A.I.D. Project Impact Evaluation Report No. 42

Bangladesh Small-Scale Irrigation

April 1983

U.S. Agency for International Development (AID)

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BANGLADESH SMALL-SCALE IRRIGATION

A.I.D. Project Impact Evaluation No. 42

by

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FOREWORD

In October 1979, the Administrator of the Agency for International Development initiated an Agency-wide expost evaluation system focusing on the impact of AID-funded projects. These impact evaluations are concentrated in particular substantive areas as determined by A.I.D.'s most senior executives. The evaluations are to be performed largely by Agency personnel and result in a series of studies which, by virtue of their comparability in scope, will ensure cumulative findings of use to the Agency and the larger development community. This study of the impact of A.I.D. Bangladesh Small-Scale Irrigation was conducted in February 1982 as part of this effort. A final evaluation report will summarize and analyze the results of all the studies in this sector, and relate them to program, policy and design requirements.

SUMMARY

This project is an example of appropriate technology constrained by institutional weaknesses. In 1976, AID entered into an agreement with the Bangladesh Government to provide hand tubewells (HTW) to farmers with small land holdings throughout Bangladesh. The Bangladesh Krishi Bank (BKB) and the Government's Integrated Rural Development Program were to handle distribution through credit and cash sales. A joint Bangladesh-AID Implementation Committee was to provide overall project direction.

The project attempted to take advantage of a technology already widely accepted in Bangladesh and adopted to its particular climatic and geologic conditions. The HTW is simple to install and maintain, and makes use of the cheap labor available in the countryside. Most important, the HTW is inexpensive and, with credit available, would be affordable by the target population--farmers who own less than three acres.

Institutional weaknesses plagued the project from the beginning. The initial project design did not adequately address some very important problems. These included the importation of iron for manufacturing the pump in Bangladesh, the exact design of the pump. the production of the pump by local foundries and the distribution system--particularly the credit system which was to ensure distribution to the poorer farmers. As will be seen, most of these problems have been worked out, but only after significant project delays.

HTWs in use appear to more than pay for themselves in a very short time. They permit the farmer to irrigate a third, dry season, crop that would not have been planted but for the availability of the water pump supplies. Bangladesh is particularly suited to the use of these pumps. It has an extremely high water table and the land will support a third crop in the late winter months if water can be provided.

Most distribution problems have been worked out satisfactorily. The Bangladesh Agricultural Development Corporation, now the project's primary implementing agency, (BADC) has established a network of zonal and subzonal stores which sell the HTWs to dealers who in turn sell them to farmers. Problems with the sale and distribution system chiefly concern the lack of spare parts and the inadequacies of the credit system.

Although some questions have been raised about pump design and production, they are not significant. It has been argued

that other designs would be preferable. While these arguments have some merit, they do not detract from the fact that some 180,000 SSIP pumps are in use. Most HTWs are used primarily for agriculture during that part of the year when the third crop is growing. The rest of the year, they may be stored or used for domestic purposes.

The Small Scale Irrigation Project (SSIP) was designed to distribute HTWs to farmers who owned three acres or less. To ensure that the target group was reached, a paperwork system of certifications and documentation was created. The paperwork proved to be a hindrance to distribution and did not achieve its purpose of limiting credit or cash sales to the smallest land holder. More than just a paperwork problem, institutional inadequacies with the farmer credit system (along with farmer biases against using that system if it required, as it did, his land as collateral) made the primary beneficiary those farmers who owned three to seven acres. Although poor by most standards, these farmers are at the higher end of the landholding scale in Bangladesh. An interesting side effect of the project is the recent development of a market for second-hand HTWs. Sold at a lower price, these used pumps are gradually making their way down to the poorest farmers.

An obvious result of the project has been increased farmer income. A third food crop is being planted by owners of HTWs. In a country so severely overpopulated as Bangladesh, this is a significant achievement. It is not known with any certainty just how much additional food is produced but the additional source of nutrition cannot be discounted. In addition, to a limited extent farmers are producing a "cash" crop in their third season. While it is too early to say how extensive this trend will be, it was clear to the team that the farmer was willing to modify his cropping pattern in some cases to take advantage of high prices for certain cash crops.

There are side benefits of HTW ownership which were not anticipated in the original design of the project, but which, nevertheless, must be viewed as positive results. Cheif among these is the large amount of potable water produced by the pumps. The use of this water results in a decrease in dysentery and stomach ailments. Finally, we should note that women are working in the fields, for the first time, operating hand pumps. Whether this is a positive good remains to be seen.

PROJECT DATA SHEET

1. Country:

   Bangladesh

2. Project title and dates:

   Small Scale Irrigation I 388-0019 1976-1981

3. Project funding:

U. S. Loan funds:	$14,000,000
Host Country	$ 8,000,000*

*equivalent for farmer credit and to manufacture hand pumps.

Scope: to produce hand pump sets for sale to 200,000 (later reduced to 160,000) small farmers. The pumps are to be sold through a net work of dealers set up through the Bangladesh Agriculture Development Corporation (BADC) throughout the country. Credit is to be provided by the Bangladesh Krishi Bank (BKB).

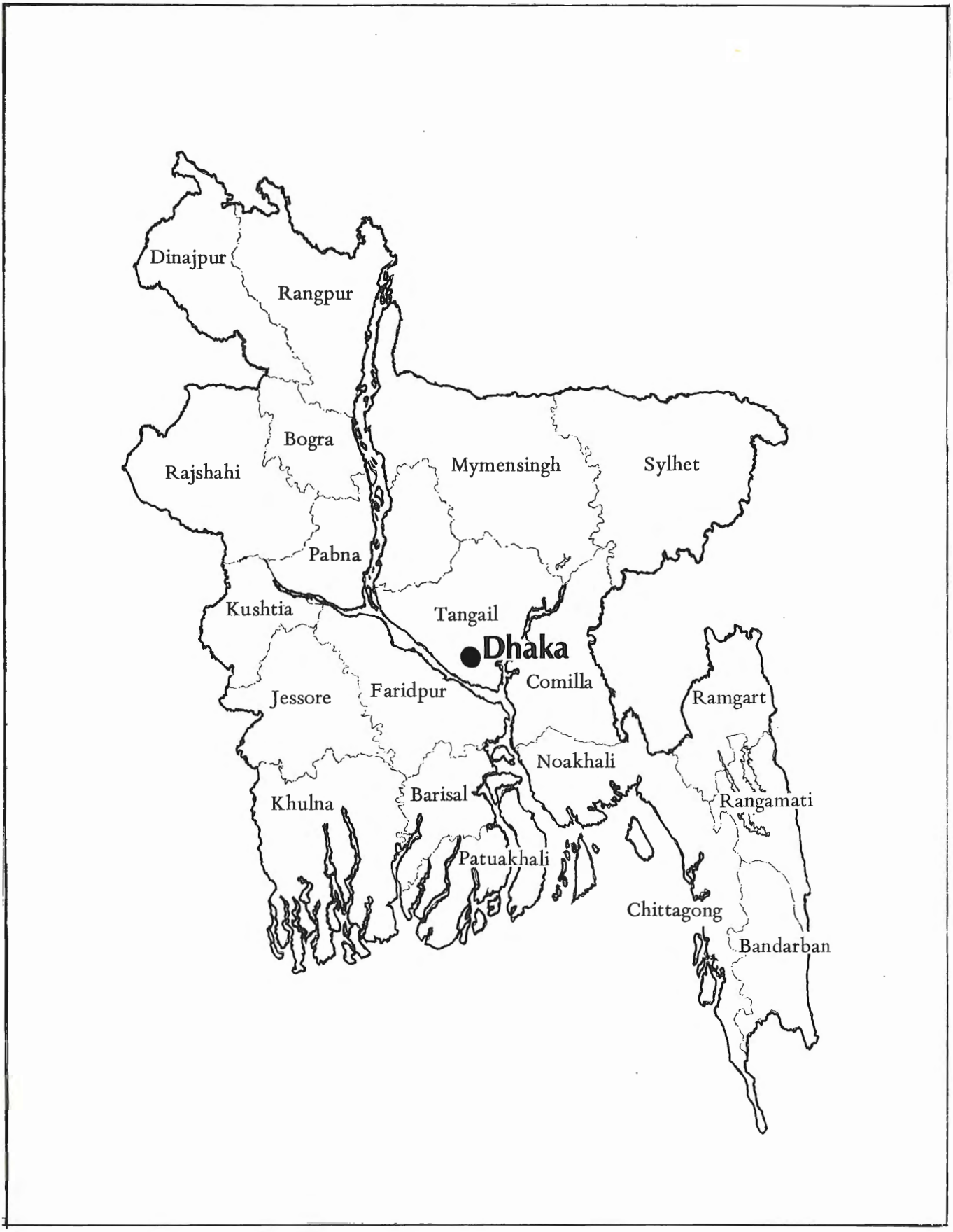
GLOSSARY

A&W	Amman and Whitney Consulting Engineers
BADC	Bangladesh Agricultural Development Corporation
BKB	Bangladesh Krishi Bank (Krishi means farmer)
CRWRC	Christian Reformed World Relief Committee (U.S. Christian Reformed Church, PVO)
DTW	Deep Tubewell
HTW	Handpump Tubewell
HYV	High Yielding Varieties (refers to hybrid rice)
IRDP	Integrated Rural Development Project
KSS	Krishak Samabai Samiti -(local level farmer) This is a cooperative.
MOSTI	Manually Operated Shallow Tubewell for Irrigation (UNICEF-funded project)
RDRS	Rangpur - Dinajpur Rehabilitation Service (Lutheran World Federation, PVO)
SSIP	Small Scale Irrigation Project (AID-funded project)
STW	Shallow Tubewell
TCCA	Thana Cooperative Community Agencies
Thana	Local government unit of approximately 200,000 people. This is the smallest political unit.

