

**VOLUNTARY GROUP ADOPTION
OF
POWER PUMP IRRIGATION
IN
Five East Pakistan Villages**

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PAKISTAN ACADEMY FOR VILLAGE DEVELOPMENT,
COMILLA.**

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**PAKISTAN ACADEMY FOR VILLAGE DEVELOPMENT,
COMILLA, EAST PAKISTAN,**

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PREFACE

This publication is the outcome of a study on introduction of power pump irrigation in the experimental area of the Pakistan Academy for Village Development, Comilla. It is hoped that the report will prove useful to the policy makers and executives associated with the development of agriculture in Pakistan. To the social research workers the report may provide significant information on the process of adoption of an innovation in a traditional agricultural community. The aspect of group adoption studied may stimulate students of practice adoption research to explore a new dimension of the problems of diffusion and adoption of improved practices.

The author wishes to express his deep gratitude to Mr. Akhtar Hameed Khan, the Director of the Academy. Mr. Khan's guidance and assistance proved most valuable in conducting the study and writing the paper. Dr. Edgar A. Schuler, Professor of Sociology, Michigan State University and Senior Advisor to the Academy was kind enough to examine the draft paper and suggest modifications. The author is indebted to him. The author wishes to convey his gratitude to Mr. A. Zaman Khan and Mr. S. Huq of the Academy and the respondents from the villages whose co-operation made it possible to complete this study. Thanks are due to Mr. Ali Ahmed who worked as an investigator.

Comilla,
September, 1961.

S. A. Rahim
Communication Section

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INTRODUCTION

In East Pakistan large areas of cultivable land remain idle during the dry season for lack of irrigation facilities. Traditionally, winter crops are grown in small patches of land where an easily accessible source of water is available. Water is lifted by hand, using buckets. This process is extremely laborious and, since only naturally available water from ponds, rivers and marshes is used, the extent of irrigated crops is very small.

It is agreed by all that one of the quickest and surest ways of increasing agricultural productivity significantly is to introduce power irrigation. The Department of Agriculture and the now defunct V-AID organisation had made programmes for the introduction of small diesel power pumps for irrigation purposes in the villages. These programmes attained some success in isolated cases but nowhere had sufficient information been obtained to study the process and implications of introducing a new machine, an innovation in our traditional agriculture. However, the need for a scientific study of this problem has been felt all the time.

An opportunity for such a study came at the Academy when its Extension Section launched an experimental programme for introducing small power driven pumps for the irrigation of Boro rice crop in its experimental area, during the season of 1959-60. The programme was started in a very modest way, with only a few diesel lift pumps of 5 to 7.5 horse power manufactured by a firm called BECO located in West Pakistan. These pumps cost about Rs. 5000.00 each. For an average farmer, who has a land holding of only about 2 acres, buying such a pump and using it individually was out of the question. Beside the economic question, the concept of planned irrigation by mechanical power itself was a new idea. Therefore, the problem was to introduce the idea of irrigation and to show how it could be implemented by the use of a machine.

The Academy made an attempt to introduce the idea of irrigation for cultivation by using the power driven pump and tried to develop the proper organization through which the adoption of such an innovation by the villagers might be sustained. This, however, has not been an independent programme in itself. The Academy's extension programme developed into a programme of overall development of the villages through organized efforts by the people. Since its beginnings, the author has been closely associated

with this programme. The present study was designed to study the process of adoption of the power pump for irrigation and the social and economic implications of its adoption in selected areas. The actual process through which the villages passed in adopting power pumps, the organized activities for successful operation, relationship with introducing agencies, change in attitude and economic changes were systematically observed and analysed.

The locale of the study

The locale of the study was five co-operative villages, namely, Tangirpar, Hemjora, Alampur, South Rampur and Sreemantapur, of the Academy's 80 sq. mile experimental development area. The region where these villages are located suffers regularly from monsoon floods and almost every year the major rice crops, Aus and Amon, are heavily damaged. In winter almost the total cultivable area remains idle. Constant natural calamities have reduced this region to a most desperate condition. People were disorganized and demoralised. Because of its limited resources, and due to the experimental nature of the programme, the Academy concentrated its attention on a small number of villages from which good responses were received at the initial stages of the programme. In the five villages named above power pumps were successfully used for irrigating Boro rice crop. The pumps were utilized jointly by means of village organizations developed along with the introduction of the pumps.

The method of study

The data for the study were collected and assembled during March-June, 1961. A combination of methods was used. The field investigator went out and stayed for a week in each of the five villages at a time when the pumps were being used. As per instructions he observed and recorded information regarding land, crops, sources of water, group activities, villagers' attitudes, etc. Based on this report an interview schedule was prepared, tested and through it a 15 percent sample of the members of the village co-operatives (the pump users) were interviewed from each village. A second set of interviews was conducted by means of a flexible guide-line prepared by the author. Persons interviewed were the officials connected with the programmes, the organisers of the co-operatives, and the drivers of power pumps from each of the five villages. The official records i. e. pump log-book, registers of the co-operatives, etc. were used to supplement the survey data. It should also be mentioned that the author's personal involvement with the

programmes, his visits, talks and discussions with the people furnished much valuable information which could not be collected through formal interviews.

