being difficult to service, beyond the means of most farmers, and with such capacity that anywhere between 15 and 200 farmers would have to cooperate to fully utilize the unit. These and other issues will be more fully discussed in section I. Before going on, a further specification of the three technologies covered in this report is as follows:

Manual pumps, which can draw from water tables about 15 feet deep and include treadle pumps as well as hand pumps, are the cheapest to produce, maintain, and repair. Some models such as RDRS's double-action treadle pump can irrigate up to an acre of boro; this exceeds the capacity of hand pumps and indicates a potential for cooperation among a group of cultivators on contiguous plots (usually fractions of an acre). These pumps are included for consideration because of their low organizational requirements.

Shallow tubewells draw from similar water table levels (up to 25 feet) but use diesel engines or electric motors for power and pump enough to irrigate 15-20 acres of boro. They are privately owned, either by individuals or groups, and have been in demand despite the near-absence of government subsidies.

Deep tubewells can tap much lower water tables but at a capital cost about three times higher than STWs for equivalent capacity. They include a range of pump sizes, but two cusecs is the common rated level (frequently higher than the actual performance level). Depending, as do the other technologies, on such conditions as soil structure, cropping requirements and so on, a DTW can irrigate up to 80 acres, and under experimental conditions has irrigated more than 100. Most have been used far below expected capacity, not only because the near-total subsidies remove any economic incentives, but also because a command area of even 40 acres would typically involve 60 to 100 farmers cultivating up to 200 plots comprising the command area. The organizational difficulties in fully utilizing a DTW have been noted by most studies of DTW groups, and can be inferred from reasons cited by Keller et al. for low utilization in a 1981 report (USAID, 1981:19-20).

Agriculture. Agriculture dominates the Bangladesh economy, employing 70% of the labor force and producing 55% of the GNP. Most food produced is for subsistence rather than for sale in the market. The major cash crop is jute, and a variety of other crops provide nutritional variety and fill out the cropping pattern when a rice crop cannot be fit in. The three rice crops, consisting of different varieties suited to different seasons, are

boro (dry winter season), aus (early monsoon), and aman (late monsoon), the last of which is the major rice crop. These are "ideal types"; the range of varieties and cultivation regimes has produced such in-between crops as "braus". Currently, under typical irrigated conditions, a cropping pattern does not include more than two rice crops a year, plus a short crop of vegetables or pulses. As new varieties with shorter maturation periods are introduced it may become possible to grow three rice crops on one plot annually, but already questions are being raised as to the consequences of continual cropping on soil fertility as well as on the capacity of water reserves to meet future crop demands.

Farms are small and fragmented, and population density is the highest in the world. Although the high fertility of soil permits even a tiny farm to support a household, about 60-70% of the rural population have not enough land for that. Only 20-30% own or operate enough to make a secure subsistence, and about 10% produce a surplus. (Stroberg, 1977:7-8). As the population has increased, average farm size has decreased. The rate of landlessness has increased at a rate two and a half times that of population increases in the past 20 years (de Vylder, 1982:10).

I. Issues

1. Lessons from Traditional Irrigation

Given the scarcity of surface water during the winter dry season, Bangladesh's experiences with small-scale irrigation before the introduction of tubewells was limited to surface water technologies which were constructed by individual farmers with local materials, needed no outside credit or maintenance services, and made no organizational demands with the probable exception of paddy-to-paddy cooperation between two farmers who were likely related to each other. Such irrigation techniques were used on nearly 1.8 million acres in 1969-70, which was 69% of all irrigated land but less than 9% of all cultivated land. Six years later 1.6 million acres were still being irrigated by traditional means, but newer technologies had expanded so that land under traditional irrigation comprised only 46% of all irrigated land (Hamid, 1978:22)

Several points can be drawn from this. Although the data do not make clear to what extent the area under traditional irrigation refers to either primary or supplementary irrigation, it is clear that relatively few farmers have experience with cultivation which completely relies on irrigation. Very likely the number of farmers who have practiced irrigation to supplement monsoon rainfall is larger. But crop management under irrigated conditions is not a widespread traditional set of skills. This point has been taken into account into programs such as the interdisciplinary research program on cropping systems sponsored by BARC.

A second point is that farmers who traditionally practiced irrigation had little need to cooperate with others. The literature examined made no mention of traditional cooperation in rights of way or field-to-field flooding, which would depend on high surface water levels. I observed at least one dhone being operated which lifted water into a channel leading to fields which didn't border on the canal, which indicates some possibility of the existence of cooperation for irrigation rights of way. However, there seems to be little basis in tradition for cooperation among water users in water allocation, system operation, and system maintenance.

Finally, most studies of traditional systems in other areas concern surface water systems, not groundwater systems, because most traditional systems have been based on surface water sources. Groundwater systems, where they exist, tend to be operated by individual farmers and require relatively higher labor inputs to lift the water. The development of water users' organizations for pump irrigation systems has very little direct precedent in tradition or in recent experience with gravity systems.

2. Water Rights and Water Control

One important consequence of the absence of traditional use of groundwater is the absence of traditional groundwater rights. Legally, water rights for irrigation are as yet unspecified, although measures are underway to develop a Water Sector Master Plan in which groundwater resources and competing water needs will be considered together. Out of this, one hopes, a firm basis for legal water rights may be established.

In the meantime, the absence of such laws combines with the non-observance of recommendations to site wells no closer than specified distances from each other (800 feet between STWs, 1700 feet between a STW and a DTW, 2500 feet between DTWs) to produce a situation of anarchy in water capture.

In groundwater irrigation, the task of bringing the water to the surface involves the greatest capital investment of any of the tasks of irrigation. The decisions concerning siting of a well at this stage also largely affect the size of a tubewell's potential command area, depending on the elevation of the site relative to surrounding land, as well as the composition of the potential users' group (comprising some or all of the owners/operators of plots neighboring each site under consideration). Since these decisions are made by whoever has most influence in obtaining and installing a tubewell, it is clear that a person or group with control at this point is likely to retain a good deal of control over subsequent irrigation activities associated with that particular tubewell, including decisions on how much water (subject to water table limitations) will be brought to the surface and made available for distribution. This conjecture is supported by observations in the WMS Diagnostic Analysis Project (1983). Since tubewells (DTWs and STWs) are generally obtainable only by farmers with the necessary price or political influence, water capture has largely been controlled by these farmers, without the mitigating effect of water regulations. It can be expected that attempts to reorganize existing irrigation groups in order to increase the efficient use of tubewells is likely to meet with resistance from farmers whose control has been well established, and for whom control over water has reinforced other types of power. Experience has shown that establishment of cooperatives has not counteracted this tendency (Strobel, 1977).

3. Transactional Costs of Large Groups

The general practice of assuming that tensions in a group are the result of "social problems" obscurs the difference between problems which are rooted in social relations and those which are caused by shortages of something else and result in the tensions being played out along the lines of social relations. Shortages of credit, technical information, trained and available mechanics, and diesel fuel can all lead to apparently "social" problems of noncooperation, water cheating, fuel hoarding, etc. But the pattern of social relations itself does have constraints to be considered. In the large view, the patterns of social class and uneven access to resources pose a large constraint to equitable and

efficient irrigation development. A land reform would be one (perhaps a necessary) means of addressing this, but this strategy is not currently under consideration. Taking a smaller view, the social relations of groups, aside from the very important characteristic of members' class relations, are influenced by group size and the nature of group tasks. Large groups entail higher transactional costs than do smaller groups, and groups with complex tasks likewise have greater quantities of transactions (and, by implication, conflicts to work out) than do groups with relatively simple tasks.

The tasks of irrigation are fairly complex, and are considered in more detail below. The size of irrigation groups is an issue which has been largely ignored by project planners. Hanratty, using land occupancy data and assuming 10% of farmers in a typical command area had three plots, 30% two plots, and 60% one plot, estimated that a command area of 100 acres (within the technical potential of large deep tubewells) would involve organizing 163 farmers, and a command area of 60 acres would include 122 farmers. (Hanratty 1983: in20) Given 163 farmers and 100 acres, divided proportionately as Hanratty suggests, the acres comprise 206 plots, or approximately one-half acre per plot. This seems a bit large for many areas of Bangladesh, where the plots may be as small as several one-hundredths of an acre, so we may assume that 163 farmers is a conservative figure.