GLOSSARY (con't)

Aus	monsoon season rice, corresponds to April - July
Aman	second season rice. Broadcast aman is planted in May and harvested in November/December. Transplanted aman is planted in July and harvested in October.
Boro	dry season rice, the only rice crop requiring irrigation. Generally planted in December and harvested prior to the monsoon season in April/May.
1 decimal=	.01 acre
1 bigha =	1/3 acre
1 Takka =	$.05 U.S.
1 Maund =	88 pounds

Bangladesh


Dinajpur
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Kushtia
Tangail
Dhaka
Comilla
Jessore
Faridpur
Ramgart
Noakhali
Khulna
Barisal
Rangamati
Patuakhali
Chittagong
Bandarban

CHAPTER ONE

OVERVIEW

Driving through the countryside in Bangladesh in March was a shock for at least one member of the evaluation team. He had grown up on a farm in Wisconsin. He remembered with nostalgia the vast expanse of flat fields of wheat and corn stretching as far as the eye could see. Looking out over the Bangladeshi terrain, he did not see an unfamiliar sight. On the contrary, it looked just like Wisconsin, except for one thing: every fifteen or twenty feet a small ridge of packed dirt could be seen dividing one farmer's "bigha" from the next farmer's "bigha". Otherwise it was exactly the same -- a vast, flat expanse of green extending as far as one could see.

The even more astonishing thing however was that this expanse of green was there in midwinter. This is the end of the "dry season" in Bangladesh. And yet acre after acre of land was producing a crop.

One reason for this winter production is the hand tubewell (HTW) the distribution and use of which we had come to evaluate. In September of 1976, AID and the Government of Bangladesh (BDG) entered into a loan agreement to finance the Small Scale Irrigation Project (SSIP). The project purpose was to provide small farmers with handpumps to be used for irrigation. The project paper does not define the term "small farmers." In the context of Bangladesh, however, a farmer owning more than three acres of land would be considered quite well off. The project attempted to restrict distribution to farmers holding less than three acres.

Three fairly unusual circumstances combined to make this an attractive project. First, Bangladesh is blessed with with an abundance of readily accessible groundwater. Acquifers throughout most of Bangladesh make the use of the handpump a technically workable method for irrigation. Second, landholding is characterized by extreme parcelization. Farmers typically own two or three acres of land divided into non-continguous parcels called "bighas". This pattern has been brought about the Muslim law of inheritance which provides for the distribution of inherited property among wives, sons and daughters. However, arable land is intensively farmed in all but the dry winter season. This means that one of the few remaining ways to increase food production in Bangladesh is through irrigation during the dry season. Third, use of handpumps by small farmers for irrigation is not new. Farmers in some areas of Bangladesh have been using handpumps for two decades. The project intended to capitalize on the fact that handpump technology was already accepted by many farmers for irrigation.

The project paper identified three primary constraints to the spread of handpump use for irrigation:

- unavailability on a broad scale of short-term credit tailored to the needs of the small farmers;
- inadequate supply of raw materials sufficient to meet the anticipated increased demand for handpumps.
- inadequate publicity concerning the availability and productivity of handpumps.

As designed, the project would make three basic interventions to address these constraints. First, a special small farmer credit program for the purchase of handpumps, to be undertaken by the government's agricultural development bank, the Bangladesh Krishi Bank (BKB), and the government's Integrated Rural Development Program (IRDP), would be established. Among other things, the credit program would minimize the requirements for collateral, and adjust interest rates to facilitate the participation of the small farmer in the program. Through this program it was expected that approximately 120,000 pumps would be sold on a credit basis. AID would finance the foreign exchange and local currency costs of each pump and, in addition, for each such pump sold, AID would also finance the foreign exchange costs of an additional pump, to be sold on a credit or cash basis. Second, AID's foreign exchange financing would be used to import raw materials, thus addressing the supply problem. Finally, the project contemplated a massive promotional effort involving all appropriate media to publicize the credit program, the availability of pumps, and the advantages of using handpumps for irrigation. Responsibility for overall project direction and coordination was lodged in a Project Implementation Committee comprised of representatives of all interested government agencies and AID.

Irrigating bananas with an SSIP hand tubewell.

The project ran into serious implementation problems at the outset. The Project Implementation Committee failed to perform and, in late 1977-1978, the project was radically restructured. The Bangladesh Agricultural Development Corporation (BADC) became the lead agency for all aspects of the project including procurement of raw materials, manufacturing and distribution of handpumps. Sales during the 1978-79 season were not as good as hoped because of problems regarding the import of raw materials and the failure of manufacturers to meet their obligations. It was not until the 1980-81 season that significant sales were recorded. By this time BADC had established a network of regional warehouses and licensed dealerships throughout the country to sell the handpumps on a cash basis. Rather than supplementing the credit program, the BADC cash sale dealerships became the primary means of distribution of handpumps. IRDP has not been an active participant in the credit program and BKB's efforts have until very recently fallen far short of expectations.

Throughout, BADC has received technical assistance from a private firm financed by AID under the project.

In sum, the project has had effective sales only for the 1980-81 seasons. Sales, for the most part limited to the winter or dry season, were continuing at the time the project evaluation team arrived in Bangladesh and, by the end of February 1982, had reached a total level of approximately 104,000. It is anticipated that by the time project financed sales have been completed, 160,000 handpumps will have been sold. For the most part, these sales would be on a cash basis through BADC licensed dealerships. It is felt that credit sales through the BKB probably will remain disappointing compared to original expectations.

Since the project is on-going and has reached the point of effective implementation in only the past two years, the team was somewhat constrained in its ability to evaluate the project's impact. Most pumps are being used this dry season (December-February) for the first time. However, the team was fortunate to be able to use two preliminary evaluations of the project prepared at the request of the AID Mission. The first, An Evaluation of the USAID/BADC Small Scale Irrigation Project in Bangladesh by Stefan C. Christopher (the "Christopher Report"), analyzes findings from a sample survey of four hundred purchasers of project handpumps. The second, an in-house study prepared by Nizam U. Ahmed (the "Nizam Report"),

analyzes survey responses from 87 project handpump dealers, representing approximately 25 percent of total active dealerships. A third report evaluating a previous UNICEF project was also reviewed.1/

In the short time available to it, the team could not undertake a similarly extensive survey. Instead, this report attempts to synthesize the findings of these evaluations with impressions the team has gained from a review of project files, interviews with project personnel, and three field trips in Bangladesh which included interviews with local project staff, dealers and farmers.

1/ "Manually Operated Shallow Tubewell for Irrigation in Bangladesh," Institute of Business Administration, University of Dacca, March 1980 (prepared for UNICEF).

CHAPTER TWO

PROJECT FINDINGS AND ANALYSIS

A. Techincal Considerations

Hydrology

Due to the nature of the topography and underlying acquifers, tubewells equipped with shallow well handpumps are found extensively in Bangladesh. Broad areas of the country are flat alluvial floodplains. Semi-confined aquifers underlie much of the country at a depth of less than 80 feet. Tubewells sunk into these aquifers generally result in water levels within 20 feet of the surface (see map end of this chapter). Since the lift of a shallow well pump is roughly 22 feet, this type of pump has wide application in Bangladesh.

A detailed hydrological study has concluded that roughly two thirds of the country can be supplied with good quality water from shallow well pumps. Recharge to aquifers is substantial, occurring during the monsoon rains. Estimates have been made that most of the north has the potential of annual recharge on the order of 20 feet.2/ This means that an aquifer that has been drawn down 20 feet during the irrigation season should recharge to its original level during the monsoon rains. This translates into roughly two feet of water available in aquifer storage annually, more than enough to irrigate most crops during the irrigation season. Shallow well pumps are thus particularly suited to hydrological conditions in Bangladesh since they are self limiting, i.e., they are incapable of drawing down aquifers more than than the annual recharge rate.

Deep Tubewell (DTW)

The DTW for irrigation purposes similar to that used worldwide, consists of a drilled borehole equipped with a submersed pump powered by a diesel engine or electric motor. Various DTW schemes have been implemented in Bangladesh with generally the government retaining control of the DTW and responsible for its operation and maintenance. Typical problems have been encountered with inadequate maintenance, less than optimum command area and inequitable water distribution. CARE has a project operating in five thanas to improve performance from DTW schemes. Certain areas of the country have been excluded from DTW schemes due to likely dileterious effects to other groundwater users. Implementation of this policy is likely to be difficult.

2/ Tubewell Project North Bangladesh Vol 1, MacDonald and Partners, Cambridge, March 1980.

Shallow Tube Wells (STW)

A recent innovation in irrigation is the low cost STW, consisting of a locally made centrifugal pump located at ground level coupled to a small diesel engine or electric motor. A small unit capable of discharging 200 to 400 gallons per minute is sold by BADC on credit for 13,000 Tk ($650). Larger models are sold for an installed price of 30,000 Tk ($1500) capable of irrigating a command area of 20 acres, though more commonly averaging seven acres.3/ The team found these pumps in use throughout the areas visited with many water distribution arrangements extant. Typically a large farmer or investor would make the original purchase and offer water to his neighbors on shares ranging from 25 percent to 33 percent of the crop yield. The STW has the advantage of being portable (the small unit can be transported by rickshaw) so that it can be removed from the field during the non-irrigation season for security reasons. Though problems may exist with operation of units under dusty conditions, routine maintenance and repairs can be performed by local mechanics. The STW is an attractive technology for many reasons, not the least of which is that the command area is relatively small and thus requires minimal organization of users. Similar to the DTW, however, the primary beneficiaries of this technology are the larger farmers.

Manually Operated Pumps

Manually operated pumps for irrigation have a long history in Bangladesh, some farmers having used them for up to 25 years. Additionally, there are traditional water lifting devices still in use in parts of the country. These include (i) dipping bucket types where a counterbalanced bucket is lowered into a hand dug well and (ii) dhones, counterbalanced canoe shaped logs which are dipped into a surface water source. The most common pump is the shallow well handpump which has been used extensively for village water supply and promoted first by UNICEF for irrigation (the MOSTI pump) and later in a slightly modified form by the AID financed SSIP project. Other recent introductions are the treadle or jogger pump, the rower pump and the diaphram pump.

3/ Amman and Whitney, "Evaluation of Irrigation Pumps in Use in Bangladesh," August 31, 1981 (Mimeo).