Comments on the programme

The programme for introducing power pumps for irrigation was launched in early 1960. Earlier, close contact with the area enabled us to identify the needs of the people. It was found that many farmers were keen to grow winter crops but could not do so due to lack of irrigation facilities. We decided to make a campaign for Boro rice cultivation and the use of power pumps for irrigation. A special extension worker was appointed and sent to the field for this purpose. At the same time demonstrations of pumps were arranged at the Academy and in the villages. The extension officers made visits to villages and explained the usefulness and advantages of pump irrigation. The basic elements of the campaigns were an informal personal approach and demonstration. Demonstrations were made in fields where crops were growing.

Another point was made clear from the very beginning. It was plainly explained that pumps could not be used individually. Farmers were told they should combine and use a pump jointly for compact blocks of lands. Successful adoption would require group action and an organization to tackle the problems of pump operation and maintenance, water distribution, realisation of charges, etc. Since we considered a village as a suitable unit of organized group action, attempts were made to persuade people from the same village to come jointly for hiring of the pump and to form informal co-operatives. On some occasions individual farmers came to hire a pump on an hourly basis. Generally they were discouraged, except in those cases where the possibility of useful demonstration was anticipated. Thus the scope of our programme was limited. Out of several villages from which response was received, only those few who fulfilled the requirements were retained in the programme. The limited number of pumps and other resources available to us was another factor which kept the programme concentrated in only a few villages.

During the first year, 1959-60, only the two villages of South Rampur and Tongirpar made collective use of power pumps for Boro rice cultivation. In the second year 1960-61, the three other villages joined. After the 1961 harvest more requests came pouring in.

THE PROCESS OF ADOPTION OF POWER PUMP IRRIGATION

General awareness

Agricultural irrigation by a machine was a completely new innovation to the people of the area. In the traditional agriculture irrigation was limited to lifting water manually by indigenous devices for growing vegetables in homestead gardens or Boro rice in patches of swampy lands. Use of any kind of power driven machine in farming was completely unknown. But the communities were exposed to an environment where many other machines had been in regular use for a long period. The railway, automobiles, launches, steamers, aeroplanes, rice mills, etc., were familiar and accepted things. Even the mechanical pump machine was not an unknown thing. A machine which can lift and discharge water was known as "Dum Kal." The words "Dum" and "Kal" are synonymous with "Breath" and "Machine", Dum Kal thus meaning a machine which can suck water. People had come to know about Dumkal quite a long time ago. Each of the 58 persons interviewed in the sample survey had seen such a machine as early as 6 years before 1961 or even earlier. They saw the Fire Brigade Machine, or similar machines used by contractors or in military establishments, in action. But none, at that time, imagined the possibility of using such a machine for irrigation.

The general notion was that such a machine is used to extinguish fires and to dewater tanks. Contractors, only government establishments or rich people could own and use them. That such a type of machine could be an essential implement for agriculture was totally unknown. The 58 persons interviewed were asked when and how they realised the importance of the power pump in agricultural operations. Fifty-six persons answered the question. Their answers clearly showed that the Academy's demonstrations and organizational activities made them realise the importance of power pump in agricultural operation. More than 90 percent of the respondents became aware of and interested in the use of power pump during the last three years. Awareness and interest came through attending meetings of the Co-operatives, listening to talks and discussions initiated by officials of the Academy, and through observing the use of a power pump in their own or neighbouring villages and demonstrations arranged by the Academy.

Decision making—case studies

The individual awareness and interest in power pumps came from interpersonal interactions and observations. This was the base on which

collective adoption was precipitated. It will be interesting to examine how individual villages took the decision to adopt and use power pump. From case studies of participating persons we shall try to reconstruct the process of decision making in each village.

Tongirpar

In the case of this village the first significant event took place in an informal gossip group in a village bazar called Pipulia. This group was talking about conditions in agriculture. The local Village-AID worker with one Mr. Jaynal from Abdullahpur village happened to be present. The major rice crops, Amon and Aus, had been seriously damaged in the area for the last 3 years, and everybody was worried. Mr. Jaynal suggested that they should grow more Boro rice crop. Many disagreed with him because it would be an impossible job to irrigate the Boro rice crop and meet the demand for water. At this point the V-AID worker pointed out the possibility of using power pump for irrigation. He also indicated that a pump would be available, on hire, from the Academy. He said that one pump probably could irrigate 3 to 4 hundred acres of land. The group became interested by this proposal. But Tongirpar did not have enough suitable land. So they invited their neighbours and started calculating the possible amount of land available.

After some days the V-AID worker went to Tongirpar and called the villagers together in a meeting. Discussion started on the possibility of hiring a power pump. The worker reported that one pump could irrigate only 30-50 acres of land. The villagers made some calculations and found that they had enough land for two or three pumps. Therefore it was not at all necessary to associate themselves with other villages. Then questions were asked about the hire charges. The worker replied that for one pump with a driver for the full season an amount of Rs. 1250.00 would be charged. On hearing this most of the villagers left the meeting. They felt it would be impossible for them to pay such high charges. They thought they could not take the big risks involved. But a small group of persons were convinced the risks should be undertaken. They thought that other people would participate when they could see the pump in action. This small group decided to hire a pump. They started persuading their neighbours to join them. After some days a pump was hired and put into action. One by one the unwilling villagers came forward to joining the initiating group.