There is little incentive for farmers who already have control over a tubewell utilized by a very small group, or who have the means to obtain a tubewell without the joint efforts of a large group, to submit to the high transactional costs involved in organizing a large water users' group. Costs incurred by increased membership would be augmented by the costs involved in negotiating irrigation of plots at distant tail ends, as increasing distance increases rate of water loss and lowers efficiency. Even if there was a will, it would be difficult to find a way to accommodate the varied needs and to mediate among the various interests of so many farmers. As the policy of near-total subsidies for deep tubewells has been a disincentive to the expansion of command areas, there has been no will on the part of larger farmers to maximize command area. The gradual lowering of subsidies may change this, but it may also simply encourage a shift to shallow tubewells, which are not subsidized but are within the purchasing power of many farmers.

This does not address equity considerations in irrigation development, however. Smaller farmers appear to have little or no secure access to a reliable source of irrigation water. Participation in a group does not ensure this, and ownership of a well is beyond the means of most. As small farmers frequently achieve higher levels of productivity, equity considerations directly affect productivity.

An additional disincentive to farmers in control of deep tubewells to expand command area is the likelihood that, in addition to increased transaction time spent in meetings and negotiations, extra effort would have to be expended to improve efficiency of on-farm water management to reduce water waste.

4. Cropping Pattern Changes

Transaction costs are related also to the complexity of group tasks. The introduction of irrigation typically is followed by changes in cropping patterns, often to high yielding varieties which have higher water requirements than traditional varieties. The greater range of crops made possible by the introduction of irrigation, as well as the new freedom from seasonal cycles of wtaer availability, increases the likelihood that cropping

patterns within a command area would become more diverse than before. Complexity of system management would thus rise, also increasing the probability of conflict. The complexity of the pattern of water demand would be compounded by the increased extent of water demand if HYV crops are favored by farmers, particularly if water supply was insufficient to meet increased demand.

5. Inter-group relations

Tubewells individually extract from a common water table. The tensions which can appear in groups sharing a scarce resource (water from a shared tubewell) extend to tensions among farmers and between groups in areas where groups are sharing an increasingly depleted supply of groundwater. The management of a common but scarce good, when access to the good is general and private, is beyond the scope of any individual group but important to the success of a group's stability.

According to Biggs et al., only about 25 percent of the cultivated land is irrigable by means of shallow tubewells and other devices with comparable reach. Competition for water at this depth has become severe enough in some areas that handpumps and STWs no longer serve as alternatives to irrigation through participation in DTW groups.

6. Information Needs

Despite the general recognition of the existence of organizational problems in tubewell water users' groups, these have received little attention among researchers in Bangladesh. Research on irrigation has been dominated by studies limited to single disciplines, mainly economics, engineering, and agronomy. Multidisciplinary research has seldom shown interdisciplinary communication or awareness. Sociologists have traditionally found more career prestige in theoretical than applied research, which perhaps accounts also for the tendency in Bangladesh to separate data collection tasks from analysis. Theoreticians spend little time in the field, leaving the implementation of their research designs to research assistants. This limits the extent to which they can develop a "feel" for the data, from which context their survey results may be more insightfully and creatively analyzed. Finally, the absence of anthropologists in Bangladesh has resulted in an absence of advocates for the anthropological method of extended participant observation, which is a necessary complement to surveys. (see Appendix D for discussion of research methodologies.)

As a result, a shortage of information about the organizational strategies and problems of existing water users' groups confronts any efforts to design appropriate interventions. However, information about water users' groups is not totally lacking. Thanks to the political economy interests of Bangladeshi and foreign researchers (Biggs, Edwards and Griffiths, 1978; de Vylder and Asplund, 1979; de Vylder, 1982; Hamid et al, 1978; Howes, n.d. and 1980; IDS, 1980; Stroberg, 1977) questions about the social context of pump irrigation have been addressed: how access to equipment and inputs is limited by patterns of resource distribution in rural areas, and how participation in pump groups and allocation decisions are largely influenced by larger farmers. Howes (n.d.) has suggested a "gateway" analogy for analyzing the steps involved by which a farmer gets access to irrigation (Gate #1: ownership of assets; #2: access to land in command area; and #3: influence over water allocation) which is one starting point for an analysis of rules, roles, and social groupings which characterize a water users' group.

7. Public and Private Activities

The government's policy to privatize the spread of minor irrigation affects mainly pump sales, installation, and maintenance services. There is no talk of privatizing management services, although such an arrangement is certainly possible. Dr. Mandal at Bangladesh Agricultural University has been interested in a group of sharecroppers in Mymensingh who have been irrigating their total area of 600 acres for several years using nine two-cusec low lift pumps. The irrigation is managed by a committee that charges a fee for comprehensive management. This is a special case: all operators are share-croppers for absentee owners, only one crop (boro) can be grown here due to excessive monsoon flooding, and the pumps are rented, not owned. A more complex set of land tenure arrangements and cropping patterns would increase demands on management.

The government may do well to invite the private sector to provide services which are burdensome to the government, and it is not difficult to imagine that entrepreneurs could successfully offer complete irrigation services: well installation, perhaps even channel construction if necessary, pump rental, pump operation, water allocation, and system maintenance. This could indeed increase the average prductivity of equipment, if privatization were regulated in such a way that merchants of management services could have little or no landholdings in the command areas they served, so that their major incentive would be to maximize the area served.

Efficiency must be combined with accountability, however, if managers are to serve the interests of all farmers. If the managers are not accountable to all farmers, there is no reason to expect that all farmers would receive satisfactory service. A manager who is accountable only to himself or to a handful of influential farmers could act according to interests shared neither by the small farmers nor the government. A manager accountable to a strong small farmers' organization or a regulatory agency would feel more pressure to take such interests into account if he wanted to stay in business.

Privatization does not circumvent the need for broad-based farmers' associations, well-conceived and enforceable regulations, and public planning. Without these privatization can result in a situation where only affluent farmers have access to and control over irrigation facilities, which will increase the gap between them and the subsistence majority. There is a real danger that irrigation services will become controlled by "water lords," preventing farmers from exercising free market choices in purchasing irrigation water or equipment. Unless and until the government is prepared to create and exercise public planning and regulations, it is advisable that privatization proceed in tandem with government efforts to make irrigation available for small farmers through cooperative purchases of shallow tubewells and joint or individual purchase of treadle pumps.

In conclusion, although privatization offers a tempting alternative to government action, it nevertheless requires extensive controls and monitoring if it is to serve the goals of increasing productivity and equity. There is no evidence that the government has the administrative capacity for this. Privatization will probably increase the gap between larger and smaller farmers which would exacerbate other types of problems.

8. Cooperative Ownership

Two Bangladeshi private voluntary organizations, Bangladesh Rural Advancement Committee (BRAC) and Proshika, direct their efforts towards organizing rural landless

and near-landless people for training and income-earning activities. (See Appendix C for descriptions of their programs.) Among the activities they promote is irrigation services. Landless/near landless groups either rent or purchase pumps (mostly STWs and LLPs, but BRAC has begun working with a near-landless group managing a DTW) and provide irrigation to as many interested farmers as possible. The fact that group members generally are not completely dependent on patronage for their incomes, and that they have access to an outside facilitator (the BRAC or Proshika worker) probably contributes to the groups' ability to field much of the pressure they might receive from more influential farmers for preferential treatment in water allocation and distribution.

An important feature of this arrangement is the pattern of accountability and incentives. Group members own little or no land in the command area, although most operate some land. There is no benefit in denying water to anyone, or in using water inefficiently. The group profits by maximizing the command area, but only within limits they feel they can supply. Their dependence on customer satisfaction makes them accountable to farmers. However, it is unclear yet whether their accountability is actually an acute vulnerability. Some groups have operated for several years, but their success depends on the good will of influential farmers, who probably would have little difficulty in undermining the success of the landless managers if the irrigation services were not convenient for such farmers' purposes. The irrigation managers are dependent on the satisfaction of all farmers, but not all farmers are dependent on the services of the managers. Larger farmers are freer to seek alternatives.