The SSIP pump is of robust cast iron construction with all major parts made in country. According to the consultant's studies the pump is expected to have a usable life of from eight to fifteen years. Local foundries have been able to produce pumps at a reasonable price to the required specifications. A rigorous inspection program has resulted in pumps which are acceptable to dealers and farmers. Very few complaints were voiced regarding the SSIP pump. In addition to the pump head itself, the package sold to the farmer includes from two to four lengths (40 to 80 feet) of 1 -1/2" galvanized pipe and one or two sections of strainer. The strainers are locally fabricated and consist of perforated pipe wrapped with brass screening.

Replacement of brass screen can be performed by local experts. Sinking wells using the sludger method is a well known craft and many farmers remove and resink their own HTWs after initially being shown how by a mechanic. Commonly replaced spare parts for the pump (flap valve, buckets, nuts, etc.) are available in the local market and some parts can be repaired by welding. The project has not included funds for spare parts and to date the local market is not providing spares such as handles, head covers and base plates. Some dealers indicated a growing need for these items and it is uncertain whether the local market will provide them in a timely manner due to the continuing shortage of basic raw materials for producing cast iron.

A major advantage of the SSIP pump is cost. The pump head is being produced for roughly 500 TK ($25) and a typical package retails for 1300 Tk ($65) not including a subsidy estimated at 280 Tk. We discovered that most farmers to whom we spoke felt they were able, at this price, to recapitalize the cost of the unit after only one irrigation season with practically any crop to which they applied it. Other pumpsets were formerly available on the market but sales have been reduced to nil because of the subsidized price of the pump.

Two disadvantages of the pump are its low yield (8 gallons per minute) and hence small command area (1/4 - 1 acre) and the basic design of the pump. Pumping is too easy at shallow depths and too difficult at deep depths. Instances of a single operator pumping 2 HTWs in tandem were observed in some areas. In other areas where the water table is deeper pumping is strenuous labor. The operator is constantly bent over and must apply pressure on both the downstroke and upstroke. A better designed pump would make use of stronger lower body muscles such as those used in pedaling a bicycle.

Several new manual pump designs have recently been introduced in Bangladesh. The treadle or jogger pump is foot operated and consists of two pistons at ground level. Pumping is performed by the operator alternatively shifting his weight from one bamboo rod to the other. The pump is fabricated from sheet steel and locally available materials for 150 Tk ($7.50). The farmer provides installation and bamboo superstructure. Over 2000 units have been sold and a second workshop has recently been opened. The discharge of the pump is roughly 25 gallons per minute with a shallow water table and the command area of this pump is up to two acres. A problem with the pump is operator fatigue. It was reported that an operator tires after one to two hours of labor. Problems are also encountered when the superstructure is not constructed to plans.

The rower pump is a simple pump consisting of a PVC cylinder and plunger. The operator pulls up on the plunger to lift water. This pump is still in the development stage and problems exist with durability under continuous use and user fatigue. The diaphram pump is another foot operated pump. Efforts to obtain a suitable long life diaphram material has so far stymied development of this pump.

The Farmer's Perspective

From a purely energy budget perspective the SSIP handpump could most likely be shown inferior to mechanized water lifting devices and probably other types of handpumps in terms of work input per unit of water pumped. However, this calculation is not particularly relevant to the small farmer, his main constraints are capital, land and social restrictions not labor. An investment in a mechanized pump may not be feasible due to lack of capital or credit. Alternatively, operation and maintenance costs through the season may be prohibitive. Land holdings and plot size may be so small that mechanized means are not practical; relations with neighbors or social customs may work against establishing water user associations to capture economies of scale of larger mechanized units.

What the team has found is that the SSIP handpump has a niche in the overall irrtigation picture in Bangladesh. The conditions for this acceptance may change with time, for example, shallow tube wells appear to be displacing handpumps in certain areas. Still, for a farmer with limited capital, a small holding, a shallow water table and no access to a STW or DTW the HTW appears to be a logical purchase. The team found instances of a demonstration effect (one user influencing acceptance by others) just starting to take effect. Expanded availability of credit and relaxed procedures for obtaining credit from some banks are having an effect on sales in the last few months. The small farmer has available a pool of landless laborers to draw on for pumping. The team found examples of farmers paying hired labor and providing other inputs while still earning a profit that capitalized the HTW. The SSIP HTW has had wide user acceptance and sales continue to expand.

Irrigating chili with an SSIP Hand Tubewell.

B. Distribution and Credit

Handpumps may be purchased on either a credit or cash basis. A distribution network has been established by BADC to ensure the availability of pumps to dealers. This distribution system includes seven regional supply warehouses (zonal stores) supervised by BADC assistant engineers, twenty-four sub-zonal warehouses, 354 BADC licensed dealerships for cash sales, BKB dealerships, and IRDP cooperative stores which sell pumps for cash or credit.

BADC advertises in local newspapers for interested individuals who want to become dealers. The prospective dealer, who is usually either selling other kinds of pumps or is in a related business, applies to the zonal store which forwards the application to the project's offices in Dacca. If approved, the prospective dealer will pay a non-refundable registration fee and enter into a memorandum of agreement with the BADC. Among the undertakings agreed to by the dealer is his agreement to sell project handpumps only to farmers from a specified area and at the price established by BADC. BKB dealerships are established in almost the same manner except that application is made to the local BKB branch manager who may license the dealer

The network has been established over the last two or three years of the project and has gradually evolved to take into account perceived deficiencies in the distribution system. The primary failing seems to be a relative inability to distribute pumps very far from village or commercial centers. The reasons for this stem both from the location of zonal warehouses and pricing limitations placed on the sale of the pumps.

HTW irrigated chili and spice. To the left of the HTW is a shelter for the operator/ quard.

A standard pump set may be sold by a dealer for no more than Tk. 1100 ($55). This includes Tk. 1000 for the pump set itself and Tk. 100 for the dealer's transportation costs from the zonal store to his dealership and his profit. If there were no transportation costs to the dealer he could earn Tk. 100 on each unit sold at the maximum retail price. In fact, transportation costs can make a substantial dent into potential dealer profits. Such costs may reach as high as Tk. 45 per standard pump set. Thus, a dealer may have to charge as much as Tk. 1045 to break even not counting overhead costs. At the same time, the dealer is faced with competition from other dealers selling pump sets, either project handpumps or other comparable pumps. The team found several dealers in Bogra selling pumps at Tk. 1030, and one for as low as Tk. 1020. This means that the Bogra dealer's profit, without regard to any other expenses he may have, will be Tk. 25 or Tk. 15 in the case of the lowest price dealer, taking into account a minimum of Tk. 5 for Transportation costs. The result of this fixed pricing system is to limit the geographic area serviced by dealerships. Dealerships will tend to be located within relatively easy access to zonal stores in order to minimize transportation costs. Similarly, farmers, who must pay the transport cost from the dealership to place of installation, will more likely be located nearer the zonal store. In short the greater the distance from the zonal stores the fewer the dealerships and the fewer the number of small farmers participating in the program. The team heard frequent criticism that sales were not getting into the rural villages. In fact, 60 percent of the BADC sales done in the entire Bogra ditrict were made by only 16 dealers located in Bogra town.

BADC has also become aware of this problem and, in November 1981, directed the establishment of sub-zonal stores. BADC has authorized twenty-four of its stores which warehouse shallow tubewells to serve also as outlets for handpumps. At the time of this report only one such sub-zonal store was in operation. In this case the assistant engineer in charge had bought 200 handpump sets and was selling them, as a retailer, to a regional development board. (It is questionable whether BADC should permit its project managers to also become dealers in pumps. The potential conflicts of interest are obvious. For his part, the assistant engineer told the team that he did not believe that he had the authority to supply pumps to dealers!) If pumps will continue to be supplied through BADC warehouses, BADC will have to be more aggressive in expanding its warehouse network if it expects to reach farmers located relatively far from warehouses or town centers. This may require hiring additional personnel to manage handpump distribution at the sub-zonal level and providing more effective orientation to the program than was evidenced in the team's contact with the manager of the only sub-zonal store presently in operation. In this regard assistant engineers at the zonal level have noted

that the BADC shallow tubewell people (proposed sub-zonal store managers) do not want the added responsibility and headaches of managing a hand tubewell program as well. This seems apparent given the slow pace of establishing sub-zonal outlets.

Failure to move sales in the countryside may have another unintended effect. We believe that purchasers of pumps who live closest to towns or market centers will more likely use their pumps for a dual purpose - for irrigation and drinking water. Those further away will likely use their pumps primarily for irrigation. Casual observation seems to indicate this, but more detailed survey information would be required to confirm the conclusion.

The dealership system has a few other major difficulties. When initially begun in 1980, prospective dealers were required to get their Member of Parliament's recommendation. This often proved difficult and was viewed as an unnecessary constraint to expanding the number of dealers. Gradually, BADC has relaxed this and most other requirements so that it is now fairly simple to become a handpump dealer. BADC might consider the feasibility of permitting zonal stores to license dealers rather than requiring approval by the project manager in Dacca as is presently the case. While the time between application and issuance of a license (approximately six weeks) is not viewed as a significant constraint, nonethless it seems an unnecessary practice which can be readily eliminated.

Finally, many of the dealers complained that they were limited by their agreement with BADC to particular regions in which they could make sales. For example, dealerships located next door to one another in Jessore each had different sales territory. The sales territory of one of these dealers included the entire territory of his neighbor. Dealers argued that they should be allowed to sell to a customer no matter where he was from. And, in fact, they often violate their agreement with BADC to do just that. The establishment of these sales territories has little purpose and may serve to discourage others from becoming dealers. A system in which the dealers feel compelled to violate their basic agreement with BADC in order to make sales will not have the respect of dealers and of the farmers who are supposed to be its beneficiaries.

The primary hope of getting handpumps to small farmers was through the agricultural credit program. In a country where the annual per capita income is approximately $100, it was recognized that small farmers would be unable to afford to make a cash payment of Tk. 1100 for a handpump. Therefore, as initially designed the project placed primary emphasis on a credit program to reach the target beneficiaries. As will be seen this approach has fallen far short of the original plan.