South Rampur

In the early part of January, 1960, a group of villagers were basking in the sun and talking over their problems. It was the slack season, there was nothing to do. Lalit Babu, the Academy's special extension worker for power pump introduction, entered this scene. Lalit Babu was an experienced social worker. He was not a stranger to the group. M. Ali, the present organizer of the South Rampur co-operative society was his friend. Lalit Babu joined in the discussion. He suggested that more Boro rice crop should be grown. But the villagers could not agree because they did not have enough bullocks and seeds to extend cultivation. Moreover, irrigation by hand lifting would be an impossible job. Lalit Babu assured them that a pump for irrigation could be hired from the Academy at reasonable rate. The Academy would also provide all necessary technical assistance. The group had faith in Lalit Babu. They started preparing land by using hand hoes. An informal co-operative group was formed for Boro rice cultivation. Then the Director of the Academy and other officers paid a visit. The Director made a little speech in an informal gathering. People were greatly impressed. Later they discussed the matter among themselves. They thought that they might make trial use of the pump. A few villagers came to the Academy to hire a pump on an hourly basis at the rate of Rs. 3.00 per hour. As the pump started working more people became interested in using it. The pump continued working.

Alampur

This village was associated with Tongirpar at the early stage of decision making activities in the Tongirpar village. Joynal Abedin, a member of the local Union Council, told Serajul Islam, the present co-operative organizer of Alampur, about the talk held in Pipulia Bazar. Serajul Islam discussed the matter of extending Boro rice cultivation and hiring a pump with his neighbours, but only a few showed any interest. Then one day he went to Tongirpar to meet Hamid, the organizer of Tongirpar Co-operative Society. They mutually agreed that a pump could be hired jointly. In the meeting held at Tongirpar he, along with two associates, attended. But when the plan for joint hiring was dropped, Islam and party could not take a decision to hire a pump for their own village. They came back, tried to persuade the villagers, but failed. Soon after, the people of Alampur saw with their own eyes the remarkable efficiency of the power pump working in Tongirpar. Their own fields, in contrast with Tongirpar's fields, were dried up and the plants were

starving for water. Now they requested Islam to negotiate for hiring a pump. Islam went to Bijoypur Bazar, met the V-AID worker, Abdul Hakim. A visit to the Academy was decided upon. Islam with Joynal Abedin and the V-AID worker came to the Academy. The two villagers did not know anybody at the Academy. They requested the V-AID worker to negotiate on their behalf with the Academy officials. Since half of the season was already over, they wanted a pump for the remainder of the season at half the full seasonal charge. This could not be agreed to because the Academy had to follow the rules prescribed by the Department of Agriculture and they did not provide much contingencies. The group made several attempts to negotiate but failed.

The good crop raised by the people of Tongirpar created a stir in the neighbouring villages. Alampur people decided to get ready to hire a pump in the next year. They formed a co-operative, started saving through regular deposits, and made arrangements for storage of water and all requisition of a power pump irrigation project well in advance.

Hemjora

The people of Hemjora were greatly impressed by the results of the use of power pump in their neighbouring village, Tongirpar. They discussed the possibilities of using power pumps for irrigation. A group of them came to Tongirpar to meet the organizer, Hamid Ali. They also wanted to have a pump. Hamid advised them to form a co-operative and start building capital through regular saving by the members. These were the conditions which needed to be fulfilled in order to establish a close relationship with the Academy. The Hemjora people formed an informal society and collected a reasonable amount from the members. With Hamid Ali they came to the Academy and arranged to hire a pump for the next crop season.

Sreemantapur

One day in early 1960 an enumerator employed by the Academy (a resident of a village near Shreemantapur) and Mohammad Ali, a labourer at the Academy farm (a resident of Sreemantapur village) went together to Poddar Bazar, a villag market. As it happened, in a tea stall they started discussing various matters with other villagers. The enumerator was talking about the

Academy. He advised Ali Ashraf (the present organizer of Sreemantapur co-operative) to organize the villagers to form a co-operative. A co-operative formed by the villagers could get many types of assistance from the Academy. On the same evening Ali Ashraf called the villagers together in a meeting and explained what he had heard from the enumerator. A majority of the villagers expressed their doubts about forming a "Samity". They had done so earlier, but the Samity had fizzled out when the organizers embezzled the funds. Ali Ashraf tried to convince the people to hire a power pump jointly. Some persons of the village had observed the use of a pump in South Rampur. But they could not be sure about its utility for them since, in their village, sources of water were far away from the fields.

Ali Ashraf, however, was not discouraged. Through Mohammad Ali he invited the Director and the Special Officer (for co-operatives) of the Academy to visit their village and to attend a meeting. They accepted the invitation. The Director explained the purposes and advantages of co-operatives and the Academy's programme. After this meeting the villagers formed a co-operative and started working jointly. However they did not hire the water pump for Boro rice cultivation. They first observed the result of the use of pumps in South Rampur. Then their doubts were largely removed. In the next season (1960-61) they hired a pump, but used it very cautiously. The result was so encouraging that all the people have now been satisfied with the pump's utility. They are sure to make extensive use of it in the next season.

Analysis of the case studies

It is interesting to observe the uniformities in the process of decision making in the five villages. In each case the process started at an informal small group evaluation of the innovation. Such evaluative discussion took place in village markets in four out of the five cases. In each case an extension worker was present to supply relevant information. The extension worker was invariably supported by a local leader. In the meeting held at Pipulia Bazar a formal leader (a member of the Union Council) took the initiative. He was a close associate of the extension worker. In the case of Srimantapur additional support was obtained from a local man who was an employee of the Academy farm. In South Rampur the extension worker was a close friend of an informal leader who later was elected as the organizer of the Rampur co-operative.

