COMPARATIVE STUDY OF PITHUWA AND CHAINPUR IRRIGATION SYSTEMS[1]

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INTRODUCTION

Farmer-managed irrigation systems are found in diverse environments and employ a wide range of technologies to exploit different types of water resources for the production of a variety of crops. All these irrigation systems require certain tasks to be accomplished if the system is to function productively. One set of management activities directly focuses on water. The water needs to be acquired, allocated, distributed, and if it is in excess, drained. A second set of management activities are concerned with physical structures for controlling water i.e., design, construction, operation and maintenance. A third set of activities focuses on organization to manage the water and the structures, i.e. decision making, resource mobilization, communication, and conflict management (Martin and Yoder 1986).

There is a positive interaction among the activities of these three sets for the operation and management of the systems and they have a direct impact over productivity. All the activities may not have equal priority in every irrigation system, however the priority is based on the need encountered in each specific situation (Martin and Yoder 1986).

The farmers' investment in irrigation in Nepal has gone largely unrecognized until recently, though over 70 percent of irrigation in the Tarai and over 90 percent in the hills are managed by farmers (Water Resource and Energy Commission Planning Unit [WEC] 1981). The pressing need to expand the use of irrigation for increased food production has prompted a search for new models and alternatives. Upadhyay and Koirala (1981:100-110) suggested that the experience, expertise, technology and knowledge that the local communities already have in building and operating the irrigation systems can be tapped by engineers and agriculturists for improving the performance of government-managed irrigation systems.

One of the first steps in understanding the farmer-managed irrigation systems of a country or a region is to document their nature, size, and the range of technologies employed in the operation of the systems. In order to incorporate farmer systems into the larger public sector irrigation development without losing the benefit of the experience and knowledge they present,

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irrigation activities and the ways in which the farmers organize to carry them out need to be identified and understood.

Therefore, a comparative study of the Pithuwa (agency-constructed and farmer-managed) and Chainpur (farmer-constructed and farmer-managedl irrigation systems in the Chitwan valley was undertaken to obtain data on organizational pstterns and irrigation activities such as repair and maintenance, resource mobilization, water allocation, water distribution and conflict management.

METHODOLOGY

Various informants within the command areas of the two irrigation systems were interviewed using a questionnaire. The questionnaire covered historical development, characteristics and performance of agricultural services and production, characteristics and performance of the physical system, and the social and institutional systems. Some unstructured interviews were also conducted during field visits to gain a general understanding of the irrigation procedures and farming systems.

The five-member study team walked from the head to tailend of the systems to identify the nature of diversion structures, characteristics and performance of conveyance structures, water allocation practices, and cropping patterns.

DESCRIPTION OF THE TWO IRRIGATION SYSTEMS

The Pithuwa irrigation system is a government-constructed farmer-managed system, named after Pithuwa Village Panchayat which falls within the command area of this project. The Chainpur irrigation system is a farmer-constructed farmer-managed system named after Chainpur Village Panchayat. Water has been tapped from the Kair Khola for both systems.

Though a perennial source, the discharge from Kair Khola diminishes considerably during the dry months. At the point of abstraction in the Kair Khola, water is diverted to the Pithuwa and Chainpur irrigation systems through separate intake structures. The point of abstraction of both systems being the same, water is diverted to the Chainpur system during the day and to the Pithuwa system at night during the dry season. Water is utilized for drinking purposes in the Chainpur system in the dry season since no drinking water facility is available. Although there is no written agreement, this understanding is strictly followed.

The canal network of the Pithuwa system extends through ward numbers one to nine of Pithuwa Village Panchayat except ward number six, which includes three villages in the command: Khairate, Madavpur and Pithuwa. The Chainpur system irrigates ward numbers three, eight, and nine of Chainpur Village Panchayat, covering four villages: Gaindehal, Kunaghari, Hatiledh, and Ladriko Dil. The command boundary of these systems is depicted in Figure 1. The command area of the Pithuwa system is 900 bighas (600 ha), whereas the Chainpur system covers a recorded command area of 98 bighas (67 ha). However, the actual irrigated area comes to a total of 233 bighas (158 ha).