At present, the cash sales program through BADC dealers is the primary means of distribution. Apart from indicating that the purchasers--now mostly cash buyers--may not be the intended target group, the implementation of the project has pointed up inadequacies in the country's agricultural credit system that limits its ability to service the small farmer.

A farmer wanting to buy a pump on credit must first be aware that credit facilities are available. For the most part this proved not to be a problem. Theoretically, the farmer travels to a bank to pick up the required loan application forms. These forms include a certification that the borrower is a farmer, owns less than three acres of land, will use the pump for irrigation only, and will not sell the handpump for three years after purchase. The farmer must take this certification and a completed loan application form to an official within his locality (thana) for endorsement. These documents, together with evidence of title to his land, must be returned to the bank for processing. Security for the loan is a combination of a portion of the farmer's land and either the pump itself or the farmer's crop. In every case, however, land forms a part of the collateral. This is usually one-quarter acre for each handpump; market value approximately Tk. 10,000 as collateral on a Tk. 1100 loan. After all pertinent documents are executed and the bank has finished its internal review, the bank arranges with a local dealer to provide a pump to the borrower upon presentation of a supply order issued by the bank to the farmer. The system as described has many problems which have combined to limit the availability of credit to small farmers.

In many instances the team found that BKB branch managers were not aware of current policies regarding treatment of handpump loans and if they were, often chose to apply stricter than necessary requirements. The inability of BKB or Bangladesh Bank (the country's central bank) to make policy changes known to branch banks was most disturbing. Several examples below demonstrate this. Moreover, there were indications that farmers do not have any faith in the banking system itself. In fact, one farmer interviewed volunteered that his father on his deathbed had warned him to never have any dealings with a bank.

Initially, loan procedures had required that the borrower make a "down payment" of 10 percent on each loan. That is, a farmer requesting a Tk. 1000 loan would only receive Tk. 900 but would pay interest on the full Tk. 1000 amount. This requirement has now been eliminated. Yet, the written guidance prepared for use by branch managers has not been revised to reflect this significant change. When asked by the team how this policy change would be given effect, a Bangladesh Bank representative stated, in essence, that branch managers would become aware of the charge gradually through meetings and discussions. This is hardly a system conducive to a uniform application of regulations and the provision of credit to the rural poor

That is not to imply that written directives get translated into action much faster. A significant issue in the extension of credit to the small farmer has been the requirement for the farmer to mortgage a portion of his land as collateral. A farmer's wealth is measured by his landholding. Even though he may know that banks never foreclose on a loan and take possession of the mortgaged property, the idea of mortgaging his land is so alien to the farmer that many would rather borrow from local money lenders than get credit from a bank. Typically, the mortgage instrument would be registered with an official registry office.

In recognition of this problem, official Bangladesh Bank policy was changed. By a circular dated December 24, 1980, all participating banks (this includes not only BKB but several other nationalized institutions) were advised that handpump loans should be secured by hypothecation of the hand pump and "by simple deposit of Title Deeds of lands" with the bank. While the bank could still theoretically take possession of the land the fact that the mortgage was not registered at an official government office is of great significance to the farmer. Under these circumstances the team saw considerable evidence that he would be more willing to apply for a loan.

This circular has still not filtered down to all branch banks or if it has, it is often being ignored. In fact, the team found that in a couple of instances it was only at the initiative of the zonal store assistant engineers, who reproduced copies of the December 24 circular and distributed them among the banks in their zones, that local banks found out about the new policy. The effect of such a change where it has been implemented has been significant. In Jessore, credit sales are now exceeding those for cash. Unfortunately, as in the case of the down payment requirement, the banking credit

Irrigating boro season HYV rice in Jessore district. This was installed to save the crop after the deep tubewell had failed.

system has been extremely slow to respond. Whether this is a reflection of the priority the banks give to the handpump program cannot be determined.

The documentation required by the banks poses an additional constraint. Both dealers and farmers find the certifications, required for cash or credit sales, of little value and, in fact, there is some indication that farmers would occasionally be willing to forego a bank loan rather than spend the effort and bakshish necessary to complete the documentation. A general rule of thumb seems to be that whenever a document has to be signed it will cost a few taka to get the signature. It is a time-consuming process for the farmer. Moreover, the farmer is often very reluctant to let the local political leader (who has to sign the certificate) know how much land he is holding. The certifications do not ensure that the purchaser in fact owns less than three acres. It became clear through our interviews that forging of signatures by dealers or paying off people to sign a certification was quite common. One dealer, objecting to the requirement, told the team he believed that it served no purpose. Instead, he thought that the technology itself would dictate who would be the purchasers. That is, the larger landowners would want to irrigate more land than could be covered by a handpump. These people really would not, for the most part, be interested in handpumps. For the smaller farmer, owning two to four acres, the technology and the price was probably right.

Dealers and, in one case, a banker show considerable initiative in coping with the documentation requirement. Many dealers hire agents who will solicit pump buyers and ensure that all paperwork is processed quickly through the bank. All the farmer needs to do is gather up all the evidences of title required, fill out the necessary forms (with the agent's help) and the agent will get the necessary signatures. A local bank manager of the Sonali Bank was providing a similar service. But even more than this was the Sonali banker's willingness to process loan applications quickly. Applying the security requirements as revised by the December 24 circular, the banker merely required deposit of evidence of title, execution of a simple deed of trust, and forms which he helped the farmer to fill out. He was able to process these documents in a few hours. For some reason, BKB bankers in Bogra require 15 days to process a loan. One is left with the impression that rural credit and banking is a highly personal thing. Those bankers, as in Jessore and our Sonali banker, willing to personalize the process, perhaps with the help of friendly dealers, will succeed in getting pumps sold for credit. Bank management generally, especially at BKB, is not as aggresssive as one would hope in ameliorating the fears and obstacles in the path of the farmer. That being the case, it will be that much longer before many small farmers look to the banks rather than the village money lender (the epitome of the personalized banking relationship) for credit.

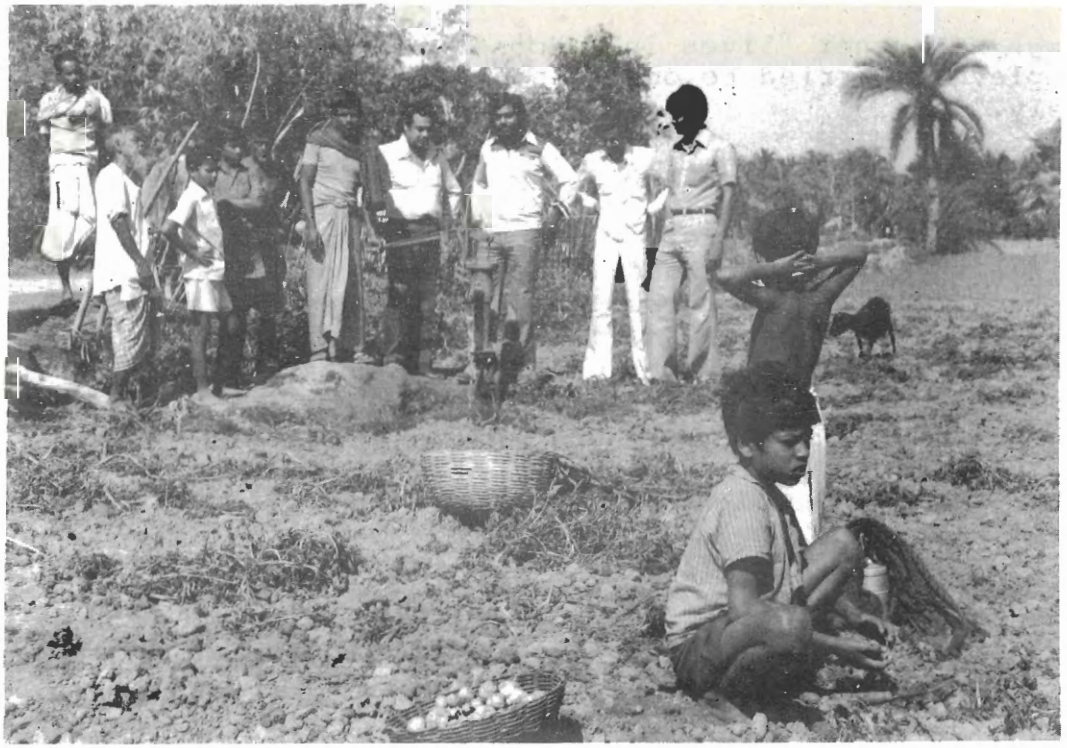
Among the most interesting aspects of the credit program that came to light during the team's survey was the use of credit for other than the purchase of a pump. A borrower would get a supply order from his bank, after completing all necessary formalities, and present the chit to a dealer, But instead of getting a pump, he would ask for the cash, less 10 percent dealer "service" charge. The dealer would sell the pump to some cash buyer, and the borrower would get a cheap loan. Village money lenders charge 30 to 40 percent; and interest on a commercial loan is between 15 to 16 percent with as much as a 35 percent "downpayment" or discount. The agricultural credit loan under the hand tubewell program are at 13 percent with a three year repayment period. There is some obvious incentive for cheating, and we can only guess at the amount. It is interesting that the Christopher Report survey found that 24 percent of the names of pump purchasers were fictitious. This may be one reason.

Finally, the Integrated Rural Development Program (IRDP) was to be another major participant in the handpump program. Moreso than the banks, the performance of IRDP has been very disappointing. And, despite the glowing endorsements from bank officials of the IRDP program, it may suffer from the same maladies as does the rural banking system - it may not in many instances work effectively in the interests of the rural poor. This takes on a significance beyond the SSIP project since the World Bank is considering a significant handpump project to be implemented through the IRDP.

In essence, the IRDP works through village-based farmers' cooperatives (KSS) and their federations (TCCA) to provide services, including credit, to the farmer. The program originated in Comilla district and has been most successful there. But the successful replicability of this elsewhere in Bangladesh is open to some question. The team spoke with few farmers who participated in the IRDP program. Those who had, in Bogra district, did not use the IRDP credit program. The reason seems to be that the limited credit available to the individual cooperative was mostly extended to the more powerful, influential members of the cooperative. Those with influence used their positions within the cooperative societies to get loans and, it appears, in many cases, not repay them. Not surprisingly, with such a high default rate credit from many local cooperatives would dry up. These views were echoed by representatives of the Christian Reformed World Relief Committee (CRWRC) with whom the team spoke in Bogra. This PVO had become deeply involved with farmers in the Bogra district by acting as an extension service and assisting farmers to become self-sufficient. Frequently this involved assisting them to purchase HTWs.