The issue of accountability is an illustration of a pattern of relationships that requires consideration in planning irrigation development. The philosophic roots can be traced far back to classical economics, but the bottom line is to establish a basis for trust between buyer and seller, or in the case of irrigation management, the farmer and the manager. Accountability results from each knowing that if trust breaks down, alternative relationships are possible. If either the manager or the farmer alone has alternatives available, the other is vulnerable. This seems to be the case at present for landless irrigation groups.

These groups are a promising vehicle for productive and equitable irrigation management. They do not threaten the status quo of current asset distribution, yet the landless receive potentially long-term employment benefits from the increased demand for wage labor for irrigated crops. The short history of these arrangements as yet shows no trends regarding effect on rates or terms of sharecropping, leasing, or mortgaging of land; perhaps these arrangements will merely slow down the rate of landlessness, since they do not affect the structure of asset distribution. Alternatively, the control of groundwater may prove to be a powerful asset for the landless. In any case, support for the development and stability of such groups is recommended as a strategy for promoting productivity and equity in water users' groups.

9. Irrigation Management in Existing Groups

Another major strategy in irrigation development is to work with existing groups of irrigators to improve water management and increase command area. This strategy, the core of CARE's Deep Tubewell Irrigation and Credit Programme (DTI&CP) and of the government's Irrigation Management Programme (IMP), emphasizes deep tubewell groups. (See Appendix C for program descriptions.) The main thrust of the IMP strategy is to provide farmers with information and encouragement for better water management.

CARE provides more incentive in the form of assistance in getting credit and seeds, as well as offering training. The CARE program in particular offers an interesting experiment in need of evaluation, for which the IMP perhaps should have waited before launching itself. Both programs in effect try to improve the performance of what is essentially a socially inappropriate type of tubewell. Their strategy does not restructure the patterns of incentives and accountability in any long term way; extension information, once given, cannot be withheld, and the role of the IMP or CARE field worker may simply be that of a temporary facilitator for services, or a "warden" for performance. Neither program has any leverage for persuading irrigators to improve water management or equity in water distribution, and there is no reason to believe that any changes in productivity or equity of water use will, in the absence of changed patterns of incentives and accountability, outlive the active presence of the outside agent. However, the temporary role and incentives offered by agents may contribute to change if they enable smaller farmers to establish credit linkages with banks or to strengthen their voice in local affairs.

10. Predicting Performance

Personalities of outside intervenors or group members can certainly assist or impede the success of irrigation groups, but these can be mediated (and success gained or lost) by the organizational patterns of a group. These patterns, which can be seen in a limited way by using survey techniques, are more comprehensible if observed over time. An understanding of rules, roles and social linkages with the group and with outside agents or officials is necessary to discovering the operative patterns of incentives and accountability. This type of information can only be obtained by using techniques of anthropological research. Without this knowledge, however, the social context for irrigation development will remain an unknown variable.

A final point to make is that rules, roles, social groupings, incentives, and accountability may vary among the major clusters of irrigation tasks, and the analysis of an organization should recognize the fluid nature of these elements. The pattern for agency/local organization roles and responsibilities will vary for each major task cluster. For instance, the BADC has long considered its role and accountability to end with the delivery of the equipment (with some responsibility for repair services); it has no place in other tasks of water capture such as reliably supplying fuel or a pump operator, and no role in channel construction, water delivery, regular maintenance or conflict management. Conflict management may be served by an outside mediator, as BRAC agents occasionally have done, or may be dealt with internally in a manner evolved specifically for that task. It is important to consider how the requirements of each task cluster will be met, and to eliminate gaps in responsibilities as well as opportunities for control over a task without accountability. The importance of water user organization for irrigation may have been overlooked in the past, but it cannot be under-estimated if planners hope to design irrigation development effectively.

II. Recommendations

Organizational considerations suggest four strategies to promote irrigation development in Bangladesh: low-cost technologies to serve small groups of irrigators; increased attention to research and extension for crops with low water requirements, both to reduce

the pressure to install deep tubewells in areas with low water tables as well as to provide alternatives to a blanket cropping pattern of water-demanding (not to mention pest-prone and soil depleting) HYVs; an experimental approach to learning about organizing water users for a deep tubewell system; and policies to support the viability of irrigation management groups consisting of landless and marginal farmers.

Low cost technologies such as shallow tubewells and treadle pumps, designed to cover small command areas, have fewer organizational requirements than the larger and per-acre costlier deep tubewell. The transactional costs in time expended are fewer, the smaller group size tends to give members more opportunity to express their interests, and treadle pumps, at least, reduce the dependence of an transactional costs between the group and outside suppliers of fuel and repair services.

The need for research and extension on crops with low water requirements is two fold. It will benefit the regional distribution of agricultural development by enabling areas with very low water tables to improve yields without resorting to the use of deep tubewells. And it will provide growers in irrigated areas with alternatives to HYVs, an important consideration not only due to the number of problems associated with continuous and contiguous planting of HYVs, but also because there are no guarantees that enough water exists in every water table to serve the water needs of every farmer irrigating HYV crops, especially as the number of these is rapidly increasing.

A sizeable proportion of Bangladesh's cultivable area is irrigable only by means of DTWs. The economics of promoting such irrigation has been questioned (Small, 1983). If indeed there is a strong economic argument for using DTWs in a given area, the organizational and management aspects need considerable attention. As little is currently known about creating viable, equitable, and sustainable organizations for rural development, planners prepared to monitor and learn from mistakes are likely to contribute to more desirable outcomes (Korten, 1980; Johnston and Clark, 1982).

Finally, policies are needed to ensure that irrigation is available to all who need it on land which is economically irrigable. The social arrangements for this require that relationships between the suppliers and users of water be based on trust, backed by mutual knowledge of incentives and accountability. The landless and marginal irrigation groups show the most potential for providing this type of service but appear to be vulnerable to the interests of larger farmers, whose alternatives reduce their incentives and accountability in an exchange relationship with the irrigation management group. Existing groups have much to offer, and much can be learned from them.

APPENDIX A

I. The terms of reference for my visit were as follows:

1. to review existing literature dealing with farmer level organization for water management, with particular emphasis on pump irrigation.

2. to survey the agencies involved in irrigation to assess their experiences specifically in dealing with formal and informal water users organizations.

3. to survey past and current research projects investigating the nature and performance of farmer level water management organizations.

4. (in conjunction with Dr. Harry Blair, the Institutional Analyst) to collect information on the linkages between water user organizations and agencies providing irrigation-related services.

To fulfill these terms of reference I reviewed the documents collected by AID relating to water management in Bangladesh, collected additional documents, visited the head offices of relevant agencies, and took field trips to visit field offices as well as irrigation groups with whom these agencies work. A list of contacts and a set of trip reports are attached as Appendices A and B. Finally, I reviewed existing research of three types: traditional, contract, and action research. The summary of recommendations suggests short and long-term activities in the areas of meeting informational needs, setting research agenda, and providing programmatic support.

APPENDIX B

List of Persons Contacted

1.	Bogra, Rural Development Academy	Keith Gorey/Sen. Technical Advisor, FAO P. Kanoksing/Irrigation Engineer, FAO George T.J. Hung/Agri. Extension, FAO Dr. Amzad Hossain/National Project Coordinator and Deputy Director, CAD Program Dr. Nurul Haq, Director, Rural Dev.Academy
2.	Bangladesh Rural Development Board/Irrigation Management Programme	Mr. M.A. Baset, Joint Director
3.	Rajshahi University	Dr. M.A. Hamid, Prof. of Economics
4.	B.A.U., Mymensingh	Dr. M. R. Biswas, Agr. Engineer Dr. M. A. S. Mandal, Economics Dr. S.M. Altaf Hossain, Agronomist
5.	B.A.R.C.	Dr. Ekramul Ahsan, Member Director Dr. Brook Green, IADS Dr. Ben Wallace, IADS
6.	CARE	Dr. Sandra Laumark, Coordinator, Deep Tubewell Irrigation and Credit Program
7.	RDRS/Dhaka	Mr. Tovar Pedersen, Acting Director
8.	BRAC/Dhaka	Mr. Mostaq Ahmed Mr. Shami Imam, Staff Anthropologist
9.	World Bank	Dr. Walter Kock, Senior Agriculturalist
10.	Ford Foundation	Dr. Anthony Bottrall, Program Officer
11.	USAID	Mr. Charles Antholt, Chief, Food and Agriculture Dr. Hugh (Sherry) Plunkett, Research/Evaluation Officer
12.	PROSHIKA	Mr. K.F. Ahmed
13.	RDRS/Rangpur	Mr. Martin Dillon, Agriculture Project Coordinator Extension Officer and Extension Workers at Lalmanirhat Unit Small farmer group in Lalmanirhat Thana
14.	CARE/Dinajpur	Mr. M.M. Emdad Ali, Asst. Unit Administrator Mr. Nur Hussain, Field Supervisor A DTW group in Parbatipur Thana