Figure 1. Command area of Pithuwa and Chainpur Irrigation **systems.**

The Pithuwa irrigation scheme was implemented in 1967 under the minor irrigation program supported by the Regional Directorate of the Irrigation Department at a cost of Rs 75,000.00. A possibility for expansion of the command area was realized since the water supply in the Kair Khola was not a limiting factor for summer paddy cultivation. In 1971 the main canal was enlarged up to the Pithuwa market. Construction of outlets at the branch canals and modification of the old canal network were also accomplished. After the construction, the command area increased to 200 bighas (137 ha). The additional cost of construction was Rs 125,000, funded by the Department of Irrigation, Hydrology, and Meteorology (DIHM). To develop a better conveyance and regulation facility, a rehabilitation program was launched in 1974 which resulted in construction of a permanent head regulator, construction of a service road, and a number of outlets. The rehabilitation cost incurred was Rs 110,000, supported by DIHM. With these improvements, the command area of this system increased to 900 bighas (600 ha).

The history of the construction of the Chainpur system dates back to 1961 when the diversion and canal construction was started utilizing only local expertise and resources. The construction cost was Rs 1,800 and the operation started after July 1961. However, even during the monsoon, water was insufficient for irrigation. In 1972 a new canal was constructed with the intake approximately 3.5 kilometers (km) upstream of the old intake. The new canal was incorporated into the old system. This change provided sufficient water for irrigation during monsoon paddy season and drinking water during the dry season. The district panchayat provided Rs 17,000 and the technical assistance of an engineer to plan the canal alignment. The farmers mobilized labor estimated to be worth Rs 34,000 for the construction of the new canal.

Physical characteristics and distribution system

No permanent diversion structure exists in the Kair Khola for either of the systems. Every year an earthen weir is constructed by piling stones, sand, and dirt across the river. In the Pithuwa system water is diverted into the main canal through an earthen approach canal 75 meters (m) long from river to head regulator. After every high flood the weir and the approach canal are damaged, requiring frequent repair taking two to three days. A bulldozer has been provided by the Chitwan Irrigation Project to repair the approach canal and the weir during the rainy season. The network includes 16 branches and a main canal of 7.5 km. Piped outlets from the main canal have been provided at the branches. There are 19 masonry falls constructed in the main canal to stabilize the canal bed. The main canal runs in a north-south direction with the branches running east or west.

The designed discharge capacity of the main canal was 1,400 liters per second (liters/s) at the time of construction of the Pithuwa system. A heavy reduction in the carrying capacity of the canal occurred due to silt deposition in the canal bed. The canal is operated throughout the year. Over 600 households are served by this system.

In the Chainpur system a temporary check dam is constructed by piling logs, brush, and stones across the river to divert the water into the main canal. Water flow of 410 liters/s has been recorded in the Chainpur main canal (WECS 1985). The length of the main canal is five km with a trapezoidal cross-section. The canal network includes 10 branches to convey water to the farmers' fields. No change in the alignment has been made since the canal was first constructed. However, a few permanent structures such as flumes and aqueducts have been constructed after a major expansion program in 1972.

Temporary checks are made in the main canal at each outlet to divert, water into the branches. The amount of water allocated to each branch is calculated on the basis of area to be irrigated. Water allocation to branch channels is decided on a time basis. In the lean period, farmers get water through branch channels in rotations. Those who shared more labor and money for the construction of the system in the beginning have the right to sell water *to* other farmers not receiving water for irrigation according to the cumulative sharing of the cost of construction of the system. Once the share is sold to someone, the buyer of the land is entitled to water. Due to this the recorded command area is far less than the actual irrigated area.

Agricultural services and production

Farmers in both systems have adopted more or less the same cropping patterns. However, the farm sizes are smaller in the Chainpur system as compared to the Pithuwa system. Therefore, there is grenter intensification of farming practices in Chainpur, which has resulted in higher yields per unit of area in the Chainpur system. The other reason for higher yields in the Chainpur system is the cultivation of farms by the owners themselves. In Pithuwa village a share-cropping system is commonly practiced, resulting in relatively lower yields. In the share-cropping system the landowner provides all the inputs and the labor is supplied by the share-cropper. Each contract is valid for one crop season, particularly for paddy, and the product is distributed equally between the landowner and the share-cropper.