The CRWRC staff viewed the cooperative credit program as an extension of the existing village power structure into a new environment. The powerful leaders were used to controlling cooperative resources. Similarly, they dominated village resources outside the cooperative also.

To conclude, the team believes that the rural credit structure in Bangladesh is extremely weak. There are signs of improvement, especially in Jessore. But, for the most part, management from the upper levels seems haphazard at best, and implementation at the branch level is very mixed. To a considerable extent, the farmer's fear of doing business with banks must still be overcome. At least with regard to hand tubewells, the banks - primarily BKB - have shown in most cases a reluctance to move agressively. In was very optimistic five years ago when the project was first designed to place significant reliance on the rural credit program to foster distribution of pumps to the rural poor. This is especially true in light of a similar failure in the earlier MOSTI program.



Harvesting potatoes irrigated with HTWs in the Jessore district.

C. Economic Aspects of the Project.

It is estimated that 104,000 HTWs had been sold at the time of our evaluation. Therefore, we are actually writing about a very small percentage of the farmers of Bangladesh - (less than 1 percent) who have purchased HTWs under the SSIP program. We asked ourselves several questions about these farmers. Who are they? How and for what purpose do they use their HTWs? What has been the effect of their purchase on their economy and life style?

The Christopher Report suggests that "The typical HTW owner is a 47 year old man who has gone to primary school." Our experience indicates that generally the purchasers were illiterate except in the Comilla area where nearly all the farmers seemed to be able to read and write.

The project was designed to reach farmers who owned less than three acres of land. Our finding, confirmed by the Christopher Report, indicates that the average land holding is slightly higher than three acres, with a range of one to eight acres.

The average HTW owner "lives in a household together with eight other people, is married to one wife, and engages in farming exclusively."

When we arrived at the question of how and for what purpose HTWs were used we found such a variety of answers that simple generalization is impossible. We found farmers who did their own pumping, whose wives pumped, whose children pumped, who hired pumpers, who had sharecroppers who pumped and gave part of the produce to the owner and a variety of variations on these themes. We found farmers who used the water exclusively for irrigation, partly for irrigation and partly for drinking water, and exclusively for drinking water. Since the pumps are needed for irrigation only in the dry season (December - March), they are either used for domestic purposes during the rest of the year or stored for security.

The average HTW owner has not had enough experience with his pump to begin adjusting his crop pattern so as to achieve the optimum return from an extra cash crop. However, he knows from experience and from observing his neighbors that irrigation will increase productivity. The Christopher Report indicates that this increase is at least 39 percent on those acres where it is used. We found that all farmers to whom we spoke would be able to write off the entire cost of the pump against the increased profit of the first crop it irrigated. As a matter of fact, farmers use the HTWs to produce a third crop which would have been impossible without the pump. Therefore, that entire crop is increased production and, of course, profit for

the farmer. Also certain crops (particularly tobacco, wheat, potatoes, chilli and HYV Boro paddy) show a marked productivity increase with the irrigation from the HTW.

The overall effect of HTW ownership on a farmer and his family is hard to assess accurately. However, certain generalizations and impressions are significant. We have seen that use of the HTW increases productivity and therefore, in the case of cash crops, family income. This increase provides important discretionary funds for the farmers. Farmers to whom we spoke made other observations. One farmer volunteered that he no longer suffered stomach aches, which he felt was due to this source of purer water. Other farmers explained that after a day of pumping there was no difficulty in falling asleep. Every farmer without exception felt that his HTW had proved to be a good investment. Some were making plans to purchase second, third and fourth pumps.

The HTW is particularly well-suited to the land distribution patterns found in Bangladesh. The average farmer owns less than two acres. However, this must not be thought of as a two acre farm for it may consist of ten or more parcels of land, and this land is not contiguous. Since the HTW is capable of irrigating a very small area, it fits well this land distribution pattern. The important exception is where farmers have banded together in coops for the purpose of irrigation. Here a large area (20 acres or more) can be irrigated by a shallow tubewell (STW) or a deep tubewell (DTW) or even low lift pumps (LLP). We found particularly in the Comilla area that cooperatives for this purpose were common and were working well. The technological advantage of these pumps is that they operate on diesel fuel or electricity. Moreover, the formation of a coop has the advantage of providing a formal community organization.

Clearly the HTW owners are the primary beneficiaries. They have an extra crop; they have a higher yield. They find themselves with additional cash. They feel that they and their families enjoy health benefits from the HTW. The farmer moreover finds himself with an asset which he may possess for ten or more years.

The pump in the field also provides employment. As we have indicated there are many patterns by which this is done. Sharecroppers use the pump and thereby increase their crop, part of which goes to the land holder in payment. Women pump with their husbands in the fields. Children also participate at the pump.

Mechanics are able to sink two HTWs per day. The average cost of sinking a well is 65 Taka ($3.25). Some farmers have learned how to sink wells themselves, so not every one of these wells is sunk by a mechanic. On the other hand some pumps are sunk more than once. At the end of the irrigating season pumps are frequently taken up to be stored and later used in another place. In any case, the financial outlay for sinking all of the pumps now in use one time would have amounted to $338,000.

There were at the time of our visit 354 licensed BADC dealers scattered throughout Bangladesh. Handling the HTW is easy; the customers need little or no persuasion and sales are relatively uncomplicated.

What does one say to this? On the positive side one can say that HTWs are good whatever their use. Getting them out and in use is the important thing. Perhaps it would preferable to relax the regulations and face the reality that some of these pumps will be diverted to other uses. We even saw one BADC pump being used in a brick-making factory. It was not being used for irrigation, but was its purpose not worthwhile?

One thing remains to be said about the HTW owners. By every index they prove to be a little bit better off than their neighbors who do not own HTWs. The Christopher analysis shows that HTW owners possess slightly more land than non HTW owners (4.84 acres as opposed to 4.38 acres). HTW owners hire out members of the household less than non-HTW owners and hire in more than non-HTW owners; HTW owners have larger families and apparently larger incomes than non-HTW owners. Given the fact that these HTWs are in the first year of operation, this greater wealth on the part of HTW owners cannot be ascribed to the greater productivity of the irrigated crop. It means that the slightly better off farmer was more able to buy the pump than his less fortunate neighbor. However, we discovered that those who bought on credit were indeed the poorer farmers.

A final group which should be mentioned are the voluntary organizations (VOL Ags) which participate in the process in various peripheral ways such as providing extension service to the farmer, encouraging and explaining the use of HTWs and helping the farmer secure credit where this is necessary.

Unfortunately, our evaluation took place when the project had been in effective operation for only one year. We cannot say from experience therefore exactly how the HTWs will affect the economy as a whole or even the individual farmer. We have seen that the individual farmer achieves increased production of existing crops and a new third crop. This will, of course, represent an overall increase in food production for the nation.

Another benefit from the SSIP is that HTWs have become well known and accepted by farmers all over Bangladesh. Even when the subsidized HTWs of the SSIP are no longer available, it is to be expected that farmers will continue to purchase and use pumps for irrigation and domestic purposes.

Typical rural bank which makes credit available for HTW purchases. The sign reads: Bangladesh Krishi Bank. Note the grafitti!

D. Private Sector Involvement

The project has had mixed experiences in its dealing with the private sector. Major involvement has occurred with private sector iron foundries. These have benefitted from the technical assistance provided by the Consultant, Amman and Whitney (A&W).

Under A&W supervision foundries have been able to operate more efficiently and produce a high quality product. Through this effort and the generally good business climate prevailing in the country, foundries have been able to expand their operations. One foundry visited was expanding its floor area by 25 percent and another had taken over another firm for machine work and assembly and had plans for construction of an entirely new facility. New firms have entered the market and submitted tenders at each opportunity. A continuing problem is the allocation of raw materials. Government restrictions on the imports of pig iron and coke have limited the potential development of foundries.

The second area of private sector involvement has been pump distribution through private dealers. The previous UNICEF project distributed through IRDP and the follow-on World Bank

project plans to use the same cooperatives. The experience with private dealers, who are allowed a 10 percent commission (less transport costs), is generally good. The commission has been adequate incentive for dealers to promote the handpump through effective advertising. Dealers have used agents to promote handpumps, they have distributed leaflets at local bazaars, shown ads at movie houses and hired bicycle rickshaw loudspeakers. In addition, dealers have assisted farmers in preparing certificates and applying for loans. Some dealers prepared and checked loan application forms and through their relations with local bank officials assured speedy loan processing. The dealer thus provides some of the services of an extension agent, a function other projects have had difficulty duplicating. A problem with private dealers is that they have been accused of mishandling credit sales as described in Chapter III (Distribution and Credit).

E. Social Observations

In his survey on the impact of the project Christopher notes little or no change in the traditional role of women in rural Muslim society. His data indicate that women were primarily using the pump to perform household chores. He found correspondingly no significant pump irrigation work being done by women. Although the team's observations were not nearly as systematic as Christopher's, we are led to a different conclusion. It should be noted that the team was in the field during the winter irrigation season; Christopher's interviews took place before the onset of the winter dry season.

The team was surprised to find many women out in the field using handpumps for irrigation. Several women even allowed themselves to be interviewed. When asked by the team whether this was a common occurrence, one dealer in Bogra said that it was. He believed that in the past, women mostly stayed in the home, but with increased use of handpump irrigation, more and more women were actually doing the pumping in the field.

From an economic standpoint this makes obvious sense. The small farmer exists on a very thin margin. Many can not afford the time away from cultivating other, non-contiguous, parcels of land in order to do the pumping themselves. Nor can they often afford to enter into a sharecropping relationship or pay a day laborer to do the pumping. The women-folk provide a necessary service for the family which is probably viewed as being without cost. It is much too early to tell whether this behavior change will have any significant or lasting affect on rural Bangladesh society.