15.	Sherpur Thana, Bogra	Agriculture Extension Officer Subject Matter Officer Local farmer
16.	Bogra Thana, Bogra	TCCA/KSS officials Local DTW group
17.	PROSHIKA/Shibganj	Landless irrigators group Shibganj Thana, Bogra
18.	BRAC/Pabna	Mr. Sunil Ghosh, Program Director Mr. Shah Newaz Khan Selim, Program Organizer Local landless group managing a DTW
19.	BARD/Comilla	Mr. Badruddin Ahmed, Staff Sociologist Mr. M. Solaiman, Research Coordinator
20.	CIRDAP	Mr. Azizul Haq, Director
21.	UNDP	Mr. Michael Hyland, Deputy Res. Representative Mr. J.K. Robert England, Assistant Resident Representative Mr. Larry Maramis, Programme Officer

APPENDIX C

Programme Descriptions and Field Visits

Programs which have targeted irrigators' organization as a point of intervention in irrigation development include CARE, PROSHIKA, BRAC, and the government IRDP/IMP program associated with the Command Area Development Program. Other programs of interest are the Rangpur/Dinajpur Rehabilitation Service (RDRS), because of their work in promoting bamboo double-action pumps which are used not only by individual farmers but also by farmers and landless groups, and the Grameen Bank Project, which makes no effort to organize irrigation groups per se, but has targeted functionally landless people for credit programs which have enabled the formation of 34 STW groups and 7 DTW groups. These six programs are described below, each followed by a description of visits to field offices and irrigation groups if these were made.

A few disclaimers are in order. The first is that these visits and interviews took place at the height of the monsoon—not quite the most opportune time to observe irrigation in action, although we did see supplemental irrigation activities. Also, the nature of a short-term consultancy tends to make field visits little more than impressionistic. The visits to pump groups were generally less than an hour long, and interviews had to be conducted in translation, reducing even further the amount of information that could be collected through this method. Finally, in the field interviews there is little basis for assessing the truth or accuracy of informants' answers, other than the verbal or body responses of their fellows. The presence of agency officials and field workers may or may not have affected the candor of farmers. Other pressures to answer in certain ways, or not answer at all, were possibly present if influential farmers were in the group. Most often the farmers with whom we spoke were self-selected, for the very reason of their influence in the village or group, and usually were either the group manager or a member of the management committee. Such cursory visits could not avoid these limitations, but the visits were made to add dimension to office interviews and in the hope that some variations in programs and attitudes of farmers would be evident.

Note: in summer 1983, approximate value of $1 was 25 taka. Three bighas = one acre.

CARE

CARE's DTW Irrigation and Credit program (DTI&CP) began in 1977 in Dhamrai and currently covers 6 thanas in 5 districts (Dhaka, Comilla, Dinajpur, Jessore, and Rajshahi). The program works with 215 existing deep tubewell groups, providing management services and assistance in obtaining credit and inputs for farmers. A one-page program description prepared by CARE is attached at the end of this appendix.

CARE cooperates with BADC for supplies and BKB for credit. The original goals of the program were to increase the acreage in DTW command areas, and later included increasing yields per acre. The goals now include organizing for equity. This is approached by selecting DTWs in areas with smaller per farmer acreage, and expanding the extension services to farmer education. CARE in essence has created an extension service. No reports are available concerning the impact of the program. Data collection for an analysis of CARE versus non-CARE irrigation groups was carried out last year, but the analysis itself was never carried out due to the departure of one of the key individuals. Nevertheless, the government's Irrigation Management Program (IMP) tried

to duplicate the CARE approach in 170 thanas last year, with results that one CARE person did not recommend.

CARE plans to "graduate" groups next year in the thana where CARE first began the project. The results of that step, together with the aborted analysis last year, would be helpful in assessing the CARE aproach. At this point it is difficult to make any conclusions about the likelihood that any changes CARE has introduced in a group will outlive CARE's departure. The supervisory role played by CARE in irrigation management may simply have been tolerated for the sake of other benefits such as extension information and access to credit and inputs that at times may be scarce. Last season CARE introduced a management fee of Tk.100 per acre, which was split 50/50 between CARE and BKB. In the field office I visited this step coincided with 18 of the 44 project groups dropping out of the program. One can speculate that perhaps these groups felt that they had gained knowledge and established institutional linkages with CARE's help, and that the help was no longer necessary, especially if it had to be paid for. But the Tk.100 is something of a nominal charge; if farmers perceived that CARE's services had contributed to higher yields, and expected that the services would continue to be beneficial, the fee would not be considered very high. I have no information on comparative characteristics of groups which stayed with the program (paying the fee) and groups which dropped out. It would be interesting to know what changes had been effected, the composition of membership, and the manner in which the decision to drop out was made in the groups which left the program.

CARE's attempts to reorganize DTW groups in order to increase command area, yields per acre, and equity in access is a difficult but necessary step to maximizing returns (i.e., agricultural productivity) to investment in DTW technology. Conclusive evidence for the success of the program is not available. Yet even if the DTI and CP is a resounding success, how widely replicable is it? Past experience suggests that successful expansion is unlikely without a commitment to providing a similar level of fieldwork inputs, both to exert pressure on local groups to perform in certain ways, as well as to provide a linkage with nonlocal institutions for all members in groups. Typically a program's expansion is associated with lower proportions of managerial inputs than a pilot project received, and typically (in rural development) this leads to a loss of control over groups and the consequent failure of the programs to reach people with few or no assets. The IMP program (see description below) has likely had this deficiency built into it.

Field visit. The field office visited has one Agricultural Officer and nine Field Supervisors to work with (currently) 26 DTW groups having a total of 1628 farmers. Other staff present in the field office at the time of the visit included an assistant engineer, an agronomist, a program officer, a junior program officer, and one of the nine field supervisors, as well as the assistant unit administrator, who has charge of the field office until a unit administrator can be assigned to it. The thana has 300-400 STWs, and a total of 93 DTWs, some of which are privately owned and others obtained through the IRDP program. A DTW group cannot join CARE until its loans are paid off to the IRDP (as required by the IRDP). Schemes have management committees of seven to nine members, selected by the entire group, and the driver and manager are selected from this group. Each scheme also has one or two linemen, and two schemes have a guard.

Farmers whose CARE-obtained loans are not paid up by the end of each year are excluded from credit services the following year, but CARE tries to deal with problems such as this by persuasion.

DTW group visit. The DTW visited began operation in 1976. Before CARE intervened, the command area covered 60 acres operated by 62 farmers. Now it covers 91 acres operated by 86 farmers. Sharecropping has increased, but CARE does not deal directly with sharecroppers, who also cannot actively participate in group decisions. However, sharecroppers may obtain CARE-derived inputs through the owners of the sharecropped land, and may participate in training sessions and attend group meetings.

Thirty of the 86 members are sharecroppers, most of whom are landless. Sharecropping terms are split 50/50. The vice-chairman owns 20 bighas outside the command area and 5.13 bighas inside. Of the 20 outside bighas, he sharecrops out 7 bighas. Of the land inside the command area he sharecrops out 2 bighas, neither of which were inside the command area previously, and the rest he cultivates himself with permanent hired labor and two brothers-in-law.

Leasing is not practiced in this group, but the area rate is Tk.1500 per year for 0.6 acre.

System construction. CARE designed the layout of the new channels needed when the command area was expanded, and the new channels were constructed by hired labor paid for by a loan from BKB (costs were estimated by CARE). The loan was repaid by assessing the entire group using a per acre charge.

System roles. The management committee consists of a chairman, vice-chairman, and five committee members of whom one is the manager, a paid position. Two of these committee members replaced others which had held office before CARE's intervention. In addition of the management committee, the system has one pump driver, one guard, and two linesmen selected by the management committee. There were no linemen before CARE entered the scene.