The small group evaluation was succeeded by one or more general meetings in the villages, where the majority villagers found avenue to express their views and attitudes. These meetings were either formally called by the extension worker or held informally through the initiative of village leaders associated with the extension worker. In these meetings the average farmers expressed their doubts and concerns and sought for sufficient assurances and guarantees against risks from the extension agency. Invariably mention was made of the needs for credit, supply of seeds, subsidy, etc. The clever persons made attempts to gain advantages from the agency. The Director and other officers of the Academy attended and addressed these meetings. It was plainly stated that the responsibility lay with the villagers themselves. The Academy would help to the best of its ability but would not spoon-feed the villagers. Much emphasis was laid on the principles and methods of organized activity and adoption of improved practices. This attitude on the part of the Academy was extremely helpful. It attracted the sincere persons and eliminated the self-interested ones whose ulterior motive was to gain some advantages. Frequent visits and informal relationships offered by the Academy staff were major factors in eliminating doubts and suspicions from the villagers' minds and in providing the feeling of security against risk involved in adoption of the innovation.

The initiative to adopt power pumps came from a small number of villagers. They were the leaders for this specific purpose. Later on, when co-operatives were formed, the organizers were elected from this group. The groups retained their initiative in the expanded programme. They were the most active in organizing field work and persuading their neighbours and friends to accept new methods. The average villagers joined them when they demonstrated the worth of the new practice.

The facts presented in the case studies demonstrate that the decision making process in the village is a democratic process. Each interested villager was free to express his own opinion, to join or reject the programme. He was given ample opportunity to judge the new method for himself and to decide about it in his own mind. The process developed through informal interactions. The role of the extension worker was advisory. He had to work through the local leaders.

LOCAL AND SUPPORTING ORGANIZATIONS

Group activities

We have already mentioned the nature of group formation in the adoption of power pumps. In each village informal co-operatives were formed. These organizations were essential for the collective use of power pumps. Initially, the groups were small in size and their activities were limited. Soon, however, more farmers joined the groups and the scope of their functions increased. The groups started saving, making joint deposits in local Agricultural Banks, planning for agricultural activities, adopting improved practices and learning new skills. Under the direct supervision and guidance of the Academy these groups started growing as significant institutions at the village level. The concepts of capital formation, planning, investment and adoption of improved practices were introduced. Detailed discussion on these organizations is, however, beyond the scope of this paper. Our description will be limited to group activities in relation to the adoption and use of power pumps.

Operation of the power pump was conducted typically in the following manner. The organizer of the village co-operative, along with a few of his associates, came to the Academy to take the pump. The pump and its accessories were handed over to them, which they then carried to their village. At the initial stage, during the first year of operation, a pump driver accompanied them. In consultation with the driver, the group selected certain sites where the pump would be placed by rotation so as to cover the total field area which was to be irrigated. This was necessary because only limited lengths of pipe were available for carrying water, and the topography of the fields and the sources of water did not permit a proper supply of water from just one place.

The organizer was primarily responsible for all these activities. But in each village several other active members assisted the organizer. All aspects of power pump use were constantly discussed in the weekly meetings of the co-operatives. The members freely contributed their labour and time in making provision for the storage of water, digging drains for carrying water, and carrying the pump from one site to another. The extent of group participation was high, as may be seen from the tabulated responses of the sample of 58 members from the five villages interviewed and reported in Table I.

TABLE I
Members' Participation in Group Work.

Nature of work	Persons Participating in the Activity	
	No.	Percent
1. Building Bund (earth work), storing water in rivers and tanks.	37	64
2. Guading the Bund.	37	64
3. Digging drains for carrying water in fields.	49	84
4. Taking care of pumps and its accessories.	46	79
5. Carrying pump from one place to another place.	49	84
Total	58	100

More than 64 percent of the members were directly involved in the major activities which comprised the successful and sustained operation of the pumps in their villages. When asked who directed them to participate in such activities 51 out of the 58 respondents replied that they did the job on their own initiative and in their own interest. Fifteen further stated that it was also in the interest of the community. A few persons also said that they were directed by the organizer and the decision was taken in the co-operative meetings. Interest of the individual members resulted in equitable distribution of water. Each member was very particular to make sure that he got his proper share of water. The more active members and the organizers assumed the supervisory role. Few complaints were made. Nine persons complained that they did not receive a proper quantity of water. Complaints were made to the organizer who took prompt action. Only one persons said that no action was taken on the basis of his complaint.

Storage and distribution of water

Proper arrangements for storage of water prior to the crop season and economical and systematic distribution of water discharged by the pumps

to the fields areas were the two most significant problems faced by the groups in adopting power pumps. Initially the groups did not realise the importance of the organized activities needed to tackle these problems. But as the pumps started working the groups learned from experience. During the first year the groups at Tongirpar and South Rampur felt an acute shortage of water. In that year they did not make any special arrangement for storage of water. In the second year, immediately after the monsoon was over, bunds were constructed across the small rivers and the banks of tanks were repaired. Except in Sreemantapur, where there was no river source, one or more bunds were constructed. They contributed their labour and all other costs in cash. By the end of the second year the groups were convinced about the need of making prior arrangements for water. It may also be mentioned that the groups did not seek any technical help in choosing the sites and conducting the earth work for the bunds.

In case of water distribution the groups, at the initial stage, showed resistance in digging water carrying channels over the entire crop area. In early 1960, when Tongirpar was visited, we found no arrangements for water channel. Water discharged from the mouth of the pipe was simply overflowing the nearest plots. Even hours later the water did not reach the distant plots. In spite of repeated insistence by the driver, no suitable action was taken. Even our advice could not convince the group. The problem was to determine who would take the trouble of performing the manual work. Soon, however, the members of the group found that without channels the pumps would be useless. The group discussed the problem and arrived at a decision. It was decided that the major channels carrying water to blocks of plot would be dug jointly. From these main waterways each individual would dig his tributaries to carry water to his own plots. This arrangement worked very satisfactorily. Within a week a network of channels was dug. When we made our next visit the whole scene had changed.