The opportunity to perform back breaking manual labor may not appear to Westerners as a significant social advancement for women, but there is an aspect to this which must be thought of in the context of Muslim customs and practices. This work is bringing women out of the house.

The Christopher Report also notes that a considerable percentage of the time spent pumping is directed not for irrigation but for domestic purposes. In fact, the report concludes that most farmers use the pump for both purposes. This seems to square with the team's observations and interviews.

Dealers with whom we spoke varied in their estimation of the percentage of pump-time devoted exclusively to irrigation. Some said 80 percent, many quoted a smaller percentage. Their answers could easily have been affected by the presence of the zonal store assistant engineer during the interview. Nonetheless, dealers admitted that even pumps for which they had accepted a certification that use would be solely for irrigation, were being used for domestic purposes also. In our travels the team saw many pumps located within a few yards of the home, obviously available for irrigating a small garden plot but, equally as obvious, also accessible for providing drinking water.

Interestingly, one of the first farmers the team interviewed raised the health benefits that were provided by use of the handpumps. The team had stopped to talk with some other people when this elderly man pulled up on his bicycle. He was not a poor man and owned at least two handpumps. After explaining how he used the pumps for irrigation he became fairly excited and volunteered that the drinking water from the pumps was good -- so good that he no longer had problems with his stomach and diarrhea. As one memeber of the team knows from experience, the latter is a very significant benefit.

HTW modified with an electric pump.

We believe that the use of the pump to provide better drinking water for the farmer's extended family is widespread, is a good side benefit of the project, and should not be discouraged, especially in Bangladesh where intestinal desease is endemic. Incidentally, this conclusion would argue for getting rid of certifications on the use of the handpump which AID and the government cannot and may not want enforce in any case.

F. Choice of Institutions.

More care should have been given in planning the project to the selection of institutions which would carry out the project. Had this been done, the project would have moved along more smoothly from the beginning. For example, originally this project was to consist of 50 per cent credit sales. This would ensure that the small farmer was able to purchase HTWs. The BKB was to provide the credit through its network of offices throughout the country. However, the BKB encountered a natural reluctance on the part of the farmers to deal with banks, especially when such dealings involved the farmers' real estate. Apparently nothing had been planned for overcoming this reluctance. One could also question whether such a fragile and unsophisticated rural credit system as exists in Bangladesh would not have been completely overloaded by the requirement of making 100,000 loans of $50 to $60.

G. Reaching the Small Farmer.

The Small Scale Irrigation Project was designed to assist the "small farmer" by making available to him HTWs at slightly subsidized prices and on credit, where necessary. "Small farmer" is usually understood to mean a farmer who owns less than three acres of land. Especially in the case of the HTWs bought on credit, it appeared to be important to ensure that the credit was made available only to the poorest farmers. The procedures set up by the BKB are describes in Chapter III. So are the circumventions which are used by the dealers. Since the procedures did not produce the desired result, but basically resulted in additional work and inconvenience for both the dealer and buyer, one must question whether the procedures are worthwhile. In fact the team was convinced that in Bangladesh HTWs (and other pumps) are extremely beneficial. They make it possible for a third crop to be produced. If some are owned by slightly more well to do farmers, can this be bad? A realistic effort should be made to see that the poorest farmers are the chief beneficiaries, but it does not make sense to undertake an effort which will certainly fail to ensure that they are the only beneficiaries.

Obstacles and Impediments

The certificates mentioned in B above are one impediment to the purchase of HTWs. There are others. One is the placement of the zonal stores. Frequently the dealer must purchase the HTWs from far away and in one case we found, from further away than the closest zonal store. The transportation costs makes it difficult for the best prices to be offered to the farmer, since dealers do, as a matter of fact, discount the HTWs to the farmers.

Another problem has been the lack of spare parts. No provision was made for spare parts. This means that when parts are needed, other pumps are appropriated for the purpose. Of course this becomes an obstacle to the smooth sale and use of these pumps.

Implementation Plan vs. Actuality.

The original plan differs from what is actually happening in many ways:

- The chief difficulty has been importation of raw materials and design and production of the HTW. These were not even discussed in the PP.

- Original plan envisioned 50% HTWs being sold on credit by BKB. The percentage has had to be vastly reduced due to reluctance on the part of the farmer to deal with BKB on credit.

- An unreal attempt was planned to insure that HTWs were used for irrigation and not domestic purposes. Since the irrigation need is only for a small portion of the year, this has proven unrealistic.

- The establishment of a complicated delivery system was to have taken only a few months. In actuality, the system has not ever been completed as envisioned.

Most of these problems could have been foreseen if more attention had been given to planning. Had this been done, the project would doubtless have moved more smoothly.

Flexibility of Purpose and Side Benefits.

As indicated above, some of the difficulties in implementing this project have resulted from the unrealistic attempt to restrict the use of HTWs or their ownership. Had the project been more flexible from the start, this would not have presented so many problems. Perhaps the best approach would

have been to assess the advantages of all the various uses of the pump and simply to have encouraged as wide a distribution as possible for any legitimate use.

Private Sector Implications of the Project

Almost nothing was said of the private sector implications in the original plans for the project. And yet, as can be seen from Chapter V, this is actually a very important part of the project.

CHAPTER III

LESSONS LEARNED

The basic lesson one learns from this is "look before you leap"! The project we studied was a good one. It really couldn't fail. And yet it almost did fail and basically because many things which were there for the finding were not found until after the project had begun. Two examples are the lack of planning for raw material import and the poor planning for provision of credit. In the former case the project was delayed for several years, and in the latter case the project had to be drastically revised, because the problems had not been provided for in advance.

Another lesson is to make sure that no artificial obstacles are placed in the way of fulfilment of the main goal of a project. In the case at hand the main goal was to provide HTWs to poor farmers. In the effort to ensure that only the target group is reached and only the stated uses of the pumps are employed, obstacles have been placed before the farmers and dealers which have greatly complicated the distribution of the pump and nearly frustrated the primary goal of the project.

Related to the above is the point (made on p. 27) that the project should be kept flexible. When this is not done, the effort to accomplish one part of the project may make other goals (sometimes more important goals) almost impossible.

APPENDIX A

LOGICAL FRAMEWORK

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY 76 to FY 79
Total U.S. Funding: $14.0 million
Date Prepared: 25 March,1976

Project Title and Number: Small-Scale Irrigation I - 388-0019A

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes: Achieve self-sufficiency in foodgrain production in Bangladesh by 1980.	Measures of Goal Achievement: 1. Total domestic foodgrain production equal 15oz. per capita per day. 2. Foodgrain imports are required only to maintain reserve stocks in case of disaster and for Food-for-Work and Nutritional Programs.	1. Ministry of Agriculture statistics on foodgrain production. 2. BDG population statistics. 3. Food Import records of BDG.	Assumptions for achieving goal targets: 1. No major man-made or natural disasters. 2. Continued expansion of use of HYV seeds. 3. BDG is able to maintain reasonable farmgate prices for foodgrains. 4. Irrigation increases crop intensity and yields per acre.
Project Purpose: Provide farmers with private ownership of small-scale irrigation equipment.	Conditions that will indicate purpose has been achieved: End of project status. 1. Sale of 240,000 handpumps with an estimated 120,000 provided on credit by the BKB and IRDP. 2. 117,000 acres are irrigated by handpumps, including those under the UNICEF & IBRD programs, as well as spontaneously purchased pumps, in 1978-79 winter season.	1. Foundry sales and BKB and IRDP loan records. 2. Invoices of handpump dealers participating in BKB program, and IRDP invoices. 3. Foundry production & sale records. 4. Sample surveys by USAID staff to determine average acres irrigated by each handpump.	Assumptions for achieving purpose: 1. Handpumps are not diverted to non-irrigation uses. 2. Expansion of production causes no loss in quality of handpumps produced by foundries. 3. Profit margin on sales is attractive to dealers. 4. Bulk of sales will be to farmers holding less than two acres. 5. Each pump will irrigate an average of one acre.
Outputs 1. Small farmer credit program for purchase of handpumps. 2. Media promotion of handpumps and credit program. 3. Domestic production of handpumps.	Magnitude of Outputs: 1. Credit program operational: a. Capitalization of Tk. 59.9 million. b. 120,000 loans made. 2. 10 different promotional message communicated throughout each winter season through radio, newspapers, ag. extension service, IRDP model farmer training and rickshaw mounted loudspeakers. 3. 240,000	1. Ministry of finance, BKB, and IRDP financial accounting records. 2. USAID media survey and monitoring reports. 3. Foundry records and USAID monitoring reports.	Assumptions for achieving outputs: 1. Small farmers willing to risk investment in handpumps. 2. Promotional materials are culturally acceptable. 3. Raw materials are not diverted into other uses. 4. Foundries capable of expansion.
Inputs: BDG: (a) Banking directives; (b) Local currency (c) Establishment of project committee; (d) Acquisition of pumps for first year from existing supply and UNICEF; (e) Arrangements to procure raw materials; (f) Arrangements to manufacture pumps locally. AID: (a) Direct local currency financing for promotional activities; (b) Fixed-amount payment for each pump sold on credit to cover local costs and imported materials for new pumps.	Implementation Target (Type & Quantity) BDG: (a) Workable interest rates, collateral requirements; (b) Tk 104.9 million for credit and local manufacturing; (c) Planning Commission, IRDP, BKB, AID, UNICEF, World Bank; (d) 40,000 (e) For 240,000 pumps; (f) 240,000; AID: (a) 100,000; (b) $27 for local costs; $86 for materials for two pumps.	BDG: (a) Ministry of Finance and BKB published directives; (b) Bangladesh Bank records of L.C. Loan to BKB and Ministry of Finance letter of allocation to IRDP; (c) Planning Commission directive establishing project committee; (d) invoices from participating dealers, foundries, and UNICEF; (e) IFBs issued; (f) BKB's or their agent's tenders to foundries for manufacture. AID: (a) Issuance of $ check for L.C. equivalent; (b) issuance of L/Comms.	Assumptions for providing Inputs:

APPENDIX B

METHODOLOGY

METHODOLOGY

The team spent its time in Dacca familiarizing themselves with the Small Scale Irrigation Project (SSIP). Project documents in the mission were read, and officials in institutions which related to the project were interviewed. These included officials in the Bangladesh Agriculture Development Corporation (BADC), the Bangladesh Krishi Bank (BKB), the Integrated Rural Development Program (IRDP) as well as mission staff who had been involved in one way or another in the project. We also interviewed officials in related projects such as UNICEF and the World Bank. The engineer on the evaluation team, Herb Blank, interviewed officials at the foundaries which produced the pumps.