System procedures. Discussion was not very specific on this topic. The vice-chairman said that the entire membership met to make decisions four or five times during the season, and the management committee met either 10 to 12 or 18 times during the season. When asked about any conflicts, the vice-chairman said the management committee makes all decisions.

The CARE field supervisor who works with this group accompanied us to the interview, and although his readiness to answer our questions erupted only occasionally his presence was an important feature of the meeting. The vice chairman did most of the talking, and is a large enough landowner to employ permanent labor. So, while this group may indeed be living up to CARE's hopes, it is impossible to say to what extent the farmers interviewed were frank and representative of general consensus.

BRAC

BRAC became involved in irrigation development in 1976, about four years after it was founded as a Bangladeshi non-government organization to work with landless people in rural areas. "Landless people" are defined as those who must sell their labor for a living; this includes people who own a little land, but not enough for subsistence and without sharecropping opportunities to make up the difference.

The first irrigation work involved LLPs rented from the BADC, but this program was discontinued and in 1980 four groups in Manikganj branched into STWs. Manikganj currently has 16 STW groups, and there are 40 more elsewhere for a total of 56. The Head Office in Dhaka also said that there are five DTW groups, two in Pabna and three in Rajshahi, but there proved to be some discrepancy in this matter in the course of a field visit to one of the three branch offices in Pabna, where it turned out that there is only one DTW in Pabna, and the branch office said there were no DTW groups in Rajshahi.

BRAC has a field staff which includes about 300 program organizers (PO), the title for field level workers, who live in "camps" of four or five POs and a program director (PD). Each of these camps, or branch offices, covers about 20 villages.

BRAC does not initiate a group for the purpose of irrigation. In fact, a group is not assisted in developing irrigation activities unless it has spent at least a year developing group leadership, holding weekly meetings, making weeky deposits into a savings account and having success with group income-earning activities. Only strong, cohesive groups are assisted to expand into irrigation. Currently BRAC is working with 1,563 landless /marginal groups, divided evenly between male and female groups. All of the groups engaged in irrigation are male; one female group made the attempt, but did not succeed. By the Head Office's figure, then, the percentage of (male) groups engaged in irrigation is about 7 percent, so far.

BRAC, like CARE, is essentially an extension program which organizes marginal groups for training in income-earning activities and tries to promote group cohesion. Program organizers are usually university graduates and some have masters degrees. I asked three POs from two camps about their backgrounds and plans for the future. All three have master degrees from Dhaka University (in business admiistration, sociology, and soil science) and plan to stay with BRAC for the foreseeable future. One had worked for BRAC for five years as a PO, another for three years. The level of commitment seems very high, but the difficulty of the POs' job may be reflected in the high attrition rate mentioned by the Head Office. Many POs go on to work for other private voluntary organizations.

POs receive a two week training course at the BRAC training center in SHAVAR, and specialized courses are available periodically. The training center's program is open to other PVOs and to government officials.

BRAC conducts its own feasibility and evaluation studies with a staff of 50 responsible for research and evaluation. These and other special studies are available for purchase at the BRAC Head Office.

As with CARE's program, BRAC does not aspire to cover the whole country. The high managerial/field work inputs required would be difficult for a large bureaucracy to provide, and these appear to be critical for program success. Replicability seems possible only within this constraint. BRAC, like CARE, has not yet graduated any tubewell groups, so sustainability has not yet been tested.

Field Office. We visited one of the three camps in Pabna, the only one which works with a DTW group. The Program Director spoke with us for an hour in the early morning, then the PO working with the DTW group brought us to the village, which was close by.

This field office covers about 50 groups, half for women and half for men. Four of the groups have STWs. During the past boro season the STWs in the area went dry, perhaps due to the lower level of the Ganges River just a few miles away. Next year the office will take on two more DTW groups, for which the DTWs have not yet been installed. This will be the first attempt I've run across to organize a DTW group of landless people at the time the DTW is actually sited and the system planned, rather than years after installation. The results will be worth watching.

The current DTW group purchased a nine year old DTW last year which a group of farmers had been renting from BADC—without paying rent. We got more details on this in our talk with the group. BRAC provided the group with a loan of Tk.48,000 towards the purchase price of Tk.52,000. The BADC also wanted Tk.7,000 in unpaid back rent, which brought the effective price of Tk.59,000. The group came up with Tk.11,000 in savings to add to the loan from BRAC. This was not a bargain when one considers that the two new DTW groups will pay only Tk.75,000 each for brand new DTWs.

BRAC also provided loans for operation and maintenance which were repaid with interest at the time of dry season harvest. The group charged only 20% of the crop for irrigation fees, which is lower than the local rate of 25%. Due to a hailstorm, crop losses made collection of water fees a problem and the group lost money. But the group members benefitted from increased employment opportunities.

BRAC entered the picture upon the request of local farmers who were dissatisfied with the management of the DTW. BADC was also supportive of BRAC's interest in helping the BRAC group (already active in other ways) purchase the well. The BRAC Project Director has good personal relations with BADC, and the prospect of BRAC's assistance in getting both back rent plus the purchase price of an aging DTW probably looked good to BADC.

Under BRAC's guidance, the village group (60 members) in its first season was able to increase command area from 80 bighas (3 bighas = 1 acre) to 280 bighas of boro crop, a remarkable organizational achievement particularly because the DTW is not located on the highest land, and because BRAC has no expertise in water management. Only two days were lost due to breakdowns; BADC's services to the DTW have improved since BRAC became involved. There are fewer private mechanics in the area than in the past.

The group persuaded all landowners in the command area to sign an agreement per a government rule, that these farmers would cultivate HYVs in the command area and accept the group as water managers. The command area was divided into six blocks according to BADC's suggestion. The rotation schedule is problematic, according to both the PD and the group. Influential farmers make threats to get more water, and the group has made an effort to accommodate these, even going so far as to make special arrangements to supply water to land higher than the DTW. (We had no opportunity to see the system layout due to the muddiness from recent rains.) The group has occasionally turned to the P.O. for help in negotiating conflict, but usually manages by itself.

Group interview. Five or ten members met us in the village, as the PO who accompanied us had told them the previous night that we'd be coming. We walked through the village which consisted of small paras lining a long path. We sat on mats in a thatched and bamboo public room. The leader said that the group had been approached by cultivators owning less than 5 bighas with the request that the group purchase the DTW

from BADC. Farmers with more than 5 bighas took more water. The original "renters" also wanted to purchase the DTW. Apparently their failure to do this was the consequence of their unwillingness to cough up back rent, and the competitive position of the BRAC group which not only offered to pay the past rent due but could also pay the full cost in cash in one payment, courtesy of BRAC's loan.

The command area of 280 bighas serves 80 growers. Fifteen of these own more than 5 bighas, and 65 own less. Of the BRAC group's 60 members, seven own less than one bigha each in the command area, and ten or 15 sharecrop from 2-5 bighas. Sharecropping terms are 50/50 split of the crop and 50/50 split of the water charges; the sharecropper pays for all other inputs.

Sharecropping frequency has not changed in the year since the group took over. The group also leases in 4 bighas as a group in a kot arrangement, which involves a mortgage-like agreement. The owner accepts a sum of money (Tk.1500 per bigha) in exchange for cultivation rights. This continues until the owner pays the money back, at no interest.

Irrigation Roles. The group has an Executive Committee of 11 members. The management committee consists of these 11 plus the two paid pump operators/water distributors, who are given Tk.400 per month. The committee has weekly meetings, and sudden problems such as a breakdown are handled immediately by the manager. At any given time the people on duty are one lineman (a voluntary job rotated among members), one pump operator, and the cultivators receiving water.

Water Distribution. The pump operates 16-19 hours a day, on for 8 hours and off for 2 or 3. During land preparation, water is distributed on a first come, first served basis. During planting, water goes first to plots nearest the channel, beginning nearest the pump, apparently using the method of field-to-field flooding.

Conflict. The biggest problem the group has faced is trying to collect water fees, especially from previous managers. The group's expenses this year were Tk.33,000 against receipts of only 150 mds of paddy, which after milling and selling wholesale would have covered about 2/3 of the costs. If the crops had not been reduced by a hailstorm the receipts would have been higher.