In the second year, additional land situated at a great distance from the water source was brought under pump irrigation. The Tongirpar group showed a remarkable feat in utilizing the pull of gravity for distribution of water. A mile-long drain was dug. The drain passed over a main road for some distance. Tunnels were dug under the road to take the drain to the other side. And finally an aqueduct was constructed to carry water across a marsh. The procedures adopted by Tongirpar were repeated in other villages. In all cases there was initial resistance. The groups were left alone

to realise the problems and discover their own solutions. This they did. It was most heartening to see the remarkable skills shown by the villagers in solving these problems by their own initiative and ingenuity.

Supporting organizations

The localised activities in the villages were constantly supported by the central extension agency at the Academy through :

- (i) Visits for supervisions and encouragement by the extension workers and officers.
- (ii) Discussion of problems at the weekly meetings of the organizers held at the Academy.
- (iii) Services, supplies and training provided by the Academy.

The two major sections of the central organization were the Co-operative Section and the Mechanized Unit. The Co-operative Section was in over-all charge of the organizational aspects. The Special Officer, in charge of the section, conducted the Organizers' meetings. Frequently, he attended the weekly meetings held in the evening in the villages. The organizers or any other village members had direct access to him. The pump hiring party came to him. He drew up the hiring contracts. This officer was a combination of extension-cum-executive officer.

The Mechanized Unit was more directly involved with the pump operations. This small unit, consisting of a few mechanics and drivers, provided the repair and training services.

The small central organization was the key to success in the introduction of the water pump. But no less important were the roles played by the Director and other members of the Academy, even the outside visitors. The plain dressed, hard working Director of the Academy was a source of inspiration for the extension workers and the village groups. Walking or riding on a bicycle, he visited each of the villages, attended the meetings of the co-operatives and personally supervised the field work. For the villagers he was a symbol of security. When villagers saw him among themselves they knew that they were secure in adopting the new venture. Visits by foreign observers and high officials elevated the morale of the people. In fact, there was a significant increase in the prestige of the innovations adopting villages, particularly Tongirpar and South Rampur, the two earliest adopters, in the eyes of the neighbouring villagers. The psychological

impact of frequent visits and of the free and informal personal relationship of the extension officers was highly significant. It removed the fears, doubts and the fatalistic indifference which is so deep-rooted in the minds of our villagers.

Services and supplies

The programme of power pump introduction was started in the 1959-60 Boro season with only 3 BECO water lifting pumps (H.P. 5 to 7.5), owned by the Development Office attached to the Academy. Later, one more pump was taken on loan from the local Agriculture Department office. These four pumps were used for demonstration purposes and as demand developed they were hired out.

There were two procedures for hiring out pumps. The first was the Government contract rule according to which Rs. 1250 is charged per pump for a full Boro crop season¹. The hiring agency provides the driver (operators), fuel and services. The other procedure was to charge on an hourly basis at the rate of Rs. 3/- per hour of operation. Since the Academy's emphasis was on group adoption the hiring of pumps by individuals on an hourly basis was discouraged, except in cases where there were possibilities of demonstration.

With not more than four pumps hired out to only a few groups the problem of servicing was not serious. It was not exactly simple either, because we started with nothing at hand. The Mechanised Unit grew up gradually with the programme. Moreover, unanticipated problems cropped up at the time of actual field work. A special case was the problem of the driver. Drivers of the Agriculture Department failed to work satisfactorily in the villages. Alternative arrangements had to be made by training local men. A semi-skilled maintenance worker was appointed at a salary of Rs. 100/- per month. This man looked after the pumps and provided minor repair services in the field. But when the pump from the Agricultural Department went out of order a mechanic from the Department had to be called for servicing. Our maintenance worker received in-service training from this qualified mechanic and thus improved his skill. In a few months the Academy received two tractors and purchased one Rotavator. Then, the need for a trained person was felt to be urgent. A qualified Mechanical Engineering Assistant was appointed on a salary scale of Rs. 150.00 to 300.00 per month. This unit of two persons looked after the machines and provided servicing

¹ Where the co-operative provided the driver the charge for a season was Rs. 950.00

in the field. Thus the nucleus of the Mechanised Unit at the Academy was formed. During the 1960-61 season the number of BECO pumps increased from 4 to 18. The additional 14 pumps were received from the Agriculture Department. Under a servicing contract with the Agriculture Department BECO, the pump manufacturer, had arranged to provide services for the pump. A small group of mechanics headed by an Assistant Engineer came to Comilla and stayed throughout the season. They provided all services in the field and, at the end of the season, when the pumps were brought back to the Academy, provided the necessary off-season overhauling and repair services. The Mechanised Unit assisted this team. In regard to supply of fuel no difficulty was faced. Hiring groups were provided with enough fuel in drums so that they would not require frequent visits. The Driver maintained the records of fuel consumption in a log book.

Driver

In 1959-60 the villages did not have any skilled persons who could drive the pumps. Drivers from the Agricultural Department were posted in the field along with the pumps hired out. It was agreed that the groups would provide shelter and food to the drivers, but the system did not work properly. The drivers, being outsiders, did not like to stay in the villages. In some cases very poor shelter and food were provided to them. They started applying for leave or leaving the station under false pretences. Under the circumstances we decided to train local persons in pump driving. Short training courses were conducted at the Mechanised Unit of the Academy. Each pump using group selected a person from among themselves. The person selected was paid a travelling allowance by the Academy during the period of training. These trained persons took over all the pump operations in their respective villages. Under this improved system no further problems in field operation were reported. The co-operatives decided to pay their drivers from the common fund.