We were fortunate in this evaluation in that a considerable amount of spade work had been done prior to our arrival. In particular, two evaluations of two parts of the project had been recently completed and the results existed in draft. The first evaluation had been carried out Nizam U. Ahmed. He had interviewed 87 dealers using an instrument of nine parts dealing with HTW sets and the dealers' experience in selling them. His report in its final form is reproduced as Appendix C. The second evaluation had been done by Stefan C. Christopher and Associates. In this report, 400 farmers who had purchased pumps were interviewed and an addditional 200 farmers who had not purchased SSIP pumps were interviewed as a control group, using an instrument of 74 questions. Although the team found some deficiences in the report, it clearly provided a basis of information far broader and more detailed than anything we could have accomplished in the time available to us.

Plans were made to visit the field and interview the assistant engineer in each of the places we went, and, with his assistance, to interview a number of dealers. We also planned to interview as many farmers who use HTWs as we could in the time available. Where possible, we interviewed branch managers of the Bangladesh Krishi Bank, the Sonali Bank, or other banks providing loans for the purpose of buuying the pumps. We planned for this purpose three trips into the countryside. The first trip took us to Rangpur, Bogra, and Rajshahi. The second trip centered around Jessore, and third trip, around Comilla. Although we did not develop a formal instrument for use in the interviews we very quickly picked out the primary questions which we wanted to ask the dealers, the farmers and the bankers. We were attempting to observe whether or not our findings confirmed the findings of the two evaluations or contradicted them. In those instances where we appeared to contradict the findings of the earlier evaluations, we used our findings with great care and sought confirmation of our them.

In some instances there was a reason for the contradiction as, for example, where we found that we had interviewed at a different season of the year than the Christopher interviewers. In others the explanation was not so clear and in some instances, we concluded that the earlier evaluators must have been on the wrong trail.

We discovered that Bangladesh farmers are quite open and friendly. They will give rather detailed information about their crops and farms. Sometimes the details are mere guesses. On the other hand, there are some things they would rather not disclose such as the exact size of their holdings. We also discovered that where exact information was clearly not available, the farmer would give an answer which appeared to be exact rather than appear not to know. Our very skillful translator was able to probe and, because he knew the life of the farmer well from firsthand experience, was able to bring out the real situation through a series of questions that we would not have thought to ask ourselves. The team believes that the Christopher interviewers must not have done this, as they took the very exact answers they received to extremely complex questions as bonafide truths.

With the exception of relatively minor disagreements, the team came to the conclusion that the basic findings of the previous evaluations were sound, and consequently we have relied heavily on those evaluations. Another conclusion to which the team came early in the survey was that pumps are indeed good for the famers of Bangladesh to have. A cost benefit analysis may dispute exactly how good the pumps are for the farmer, but no analysis that we saw showed that they were not cost beneficial. Moreover, there are hidden values to owning pumps and we did not feel that these were sufficiently factored into the analyses which we had seen.

When we had finished our three field trips and the interviews which were carried on in Dacca, the team settled down to review our findings and the work out what lessons could be learned from the SSIP project in Bangladesh. There was no significant disagreement among the team members about these results. Although we had had different experiences, our experiences all led to the same conclusions and each person's findings were consistent with the those of the rest of the team.

APPENDIX C

NIZAM REPORT

Nizam Report

Executive Summary

Under the Small-Scale Irrigation Project (SSIP) handpump tube wells are being manufactured and sold to farmers. The implementation of this USAID financed project has been entrusted to the Shallow Tube Wells Division of BADC. Under this project BADC plans to manufacture and distribute 200,000 handpump tube wells.

In conjunction with the final evaluation of the SSIP a field survey was conducted between December 7, 1981 and January 15, 1982 to determine the need for and availability of spare parts for the SSIP HTWs, and to obtain data about HTW sales and dealer characteristics. Summarized below are the major conclusions drawn from the study:

I. Spare Parts Situation

45% of the respondents dealt in HTW spare parts of various origins, locally made and imported. The demand for HTW spares is great for the HTWs sold in the past and the demand for SSIP spares is also expected in the near future. While SSIP pump materials like plunger, flap valve, strainer, pipe, etc. are interchangeable, piston rod, head cover, handle and base plate are not compatible with other available spare parts. Moreover, BADC does not provide any spare parts. As a consequence SSIP HTW is likely to be out of operation for want of required spare parts.

Of the total pump head stock held by respondents, 85% were SSIP pump heads and only 15% were other pump heads. Of the total pipe stock, 92% were SSIP pipes and only 8% were pipes other than SSIP. Of the total strainer stock, 68% were SSIP strainers and 32% were strainers other than SSIP.

II. Dealer Characteristics

Up to the time of the survey, SSIP appointed 577 dealers of whom 354 had signed the required agreement with BADC (having paid TK 500 to BADC) throughout the country. A total of eighty-seven (25%) of these 354 active dealers were interviewed in all seven SSIP Zones in the towns of Rangpur, Bogra, Natore, Jessore, Jamalpur, Joydevpur and Comilla. Up to the last day of this study 82,075 (41%) of 200,000 pump sets targeted had been sold by SSIP thru its distribution mechanism.

Of the total dealers interviewed, seventy-five (86%) were appointed by BADC (SSIP) and nine (10%) were both BADC and BKB appointed dealers. Three pump dealers interviewed were neither BADC nor BKB but private dealers. Locating a BADC dealer's shop was not easy, as only nine (10%) of the dealers

interviewed displayed signs outside their shops stating them to be BADC dealers.

The dealers interviewed all had long experience with HTWs, 55%, of them having sold HTWs for irrigation long before the SSIP. The dealers were found to be engaged in other businesses as well as HTWs. Almost all were appointed within 6-8 weeks of their application.

The transportation cost for delivery of SSIP pump sets was reported by the dealers to be from Tk. 7-45 depending on distance of SSIP stores from dealer's shop. By comparison, the transportation cost for delivery of other pump sets than BADC ranged from Tk. 25-75. Only eight of the dealers interviewed commented that the commission allowed by BADC is poor. 71% of the respondents commented that the quality of SSIP HTWs was superior and the price cheaper than non-SSIP pump sets. However, 41% of the respondents regarded SSIP strainers to be of poor quality. Some respondents (29%) commented that SSIP handle design is not practical, and a bent handle should be introduced in place of the straight to avoid accidents.

The majority of the respondents reported no problem in obtaining pump sets from the SSIP stores. Most dealers were selling SSIP pump sets at the maximum retail price fixed by the SSIP (which for set A is Tk.1100, set B is Tk.1430, set C is Tk.1760 and set D is Tk.2090.) However, some dealers were selling at lower prices than maximum retail prices too. (The lower price range for set A was found to be Tk.1025-1100, set B, Tk.1325-1430, set C, Tk.1685-1760 and set D, Tk.2000-2090.) The maximum demand for SSIP sets was for set A and B with sets C and D less popular.

Almost one-half of the respondents employed sales persons/agents to promote HTW sales. Employment of sales personnel ranged from 2-15 persons who were paid Tk.5-30 per set as commission. Most sales agents were reported to be HTW installers and mechanics.

III. Other Findings

1. Credit:

The study indicated that pump dealers were not getting much institutional credit to boost purchase and sales. Only two respondents reported getting credit from Rupali and Bangladesh Krishi Bank respectively for purchasing SSIP pump sets, although a program is operational.

2. Customer Certification:

22% of the respondents interviewed commented that certification by Union Parishad Chairman/Member or School Teacher was inconvenient and bothersome. Customers are not interested in getting the required certificate in order to make a simple cash purchase.

3. Appointment of dealers in clusters:

21% of the respondents believed that dealers were indiscriminately being appointed in clusters. Although dealerships are supposed to be awarded on area basis BADC does not adhere to this. Most of the dealers surveyed were in clusters, i.e., several concentrated in the same market area.

APPENDIX D

ECONOMIC ANALYSIS

ECONOMIC ANAYLSIS

Internal Rate of Return

The project Paper economic analysis determined the internal rate of return of the project to be 85 percent. Since this is an extraordinarily high return for a development project it was decided to recalculate the IRR based on current data. The primary economic justification for the project was increased grain production which would result in foreign exchange savings by displacing imported grain. It was assumed in the PP analysis that all production would be food grain; in actuality many farmers produce other crops which have higher returns.

For the purposes of this evaluation two cases were analyzed since data is still lacking on farmers selection of appropriate crops. A conservative analysis was desired, therefore the crops having least return were used. Benefits from nonfood crops (primarily tobacco) estimated at 6 percent of handpump use have been disregarded. Inclusion of this production would further increase the IRR. The results of the analysis show an internal rate of return of 20.8% for wheat production and 23.3% for rice.

The assumptions for the PP anaylsis were that (1) 40,000 pumps would be sold each year for six years, (2) five percent of the previous years operating pumps would go out of service each year, (3) pumps would have a service life of five years, (4) each pump would produce one half metric ton of foodgrain per year that would not otherwise have been produced, (5) value of foodgrain would escalate 5% per year, (6) costs of production would be $10.00 per pump for fertilizer, other input prices would not be included, (7) total project costs would be $22.64 million, and (8) project expenditures would also include two percent interest on the disbursed balance of the loan.

The assumptions made in the current analysis are discussed below:

(1) The USAID Mission's best estimate is that 200,000 pumps will be sold under the project, 65,000 being sold in 81/82 and more that 70,000 the next year. Sales details are shown in Table #1.

(2) The Project Paper assumption of 5 percent dealine rate per year is also made in this analysis.

(3) The estimate of service life has been increased from five to eight years based on experience to date and consultant's estimates.