It's interesting to note that the BRAC group was approached by farmers to take over the irrigation services; one wonders how the idea came to them. The BRAC group had proved itself capable of managing other economic activities, but this sui generis turn of the farmers to privatized (cooperative) management services invites further investigation. This being the only BRAC DTW group in the area, there was no model directly suggestive of the arrangments which evolved.

Another question is how the group managed to increase the command area so much with no irrigation management training. Of course, the DTW has been in use long enough for the farmers who did get served to develop experience in farm level water management. In addition, the BADC offered technical advice.

Finally, the advisability of encouraging a group to purchase an aging DTW for a price hardly lower than the subsidized price of a new DTW must also be called into question. It's not clear what options were open to BRAC and the group; perhaps it wasn't possible to get a new engine. In any case, the engine did not lose much time in breakdowns, and is perhaps in better shape (having pumped fewer hours per season?) than others installed at the same time.

If the BRAC approach has enabled rural landless groups to develop managerial skills and to be perceived by farmers as capable of providing good irrigation services, this is a welcome development, but yet to be shown as sustainable and replicable with other DTWs.

PROSHIKA

PROSHIKA began in Bangladesh in 1975 as an operation of Canadian University Services Overseas (CUSO) to provide training services to PVOs and small organizations. The following year the trainers decided to reorganize and to redirect their efforts to working directly with landless and marginal farmers. Although similar to BRAC, PROSHIKA follows Paolo Friere's approach in style and content, which emphasizes mobilizing the poor to raise their awareness of the roots of poverty. In so doing, PROSHIKA hopes to avoid a common result of assistance to poor, namely, that as their condition improves the beneficiaries invest their new or increased savings in traditionally usurious money lending, thereby perpetuating the poverty of others. The PROSHIKA program has been independently studied by a BARC (Comilla) staff member (Abedin 1982).

The combined staff of its now-divided branches (Dhaka and Comilla) includes 78 regular field workers (paid), 43 coordinators (paid), and 31 on the support staff (paid), as well as 167 volunteer amateurs. The areas in which the training and credit activities were carried out include 49 thanas in 10 districts, comprising over 4000 groups (Abedin, 1982:70).

Although PROSHIKA does not have a publication/documentation/research unit, its program for promoting landless irrigation groups has been documented and analyzed by Wood (1982). An important contribution to irrigation studies in Bangladesh, Wood's article emphasizes the nature of water as an asset for production, and argues for the rights of the landless to a share in this newly-defined asset. The article provides an economic analysis of 51 STW groups (28 made a profit) and 37 LLP groups (21 made a profit). PROSHIKA does not deal with DTWs.

Field visit to STW group. This was the only visit we were able to make without the company of agency field workers. We went to the PROSHIKA field office in Bogra district very early in the morning, but the staff members (who live nearby) were not around. We got directions to a nearby group and went directly to that village, where we met the group leader and a crowd, and talked for more than two hours.

The village group was formed after a neighboring village had begun a group. The villagers approached the PROSHIKA worker and asked for his help. The group officially organized on June 17, 1981 (this date was firmly fixed in the leader's memory) with 29 members. Before getting a STW in time for the 1981-82 boro season, the group initiated weekly savings requirements (Tk.1 per member) and weekly meetings, which included orientation for HYV cultivation and apparently were under group direction, as the PROSHIKA worker was said to be "sometimes" present.

The group managed to save Tk.15,000 in the six months before they bought the STW. (This figure may be wrong, or additional savings were used, or average weekly deposits greatly exceeded Tk.1, because 29 members x 26 weeks x Tk.1 = Tk.754)

Command area. The STW served 52 bighas its first season, but area was reduced to 39 bighas the next season due to insufficient water. The group plans to reduce this to 35 bighas next season because the "machine is getting old" and has had mechanical problems. Of the land in the command area, 50% is operated by group members: 8 bighas are owned (by 15 members) and 12 bighas are sharecropped (by 12 members). Cropping pattern has changed from 1 aman crop to boro, aman, and some wheat and potatoes.

Site selection. Group chose site belonging to a group member, on land high enough to serve command area. Owner agreed to donate land legally. He doesn't get any water fee reductions.

Channel Layout. The group designed the layout before they got the STW. This took three months, during which time the group requested, and got, all farmers near the STW site to sign a paper agreeing not to make trouble with the channels.

Irrigation Roles. The first year two people were hired, a pump operator for Tk.1000/season and a distributor for Tk.600/season. The second year these positions were consolidated and the salary set at Tk.1500/season. The operator was selected due to his experience running his grandfather's STW in another village. He was also given training when the STW, which came with a tool box, was bought. The operator hopes to become a mechanic, and is training the group leader to run the pump. All group members received PROSHIKA training in crop cultivation and channel maintenance.

Water distribution. The command area consists of four blocks. Water is distributed in a four day rotation during which the pump operates around the clock, "resting" for an hour for every four hours of pumping. The boro season requires 90-120 days of pumping. Member farmers carry out much of the distribution at night to give the operator time to sleep. Water flowing into a channel goes to all fields simultaneously.

Water charges. The first year they charged 25% of the crop. My notes also show an elaborate set of cash charges, so it's not clear if two systems were used. The second year the cash charges went from Tk.450/bigha up to Tk.500/bigha to cover higher input prices. As in the first year, Tk.100/bigha was earmarked for loan repayment.

System maintenance. Since members received training in channel maintenance, it's likely they take responsibility for this as they do voluntarily for distribution, although we did not follow up with this question. Mechanical servicing is obtained on the open market for Tk.100 per visit. PROSHIKA had arranged a Tk.50 fee with a particular mechanic, but he is often too busy to come.

Supplementary irrigation. This enlightened group actually offers supplementary irrigation. Last October one irrigation was needed, and was provided for a fee of Tk.20-40/bigha. They believe this made a difference in the yields. They waited, however, until the soil was dry and cracked. The command area for this irrigation was 50-60 bighas. Some farmers near the pump chose instead to irrigate from some nearby tanks.

This year the group will not wait for the ground to get so dry. At the time of the visit, monsoon rains had been a small fraction of average rainfall. The group had decided several days earlier to wait 10 more days for adequate rain before beginning pump irrigation.

Conflict management. This group had a successful experience negotiating agreements during the channel layout planning phase. They also dealt efficiently and democratically with a crisis caused by a 14-day pump shutdown. When it got repaired they held a meeting of all cultivators in the command area to decide who needed water the most. The decision took three hours, and involved everyone hiking out to see for themselves which plots were neediest. They got a unanimous decision.* One measure of the success of this conflict management was that no one stole water at night during this crisis. Honest men may have been kept honest by the team vigil of group members taking turns to keep watch with the operator.

Comments. As with the other site visits, this group cannot be taken as a measure of PROSHIKA's success. It is notable that the group shows initiative, and that PROSHIKA has aided and abetted this, without seeming to make the group feel dependent on PROSHIKA. They have confidence in their competence and clout as a group, they are also persistent, as illustrated by a story they told of unsuccessful attempts and unrelinquished hopes to get a road built to the village for oxcarts. At present all transportation is on foot, but landowners will not give up the land needed for a road.

PROSHIKA and BRAC both build on the notion that people who do not operate enough land to earn a subsistence can organize management services for tubewell command areas. In all cases I've read about the groups actually owned the tubewell; in no case did the group provide services for an individually-owned tubewell. The main benefits to this organizational strategy are that the landless and marginal farmers are interested in fully utilizing the tubewell in order to maximize the employment opportunities for wage labor. The group is accountable to the water users, whose accounts they want to keep, but it is also interested in keeping costs down because it must meet its obligations and not discourage farmers with high charges.

The weakness in this otherwise balanced set of incentives is the interdependence of proximate irrigation systems. There is no control over the site selection for new tubewells. Not only can a nearby tubewell compete for command area and interfere with the economic planning of a STW group, but an individual (well-off) farmer's option to get a STW of his own despite the nearness of a community-managed tubewell weakens the incentive of a farmer to participate in a group.

IRDP's Irrigation Management Program (IMP)

The IMP is the government's program (via the Integrated Rural Development Program) to improve water management and increase both command area and yields. The IMP is implemented through the thana level BRDB staff responsible for rural cooperatives. The program provides training to thana level officers (from BRDB, BADC, and DEA) at the Rural Development Academy in Bogra, who then provide training at thana offices for key farmers in village cooperatives (KSS's).