During the course of this study each of the drivers was interviewed. They were found to be highly interested in their jobs. They enjoyed the work and considered it prestigious. Each of them expressed his desire to have training in pump mechanics. They expressed the opinion that with that training no outside help would be needed for the maintenance of the pumps, provided spare parts were available. At the time of interview the drivers were being paid only partially by the co-operatives. But the drivers were confident that the pay still due would be paid to them after harvesting was over.

SOCIAL AND ECONOMIC IMPLICATIONS

Pump as a group nucleus

Our experience in introducing the power pump in this area has had great significance for the Academy. It has demonstrated a technique for organizing people and for developing local institutions. The power pump as an innovation had certain advantages. It was not a totally strange machine. When adopted jointly, high initial investment per farmer was not required for its adoption. Joint adoption did not present any complex problem. The result of adoption was demonstrable in a short period. With these favourable factors, the power pump became a nucleus around which a group could form. This power pump nucleus group had a common interest and worked jointly. This group was the basic structure on which a formal co-operative institution at the village level was developed. The irrigation pump provided the initial power to break the prevailing inertia, to bring people together, to provide them a chance to see the implications of co-operation. The villagers themselves were aware of this fact and recognized that the power pump was instrumental in bringing them together. In answering a question about what benefit they received from the pump 44 persons out of 58 (76 percent) said that the village co-operative was formed through the power pump.

It is well known that no organization can be formed without some common interest or interests on the part of the participants. The common interest is generally presented in an abstract form. The need and usefulness of co-operation is explained in terms of abstract ideas. In the present case, however, the power pump symbolised these ideas in vivid and dramatic form. That the power of a machine combined with the power of united group effort can give the strength and courage to fight nature and achieve victory was demonstrated. Our experience showed that a machine with some favourable characteristics can serve very well as a nucleus for organizing the villagers into a group which may lead to the development of local institutions.

The second point of significance was that acceptance of the new technology demanded a set of new organizations, the village co-operative and a central organization supporting it. Without the development of such organizations our programme could not succeed. Considerable time was spent in explaining this fact to the people and to take concrete action along this line. Use of the power pump could not be an isolated improved practice in agricultural operation.

Seeds, manures, loans, etc. were needed for cultivation. Therefore, of necessity, the new organization had to tackle all these interrelated problems that were confronted by the village agriculture.

Again, in our villages, agriculture is a way of living. Therefore the organization which dealt with agriculture had its influence over the total village life. In each of the five villages included in the present study there were cases of social problems settled by the village co-operatives. We could observe the revival of the functions of the traditional body of village elders, the 'Samaj', in the co-operatives.

Our experience has clearly shown the important elements of a technological change. Introduction of a new technology induces development of corresponding new social institutions. On the other hand, a new technology can take root in traditional soil only when an equivalent human organization is developed through planned efforts for its support.

Opinions and attitudes

In an earlier period the general opinion was that the power pump as a machine had no relevance to the traditional agriculture. The concept of mechanization in farming was totally absent. But awareness about or actual observation of power pumps at work aroused the villager's curiosity. Villagers wondered aloud about the cleverness of the people abroad who had made these powerful things which reminded them of other kinds of machines. The power pump was associated in their minds with cities and towns, with the rich, educated, privileged classes of society. People were curious to see a pump working. They enjoyed seeing its tireless power as they would enjoy visiting a zoo or a circus. Their uninvolved attitude started changing into involvement as demonstrations were performed in the fields and the functions and uses of the machine were explained. But the over-estimation—that the pumps could do impossible things—remained till the individual farmers had made use of them for a full crop season. Close observation and experience in actual use removed most of these misconceptions about the machines.

During the first year, in South Rampur and Tongirpar, attempts were made to bring as much land as possible under irrigation by a single pump. The objective was to reduce the cost per acre or per person by increasing the area irrigated and the number of pump users. Little attention was paid to the capacity of the machine. People were greatly concerned about the cost. There was great fear of risk and all possible care was taken to minimize it by

reducing the individual investment. This ultra cautious attitude lost its intensity during the second year or, in the case of late adopters, when reliance on pumps increased due to the good results which had been achieved earlier.

In response to a question on what benefits were received from use of the pump, each person gave emphatic positive answers. "Pump has saved us", "Without pump it would be impossible to cultivate so much land", "We have received a crop which has never been grown at this time of the year", "Pump has brought unity among us", and "We have formed a samity", were the types of answers received. When asked about the disadvantages of pump use an overwhelming majority replied that there was no disadvantage. A few persons said that transport of pump from one place to another was laborious: They suggested that the machine should have four wheels instead of two. Some farmers stated that it was difficult to work in the fields due to cold weather ; they found that working with bare feet on wet ground was specially painful.

The most frequently cited reasons given by the farmers for not using the pump earlier were lack of knowledge about the pump, non-availability of pumps and lack of organized activities. Once the proper programme was taken up the farmers could see why they had not been able to use the pump earlier. They could now visualize the proper use of pumps in future. Thus, a very high proportion of the 58 persons interviewed reported that they would use the pump for irrigating Aus and Boro crops. Many of them further reported that they would use the pump for rabi crops as well. Use of power pump for other purposes was also kept in view. More than half of the interviewees reported possible use of the pump for dewatering tanks. One person said that pumps owned by the village could be hired out to other villages.