(4) From survey results, it has been concluded that 84.5% of the pumps are used for irrigation or some combination of irrigation and domestic water supply. Of these 94% are used for production of food crops. The net effective number of pumps used for food production is thus 79.4% of the number of pumps in service.

(5) The PP estimated each pump to be used in the production of one half metric ton of grain per season. Based on current information it is known that a farmer can feasibly irrigate one third of an acre of Boro season rice with a yield which has been found to be .35MT. Alternatively, for wheat, based on two thirds acre production, the yield is .42MT. Production of other crops (primarily vegetables) may have higher returns to individual farmers depending on accessibility to markets, transportation costs and other factors beyond the scope of this analysis. Inclusion of a mix of these crops would tend to increase the IRR.

(6) The assumption in the PP of price escalation in foodgrain of 5 percent per annum has also been adopted in this analysis using 81/82 base prices.

(7) Detailed prices of inputs have been included in this analysis. These inputs include cost of fertilizer (Urea, TSP, MP), pesticide and seed, with prices assumed to escalate at 5% per year. The PP cost estimate of inputs included only fertilizer and did not include an escalation factor. The cost of human and animal labor is disregarded as was done in the PP as the opportunity cost of labor at this time of the year is negligible.

(8) Total project costs are estimated at $26.4 million, (vs. $22.64 million in the PP) with AID's estimated share being $12.9 million. Host government expenditure figures are estimated based on the five year plan, see Table #2.

(9) An expenditure of two percent interest on the disbursed balance of the loan is included in this analysis as it was included in the PP.

Discussion: The calculation performed for the PP shows an unreasonably high rate of return. This resulted from a number of factors including an overestimate of the number of pumps sold and the number of pumps actually used for food crop production. The PP analysis also overestimated the amount of grain produced per handpump and underestimated and did not escalate the cost of inputs. These PP estimates all tended to increase the value of the IRR.

The analysis performed herein analyses two cases: in the first case that all Hand Tube Wells (HTW) producing food crops, produce rice and in the second case that all HTWs produce wheat. These assumptions were made because data is still lacking on HTW produced crops. The survey results show, and the team's own impression are, that farmers are still experimenting with appropriate crop production when utilizing the HTW. Farmers are still discovering that they can make a sizeable income from Boro season HVY rice production on plots as small as one third acre. It is expected that with next year's production farmers will show a definite trend to rice and higher valued crops, although these may not be grain crops. Crops which will likely show increasing importance are

vegetables, potatoes, melons, spices, etc. Thus the analysis of the two cases is an attempt to determine a conservative lower estimate of the IRR.

The analysis shows that in the current season (81/82) the project is still operating with a negative cash flow. This confirms impressions stated elsehwere in this paper that the evaluation is being held too early to determine project impact. Only with this year's harvest is there significant value of production, estimated at $6 million. For 1983 through 1988 the analysis shows production stabilizing at about $10 million per year during which time the major positive cash flows of the project are generated.

Recalculation of the IRR in several years' time may show higher dollar values of production although production may not be in the form of food grains which directly replace imported grains as anticipated in the PP. A more detailed analysis would value export or import substituting crops at their shadow prices to account for savings in scarce foreign exchange whereas other crops would be valued at market values. Although vegetable and other crops are attractive to the farmer in terms of potential returns, grain crops are more attractive from the government's viewpoint because of their savings in foreign exchange. Interventions other than the HTW (e.g. subsidized rice seed) may be more appropriate if the government's goal is self sufficiency in food grain production. Two final points are that (1) production of other crops (vegetables, melons, etc.) which do not have direct foreign exchange saving may have important nutritional benefits to the population of Bangladesh and (2) these crops may to some extent be substituted for grain crops. Factoring these considerations into an economic analysis may be appropriate when more information is available concerning farmers' crop production practices with the HTW. In any case the IRR of the project appears at minimum in the range of 20 per cent based on currently available data, a very acceptable rate.

TABLE #1

Handpumps in the Field

Pumps sold:

	1st Year	2nd Year	3rd Year	4th Year	Total in Field
79/80	18,702	---	---	---	18,702
80.81	17,767	45,401	---	---	63,168
81/82	16,879	43,131	65,000	---	125,010
82/83	16,035	40,974	61,750	70,897	189,656
83/84	15,233	38,926	58,662	67,352	180.173
84/85	14,471	36,979	55,729	63,985	171,164
85/86	13,748	35,130	52,943	60,785	162,606
86/87	13,060	33,380	50,296	57,746	154,482
87/88	---	31,705	47,780	54,859	134,344
88/89	---	---	45,392	52,116	97,508
89/90	---	---	---	49,510	49,510

Note: Assumes 5% annual deadline rate and 8 year life of pump.

TABLE #2

Project Expenditures

	AID	HG	LOAN INTEREST	TOTAL
78/79	416,759	500,000	8,335	925,094
79/80	1,921,764	2,000,000	46,770	3,968,534
80/81	5,165,897	4,827,500	150,088	10,143,485
81/82	5,395,580	3,952,250	258,000	9,605,830
82/83	---	2,248,250	258,000	2,506,250
83/84	---	---	258,000	258,000
84/85	---	---	258,000	258,000
85/86	---	---	258,000	258,000
86/87	---	---	258,000	258,000
87/88	---	---	258,000	258,000
88/89	---	---	258,000	258,000
89/90	---	---	258,000	258,000

1. Estimated

2. 2% of disbursed loan balance.

TABLE #3

IRR OF SSEIP BASED ON
BORO RICE PRODUCTION

(1) Year	(2) # of HTW in Serv.	(3) # Used for Irr. food cr.	(4) Foodgrain produced (MT)	(5) Price per MT ($)	(6) Value of Produce ($000)	(7) Unit Cost of Inputs	(8) Total Cost ($000)	(9) Net Value of Produce ($000)	(10) Project Expendi-tures.	(11) Cash Flow ($000)
78/79	---	---	---	---	---	---	---	---	925	(925)
79/80	18,702	14,855	5,199	159	827	13.02	193	633	3,969	(3,335)
80/81	63,168	50,174	17,561	167	2,933	13.67	686	2,247	10,143	(7,897)
81/82	125,010	99,295	34,753	175	6,082	14.35	1,425	4,657	9,606	(4,949)
82/83	189.656	150,644	52,725	184	9,701	15.07	2,270	7,431	2,506	4,925
83/84	180,173	143,111	50,089	193	9,667	15.82	2,264	7,403	258	7,145
84/85	171,164	135,956	47,585	203	9,660	16.61	2,258	7,402	258	7,144
85/86	162,606	129,158	45,240	213	9,636	17.44	2,253	7,384	258	7,126
86/87	154,482	122,705	42,947	223	9,577	18.31	2,247	7,330	258	7,702
87/88	134,344	106,709	37,348	235	8,777	19.23	2,052	6,725	258	6,467
88/89	97,508	77,451	27,108	246	6,669	20.19	5,564	5,105	258	4,847
89/90	49,510	39,326	13,764	259	3,565	21.20	834	2,731	258	2,473
										IRR=23.3%

TABLE #4

IRR OF SSIP BASED ON
WHEAT PRODUCTION

(1) Year	(2) # of HTW in Serv.	(3) # Used for Irr. food cr.	(4) Foodgrain produced (MT)	(5) Price per MT ($)	(6) Value of Produce ($000)	(7) Unit Cost of Inputs	(8) Total Cost ($000)	(9) Net Value of Produce ($000)	(10) Project Expendi-tures.	(11) Cash Flow ($000)
78/79	0	0	0	---	---	---	---	---	925	(925)
79/80	18,702	14,855	6,275	141	885	19.76	294	591	3,969	(3,969)
80/81	63,168	50,174	21,193	149	3,158	20.74	1,041	2,117	10,143	(8,026)
81/82	125,010	99,295	41,942	156	6,543	21.78	2,163	4,380	9,606	(5,226)
82/83	189,656	150,644	63.632	164	10,436	22.87	3,445	6,990	2,506	4,484
83/84	180,173	143,111	60,450	172	10,397	24.01	3,436	6,961	258	6,703
84/85	171,164	135,956	57,428	181	10,394	25.21	3,427	6,956	258	6,709
85/86	162,606	129,158	54,556	190	10,366	26.47	3,419	6,947	258	6,689
86/87	154,482	122,705	512,831	199	10,314	27.80	3,411	6,903	258	6,645
87/88	134,344	106,709	45,074	209	9,420	29.19	3,115	6,306	258	6,048
88/89	97,508	77,451	32,715	220	7,197	30.65	2,374	6,823	258	4,565
89/90	49,510	39,326	16,611	230	3,821	32.18	1,266	2,555	258	2,297

IRR=20.81%

NOTES on TABLES #3 & #4

1. Col. 2 assumes an 8 year life of pump and 5% deadline rate per year (see TABLE #1).

2. Col. 3 is based on survey results that 84.5% pumps are used for irrigation and 94% of acreage is for food crops. Net effective number of handpumps used for foodgrain production is thus79.4% of col. 2.

3. Col. 5 of TABLE #3 is based on .331 acre per handpump, 26 maunds/acre yield (1.04 MT/acre), yield per pump is thus .33 MT/handpump.

4. Col. 5 of TABLE #4 is based on .66 acre of production per pump, yield of 16 maunds/acre equivalent to .422 MT/pump.

5. Col. 5 is based on 5% escalation from 81/82 prices of $175 per MT for TABLE #4 and $156/MT for TABLE #5.

6. Col. 7 of TABLE #3 is calculated as follows: Unit Cost: $14.35/handpump escalated at 5% per year from 81/82 (Urea cost = $18.16/acre, TSP cost = $2.41/acre, MP cost = $2.41/acre, Pesticide = $3.45/acre, Seed = $9.55/acre). Labor valued at zero.

7. Col 7 of TABLE #4 is calculated as follows: $21.78/handpump escalated at 5% per year from 81/82. (Urea cost = $10.93/acre, TSP cost = $6.30/acre, MP cost = $1.57/acre, Seed cost = $14.20/acre). Labor is valued at zero.

6. Col. 10 is taken from TABLE #2.

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