Thana Office visit. We visited a thana BRDB office near the Bogra Academy and spoke with a project officer who had received training at the Academy. He said that the IMP program began as weekly training sessions for KSS (village agriculture cooperative) chairmen and other members. During the boro season five or six men from each DTW (scheme manager, operator, and block leaders) are given orientation training for four

*Of course this is all as retold by the group leader. A unanimous decision is impressive. It would be interesting to know what other criteria were involved besides plot condition; for instance, if any members got two plots irrigated before another got water for one plot.

days. This TCCA/KSS office has administered the distribution of 25 DTWs, of which 20 operated during the last boro season, and 735 STWs, of which 730 were used.

The average DTW command area has increased by 45%, we were told, from 40 acres to 62.5 acres. Most of these DTWs were installed by 1975 and suffer the usual siting problems.

The IMP plan for irrigation roles calls for a DTW management committee to be formed as a sub-committee of the KSS. The management committee consists of a chairman, a manager (paid), and six block leaders. In addition, there is an operator and two water distributors.

The IMP program has been based on other programs such as CARE's DTI&C Program, but appears to lack the flexibility that is more characteristic of smaller programs. The specification of six block leaders--not four, not five--is indicative of a packaged approach that gives little leeway or guidance to field workers confronted with a situation where the package does not fit. Another indication of the top-down planning is the IMP manual which directs planners to approach farmers after the planners have designed a new canal layout--to sell the package to the farmers. Finally, the IMP program is directed towards the most prominent and easily reached farmers. Pump operators and farmers in leadership positions are given classroom training at thana headquarters. No attempt is made to assess or meet the needs of smaller farmers nor to ensure their access to information or full participation in pump groups.

Top-down approaches are not useless; there is certainly a need for institutional linkages to deploy nonlocal resources (DTW's, technological information) to local users groups, and to ensure some degree of compliance with a system of access rights so that groundwater, as a scarce public resource, is used to meet the needs of the greatest number of people (or for whatever policy goals have been established). The IMP program does not go far enough in these respects; rather, it seems designed to salvage problems caused by too little regulation of siting wells and nonadherence to original command area plans as outlined in applications for DTWs. Many DTWs were not sited as indicated. Perhaps a more effective strategy of increasing irrigated acreage is to re-site all the poorly sited tubewells; or better still, fill in the DTWs and offer several STWs in their stead.

IMP DTW visit. The DTW discharges about 1.7 cusecs and irrigates 72 acres, which will be increased to 80 acres. We spoke with the system manager, and directed a few questions to some of the other farmers including the operator. The scheme serves about 60 farmers, of which 37 belong to the KSS. This unit was bought with an IDA Loan of Tk.70,000, for which 18 KSS members had to mortgage land. I asked a few of the farmers present about the land they own and/or operate:

Manager - 1.2 acres

#2 - inside command area: .3 acres owned/operated and 2 bighas sharecropped using family and day labor.
- outside command area: 3 bighas owned/operated.

#3 - (one of the distributors) sharecrops 1 acre in command area, but father also owns 7 bighas.

#4 - (model farmer) inside command area: 10 bighas owned (7 self-operated, 3 sharecropped out); additional 1.5 acres outside command area.

Cropping pattern switched from aus, aman to boro, T. aman, wheat /potatoes/mustard.

Channel construction. Thana officers helped design layout, and farmers included in scheme constructed them.

Irrigation roles. This system has a manager, an operator, and three linemen (paid Tk.1200/boro season). When I asked why there were three linemen (distributors) instead of the recommended two, the answer was very long and evasive. (translator's impression) They finally said each lineman covers two blocks, works eight hours a day, six days a week. Each block requires two linemen.

Training. The answers to this were conditioned by the presence of the BRDB official; the farmers took the cue. Therefore, the only training received has been TCCA training, and no one had ever seen the DEM's Agricultural Extension Officer.

Water Distribution. The linemen distributed according to the directions of block leaders and managers.

Water Charges. Two rates were used. KSS members are charged Tk.950/acre, while nonmembers pay Tk.1000/acre. The high rates are charged to cover loan payments.

Conflict management. "No conflict."

Supplementary irrigation. A separate budget will be used for this. So far no supplementary irrigation has begun, but there is a plan to do so for aman if there is no rain.

Rangpur/Dinajpur Rehabilitation Service (RDRS)

The RDRS program for irrigation began in 1977 with LLPs and STWs, but this was phased out by 1981 with the bamboo well program which started in November 1980. At first RDRS worked with farmers having less than a maximum of three acres, but has since reduced that to those with less than two acres—extension workers tended to favor working with the farmers at the upper end of the scale, who were easier to reach, so RDRS shortened the scale.

RDRS worked with Sonali Bank (backed by the Bangladesh Bank) and subsidized the price of pumps. Repayments were fairly good. Deutz pumps were used. Most of these pumps were put into areas with richer farmers; RDRS pulled out of these areas in order to put their resources into areas with poorer farmers. As a consequence, followup and related activities were not done.

Some landless groups were involved in this early stage, people who took land in sharecropping, but these didn't work out, for reasons not made clear to us.

The bamboo well program has been their major effort in irrigation since late 1980. In areas with STWs farmers prefer using their own bamboo TW to buying water from STW owners.

Bamboo tubewells (BTW) are available to anyone who wants one, subject to supply; last year supply could not meet demand. Many BTWs are purchased by individual farmers with no programmatic involvement with RDRS. Other purchasers include Contact Farmers (CFs, something like model farmers, who work with extension officers) and Small Farmer Groups (SFG) who are programmatically involved with RDRS and must meet certain criteria in order to be so involved.

Groups typically consist of 5-9 members and carry out general extension activities, but clearly the chance to purchase a BTW is the first major benefit they perceive. The groups, once formed, must fulfill certain functions for a period of time (3-6 months) before they are officially "approved" and thus eligible for subsidized inputs from RDRS.

The BTWs have a lifetime of 3-5 years (the metal parts will last for 5-6 years). A recently developed simple chemical treatment may prolong the life of mature bamboo parts to which it is applied for up to ten years. A farmer who supplies his own bamboo can buy and install a well for Tk.250. RDRS controls the production of these BTWs in four shops in Rangpur, Lalmonirhat, Dinajpur, and Kushtia. They intend to continue to restrict production to their own shops by selling the pumps below cost as long as is necessary (1) to maintain the quality control required to get the BTW launched as a technology which is reliable, and (2) until farmers are familiar enough with it to recognize good quality manufacture from poor. This may be difficult to do as workshops can be set up by any entrepreneur with the means and some basic skills, and the quality of manufacture is not always clearly evident even after a pump has been installed; it may only be manifested in a shorter working life than rated. As yet no one has attempted to compete with RDRS BTW production (RDRS supplies materials to the four workshops, and has a hard time obtaining these). RDRS hopes to privatize production within a few years, but a still unresolved problem is the lack of demand for BTWs from March to November: no other means of employing the workers during these months has been identified.

RDRS has a total staff of 265 persons. Of these, 190 are extension workers. These extension workers are recruited locally but assigned to areas at least 20 miles away from their homes. They usually have high school certificates. Turnover is not too high, as jobs are scarce for this educational level, and salary increases are based on merit. RDRS weeds out about 15% of the less promising EWs each year. Most of the EWs are men; 5 or 6 women started six months ago, and four remain and work with women's groups. Each (male) EW used to work with about 40 contact persons but the typical load these days is 20-30 contact farmers and 2 or 3 SFGs. One EW is assigned per union; it was said that there are no feelings of competition with DEM officials (thana level Agr. Ext. Officers, Subject Matter Officers, etc.).

The extension workers work with each CF for three to four years. Some farmers have been dropped (not "graduated"); RDRS plans to "graduate" some groups and contact farmers, but has not yet done so.

Extension officers are selected from among applicants responding to advertisements; interviews were in progress for four positions during our stay in Rangpur. For these positions RDRS prefers to hire people with diplomas and 10-15 years experience at thana level. Agricultural university graduates typically have trouble finding satisfaction in these jobs. RDRS does not have close relations with the BADC office across the road, and does not anticipate developing these.