As regards how they could continue use of the pumps there was general agreement that the village should purchase its own pumps. But, for the individual, purchase of a pump would not be possible. Therefore pumps should be purchased jointly. It was suggested by a majority that joint purchase would be possible if payments were made by instalments. Only a few persons, however, could realize the implications of owning pumps jointly. When asked about the problems of joint ownership these few persons mentioned the problems of sharing responsibility, services and operation, etc. One rich farmer said he thought that joint ownership would not work. He was in a position to purchase a few pumps. He could see the business possibilities in purchasing a few pumps and hiring them out to the villagers.

Economic benefits

Adoption of power pumps substantially increased the productive activities in the adopting villages. The idle days of winter were filled with brisk activities. One could hear the constant puffing sound of the pumps

working. People were busy in digging drains, transplanting and sowing paddy. In South Rampur and Tongirpar, village roads were transformed into water carrying drains. The earthen bunds across the small rivers were proud exhibits. People from distant villages came to see these operations.

There was a great increase of boro cultivation in the villages due to use of power pumps. Figures obtained from a sample of 58 persons are presented in Table 2. These figures show the extent of increase in Boro rice cultivation. The table also gives comparative figures for Boro rice cultivation by hand irrigation, the traditional method.

TABLE 2
Increase in Boro Cultivation in Five Villages Adopting Power Pump.*

Total No. of villages	5
Total No. of persons interviewed	58
Total rice land owned by these persons	189.20 acres
Total rice land suitable for Boro rice cultivation if water is available.	87.25 " (46 percent of total land)

Year	Type of irrigation	Number of persons cultivating Boro rice	Total area cultivated for Boro rice (acres)	Area per person. (acres)
1958-59	Hand	26	19.74	0.76
	Pump	0	0	0
	Total	26	19.74	0.76
1959-60	Hand	28	22.60	0.81
	Pump	26	13.80	0.53
	Total	43	36.40	0.85
1960-61	Hand	29	15.95	0.55
	Pump	39	44.82	1.15
	Total	52	60.77	1.17

* Data obtained from a sample of 58 farmers, a 15 percent sample of the members of the Co-operatives.

Since the introduction of power pump the number of Boro rice growers and acreage under Boro crop have increased rapidly. From the 1958-59 to the 1960-61 season the number of Boro rice growers doubled. The acreage under the Boro rice crop was increased by three times. In 1958-59 only 23 per cent of the potential land available for Boro cultivation was actually cultivated. In 1960-61 this figure rose up to 70 per cent. Power pump replaced the traditional method of irrigation by hand. In 1958-59, twenty six persons cultivated Boro rice on about 20 acres of land by hand irrigation. None used the power pump. In 1960-61, twenty nine persons cultivated Boro rice by hand irrigation on only 16 acres of land. Thus there was a decrease in acreage of land irrigated by hand. It may be noted here that some persons used both the methods of irrigation. This fact explains the 'total persons' figures in Table 2. The figures show the number of persons who cultivated Boro rice by using either or both the methods of irrigation as classified in the table.

Figures of the yields obtained from the farmers show that total production from Boro cultivation was increased by more than 200 percent. In 1958-59 the total production from 19.74 acres was 348 maunds of unhusked rice. Per acre yield was 17.6 maunds. In 1960-61 total production from 60.77 acres was 1173 maunds of unhusked rice. Per acre yield was 19.3 maunds. Thus it seems that use of power pump also increased the yield per acre.

The economic significance of power pump use was that farmers could get an additional crop from land which otherwise remained idle during the most lean period of the year. This life-saver food-grain crop was a great help to the farmers whose major rice crops—Aus and Amon—were continually damaged by floods.

The use of power pump was an economic operation. In Table 3 an economic analysis of production and cost is presented. The figures of total land irrigated by power pumps and charges for power pumps were obtained from the official records. The figures of per acre yield and cost of cultivation in cash and in kind were estimated from the sample survey data collected from the 15% sample of the members of co-operatives. The total cost figures shown in the last column do not include the pump drivers' pay. The co-operatives paid their drivers from their own funds. All figures relate to the 1960-61 season. In Tongirpar three pumps were used. In all other villages only one pump was used.

TABLE 3

Economic Analysis of Power Pump Use in Five Co-operative Villages,
1960-61.

Village	Total land irrigated by pumps (acres)	Yield per acre	Per acre cost of cultivation-seed, labour and fertilizers cash and kind (Rupees)	Per acre Cash charge for pumps ² (Rupees)	Total cost per acre (Rupees)
Tongirpar ¹	88.17	19.3	106	26.9	142.9
Hemjora	39.71	20.9	90	23.9	113.9
South Rampur	27.90	15.8	99	34.0	133.0
Shreemantapur	31.35	21.1	116	30.3	146.3
Alampur	36.74	20.8	88	25.9	113.9
Total	223.87	19.3	97	27.7	124.7

¹ In this village three pumps were used.

² Excluding drivers' pay. Charge for a season was Rs. 950.00

The figures for yields show little variation. In South Rampur the crop was partially damaged by hail storm. Cost of cultivation did not include farmers' own labour. The figures show some variation but within a small range. As the rent charged for a pump was fixed, the figures of power pump charges vary directly with the actual area irrigated.