Field Office. Met with the Extension Officer, two extension workers, and one social worker for about half an hour. They elaborated on some of the information given by the main office in Rangpur. Extension workers received training at the DEM's Agr. Training Institute for 1½ months, which includes water management in the general training. RDRS pays ATI for this training, then gives the EWs additional training in group management and treadle pump technology.

We also learned that farmers rent out their pumps; the rate is Tk.20 for one irrigation of 1 dhon (local unit which equals .37 acre). The wellhead and pumping apparatus can be moved around to different wells, which cost about Tk.50 to sink.

SFGs often own a bit of land; total acreage for the group can be as much as 10 or more acres, and they may require as many as seven pumps to irrigate this.

Private farmer. On the way to visit a SFG, accompanied by the EO and an EW, we stopped when we saw two men operating a treadle pump not far from the road. They turned out to be permanent wage laborers for one of the shopkeepers along the road, who owned the dhon (27 decimals) that they were irrigating for land preparation, as well as about seven more dhon across the path. This farmer also rented about three acres from the Air Force, which owned a lot of land (1000 + acres) nearby and rented it out to farmers for Tk.50 per acre, a nominal sum in an area where one dhon sells for Tk.6000. The treadle pump was located at the level of the path, which was a couple of feet higher than the field, therefore it was drawing water up 2 feet higher than necessary. It turns out that the owner doesn't do any of the labor involved in cultivation other than to manage the process. His two employees and his son do the work while he spends his time at the shop. The workers are paid the going rate: per day, Tk.5 plus one sheer of rice (1 sheer costs Tk.6-7).

The BTW is 34 feet deep, cost about 420 Tk. to buy (including bamboo) and install, and irrigates the dhon in about 8 hours. The farmer has changed his cropping pattern from traditional varieties (4 mds of aus and 5-6 mds. of aman on these 27 decimals) to potatoes (got 22 mds. this year using a variety which has produced up to 32 mds./dhon) and T. aman.

The Air Force has installed 7 DTWs on its land, used by 500 farmers. The farmer hopes to be included in the command area in the future, but the Air Force is the DTW committee and makes these decisions. It would have been interesting to find out what alternatives he could see if he was unable to get irrigation from the DTW.

Also in this thana there are 43 other DTWs (for a total of 50), 200 STWs and 2000 treadle pumps.

Small Farmer Group. Seven members, all from same para, formed this group when leader was approached by RDRS EW and asked to form a group. He picked close friends. All seem to own a little land. The group began six months ago and received RDRS approval (hence eligibility for subsidized inputs) last month. The group also has a cashier who can write and keeps the books. Group activities have included experimenting with vegetables, maize and sweet potatoes, and summer pulses, and they have managed to save 2 Tk. each per week with which they plan to buy a treadle pump. One of the group members already owns one, but this is not seen as a problem for future distribution of

investment benefits. In addition, the group has rented 20 decimals from a rich farmer which they are cultivating as a group and the income from which they will deposit into group funds. The leader said it was not possible to get everyone to do an equal share of the work, but that this was not a problem.

Examples of land ownership/operation: Leader owns .95 acre, and sharecrops nothing. Member #2 owns 1.2 acre, s/c .27 acre. Member #3 owns 1.08 acre, s/c .80 acre. Sharecropping arrangements are 50/50, with all inputs provided by s/c. Members all work as day laborers for additional income. Fifty percent of the village households have less than two acres, and an additional 30% have no land. When we asked if other people had wanted to join the group, the leader said that other people didn't understand the benefits immediately, but will want to form similar groups when the benefits have been demonstrated. Evidently participation in groups is a costly activity for the poor in this village.

In the meantime, the SFG plans to purchase a treadle pump and cultivate HYV next year. The main benefits perceived by the leader so far are (1) the changes in cropping pattern introduced by the EW, (2) the compost training, and (3) the management training. (Hammond noted later that no one seemed to perceive group cohesion as a means of achieving goals to be a benefit). The most difficult part of the group activities so far is to work the group land. The next most difficult aspect is depositing 2 taka each week.

There are "rich" farmers in the area (there was a bit of dicussion when we asked how much land the largest owner has; eventually they came forth with an aproximate figure of 200 bighas), but the group has not had any problems with them, and anticipates none. Group members do day labor for the big one. Members last saw the local DEM agricultural extension worker three months ago.

Grameen Bank Project

This project is a strategy for providing collateral-less loans to landless individuals by bringing the banks to them. GBP recruits individuals for branch offices of the regular commercial banks. These people become bank employees with the responsibility of making contact with poor people and providing information and encouragement to participate.

The poor (marginal and landless farmers) must form a group of five people (no more, no less) who meet once a week and deposit at least 1 Taka each in the name of the group in the commercial bank employing the GBP bank worker. One member is designated as chairman and another as secretary.

Loans are available to individuals in groups on a quota basis. Only two can get loans at first, and the choice of which two is left up to the group. After they receive a loan (Tk.500-5000), repayment begins the following week. The repayment period is one year. After 4-6 weeks, if payments have been made regularly, two more members can get loans. If they also repay regularly, the fifth member becomes eligible. Group pressure is the main mechanism to ensure repayment. Recovery rate has been 99% (World Bank 1983: Table 12, Annex 1).

The groups of five can combine into large groups to pool their individual loans for large projects such as purchasing a STW or even a DTW. Last year 34 STW groups and one DTW group were in business, with six other DTW groups ready to operate next year.

REFERENCES

Abedin, Zainul
1982 A Study on Proshika Process of Mobilization for Development. Comilla: BARD.

Biggs, Stephen D., Chris Edwards, and Jon Griffiths
1978 Irrigation in Bangladesh. Discussion Paper No. 126. Institute of Development Studies, University of Sussex.

de Vylder, Stefan
1982 Agriculture in Chains. London: Zed Press.

de Vylder, Stefan, and Daniel Asplund
1979 Contradictions and Distortions in a Rural Economy: The Case of Bangladesh. Swedish International Development Authority.

Hamid, Mohammad Abdul et al.
1978 Irrigation Technologies in Bangladesh. Rajshahi, Bangladesh: Rajshahi University, Department of Economics.

Hanratty, Martin
1983 Minor Irrigation Development in Bangladesh. USAID /Bangladesh.

Howes, Mick
1981 The Creation and Appropriation of Value in Irrigated Agriculture: A Comparison of the DTW and the HP in Rural Bangladesh. Comilla: CIRDAP.

Howes, Mick
n.d. The Social Organization of DTW Irrigation in Bangladesh: A Case Study. Mimeo.

Institute of Development Studies
1980 Who Gets a Last Rural Resource? The Potential and Challenge of Lift Irrigation for the Rural Poor. ODI Network Paper 1/80/4.

Johnston, Bruce F., and William C. Clark
1982 Redesigning Rural Development. Baltimore: Johns Hopkins.

Khan, H. R.
1982 Study of Water Sector in Bangladesh. Vol. 1: Water Resource Development. Dacca: UNDP.

Korten, David C.
1980 Community Organization and Rural Development: A Learning Process Approach. Public Administration Review, (Sept./Oct.):480-511.

Small, Leslie E.
1983 Economic Aspects of Minor Pump Irrigation in Bangladesh. WMS Consultancy Report, USAID/Dhaka.

Stroberg, Per-Arne
1977 Water and Development: Organizational Aspects on a Tubewell Irrigation Project in Bangladesh. Dhaka: SIDA.

Water Management Synthesis Project
1983 Diagnostic Analysis of Five Deep Tubewell Irrigation Systems in Joydebpur, Bangladesh. Fort Collins: Water Management Synethsis Project, Colorado State Suniversity. WMS Report No. 15.

Wood, Geoffrey
1982 The Socialization of Minor Irrigation in Bangladesh. Dhaka: PROSHIKA.

World Bank
1983a Bangladesh: Recent Economic Trends and Medium-Term Development Issues. Report No. 4277-BD. Washington, DC: The World Bank.

1983b Bangladesh: Selected Issues in Rural Employment. Report No. 4292-BD. Washington, DC: The World Bank.

USAID
1981 Bangladesh/USAID: Irrigation Development Options and Investment Strategies for the 1980s. Water Management Synthesis Project, Report No. 3. Logan, Utah: Utah State University.

1976 Bangladesh: Small Scale Irrigation, I: Project Paper.