The figures for total cost do not include the cost for driver's pay. At the time of the study a total amount of Rs. 719 had been paid to the 7 drivers of the five villages. The drivers reported that some amount of pay was still due to them. At a generous estimation the cost for a driver should not go above rupees five per acre. With this estimate we may modify the total cost figures by adding Rs. 5.00 to each of them.

On the average, the total cost of producing 19 maunds of Boro rice by using power pump irrigation was Rs. 130·00 only. About 24% of this cost was incurred for using the power pump. As against the total cost the farmer received 19 maunds of unhusked rice whose value at the current market price (Rs. 15·00 per maunds) would be Rs. 285·00 only. Thus, the net gain was Rs. 155·00. The net gain per acre was more than the total investment in cash and kind on land for this particular crop.

CONCLUSIONS

In this last section we may summarise the conclusions drawn from the study of group adoption of power pump irrigation in the five villages. These conclusions are based on facts observed under limited conditions. Therefore great care should be taken in making generalisations from them. They may prove useful however, in designing further studies under varied conditions.

1. In our experimental programme no significant social or psychological force prevented the introduction of power pumps in the area. People were keen to adopt the machine when they learned how it could be used and found that its use was profitable. A similar receptivity was experienced in the introduction of power tractors for cultivation in this area. People accepted these innovations quickly. These facts indicated that there was no major social or psychological barrier which might prove a big handicap in introducing mechanization in the traditional agriculture. The real problems were educational, organizational and economic.

2. The educational problem consisted in developing a system through which a continuous flow of information and ideas could be maintained between the agencies and the people. The importance of field demonstrations in showing people how the machine could be applied in their own situation was recognised. It was found that such demonstrations created the specific awareness and interest which resulted in group action when attempts were made to initiate such action. Once people mentally accepted the innovation the educational problems became more important. Arrangements had to be made to introduce basic skills in the villages through frequently repeated short training courses.

3. Economic considerations, primarily, led to group adoption of the power pump. The group adopting a pump had to work jointly for which an organized body was needed. It was found that a village level organization on co-operative lines, and a system of supporting this organization through a central body, worked well. The village co-operative catered to the local people's needs and organized the necessary voluntary group actions. The central organization played the role of an advisor, educator and supplier of goods and services. An interesting fact observed was that the pump itself played the role of a catalytic agent in forming and solidifying the group.

4. Group adoption of power pump was found to be a highly economic operation. This fact was quickly recognised by the villagers. The factor of calamitous risk was greatly reduced because each adopter was sharing the risks in an organized way, and there were higher levels of the organization associated with Government which would provide all assistance in case of unforeseen disasters.

The process of group adoption and decision making observed may be summarised as below :

- (a) General awareness about the power pump. At this stage people knew about the machine but did not know that it could be used in agriculture.
- (b) Awareness about the power pump applied to agricultural operations. At this second stage, awareness stimulated interest.
- (c) Evaluation of the innovation by a small group of leaders. At this point the process of decision making commenced and specific communication between the group and the agency started.
- (d) Presentation of the case to the total village in meetings organized by the initiator-leaders. Here each individual was given a chance to express his views in the complex process of achieving a group decision.
- (e) Initiative displayed by the leaders in making trial use of the power pump.
- (f) Acceptance of the joint innovation adoption programme by the more cautious and conservative people after they had seen the positive results of trial use.

5. Adoption of power pump was a democratic process. Intensive educational work and a very high intensity of personal contacts through regular meetings, training courses, field visits, etc., greatly speeded up this process.

APPENDIX

A Note on the up-to-date position of Power Pump adoption.

This note is added to the report with a view to give the readers an up-to-date picture of the impact of power pump introduction in Comilla Thana—our 80 square mile experimental area. Now, in November, 1961, one can notice the development of organized activities to extend irrigated winter cultivation by the use of power pumps. In 1960 only a few villages adopted power pump irrigation. To-day a large number of villages are ready to use power pumps. The unit of operation is no longer going to remain within a single village—several villages are associating themselves with a co-operative village and making joint plans. To-day there are 50 co-operative villages under the Academy's programme. The organizers of the co-operatives discussed in detail the problems of water storage in the area. The matter was also discussed in the Thana Council—the Basic Democracy unit. They planned a line of action which is being executed at a remarkable speed. Bunds have been constructed across the three main rivers so that a maximum volume of water may be stored. One of these bunds, with a sluice gate, has been constructed by the Water and Power Development Authority. Thirteen smaller bunds have been constructed at strategic places spread over the area.

These bunds have been constructed by the local people with no or very little help from the Government. The village co-operatives took the initiative. They mobilized groups of villages and organized voluntary labour. In a few cases Union Councils initiated action. But, in all cases the co-operatives worked in close association with the Union Councils—the local self government units. The Thana Council played a co-ordinator's role.

The central organization located at the Academy has strengthened its position. The Academy is working with 50 village co-operatives. Sixty four pumps are ready to be hired out. It is expected that all of them will be hired out. The mechanized unit is well prepared to provide field services.

The unit is conducting training on operation and mechanics of power pumps. A substantial number of villagers have already been trained. This year the pumps will be operated by the village drivers.

In the villages groups are now being formed spontaneously. It has become difficult for the Academy to keep direct contacts with all these new groups. The villages around a co-operative village are coming forward to join hands with the co-operative village to make joint plans. Thus the unit of operation of power pump is becoming larger. The co-operative villages have assumed the role of leadership. In addition, they are also playing the role of local agents.

The earlier demonstration of power pump use by a few villages has grown into a community action programme. This has been possible because of the development of local organizations like the co-operatives and linking them with the Basic Democracy units.