Paddy and maize are the major summer crops in both localities. The majority of the farmers grow paddy as the main summer crop. Among the winter crops, mustard and wheat are common. The cropping patterns in both areas are maize-paddy-mustard, paddy-wheat-fallow in the irrigated area. In the unirrigated areas the popular crop rotations are ghaiyapaddy (upland rice)-mustard-maize, maize-mustard-fallow, and maize-wheat-fallow. The cropping intensity is slightly higher in Chainpur (275-280 percent); in Pithuwa the intensity is 250-260 percent.

Masuli is a commonly grown paddy in both areas. **4** few farmers also grow IR-20 and IR-84 cultivars **of** paddy. RR-21, Lerma-54, and Siddartha cultivars of wheat are in extensive cultivation. Rampur yellow in summer and Arun in spring are the dominant varieties of maize in the area. In mustard, the Chitwan local variety is grown extensively. Although the Sajha Depot (cooperative) supplies chemical fertilizers and improved seeds, the sources of information for improved seeds and the use of chemical fertilizers are the innovative local farmers. Other minor crops grown in the area are black gram on the bunds of paddy fields and potato and other vegetables at the, kitchen yards and paddy nursery fields during winter.

The use of chemical fertilizers **is** limited to wheat and mustard crops in both systems. Nearly **95** percent of the farmers use chemical fertilizers for mustard, and 60 percent of them use it for wheat. However, the quantity of fertilizers used falls far below the recommended doses. The cooperative, located in Pithuwa Panchayat, is the source of supplies of these inputs for both systems. Farmyard manure is used extensively in both localities.

Free flooding **is** the common method of irrigation in both systems. The water holding capacity **of** the soil is medium to high. Furrow irrigation is limited to vegetables. The farmers rely on their own experiences to help them

plan irrigation schedules depending upon the critical stages of the crops. There is no alternative source of irrigation in both command areas.

Organization for irrigation management

Strong organizational structures to supervise the ope-ation of and maintenance of the systems have been formed by the farmers of both systems through selection/election. The members of the organization decide the schedule of the major repair and maintenance program as well as resolve the conflicts arising due to water share and resource mobilization. The organizations are known as Kulo Samitis (canal committees) and have the respective functionaries shown in figure 2.

Figure 2. Functionaries of the Pithuwa and Chainpur systems.

Pithuwa irrigation system	Chainpur irrigation system
-Chairman (village pradhan)	-Chairman (selected/elected)
-Mahasachib-selected/elected (general secretary)	- Vice chairman (selected)
-16 members (chairpersons from the branch committees)	-10 members (one from each branch) (selected/elected)
	-Member secretary (elected)
	-Treasurer (selected)

In Pithuwa no water distribution policy was formulated after completion of the canal network by DIHM which resulted in conflicts over water shares. More powerful farmers encroached upon the rights of others. A prominent farmer of branch number 14 organized all the farmers of this branch into a committee. The committee formulated rules and regulations for water allocation and distribution of this branch. With the farmers' participation in the committee, the conflicts arising due to water share decreased quickly. The example set by this branch was observed by the farmers of other branches and they started organizing themselves into committees. Eventually all the farmers formed branch committees for water allocation and distribution. Once the branch committees started working satisfactorily a federation of branch canal committees was created by the elected/selected members of the general assembly of farmers known as Main **Kulo** Samiti.

The Chainpur system started with an irrigation system construction committee. This committee emerged as the Main Kulo Samiti after the water was released for irrigation. Those who contributed more labor and money for the construction of the system in the beginning had the right to sell water shares to others on the basis of cumulative sharing of the cost of construction, repair, and maintenance of the system. The selling of water shares started with the change of the source upstream which allowed water to be made available to an expanded area. This has created a feeling of equal ownership among the new members and hence, the Kulo Samiti is a strong organization. Other binding factors contributing to the development of a strong committee are the varied uses **of** water. The farmers are totally dependent on

the water in the canals for household and livestock use. This has necessitated continuous repair and maintenance of the system.

The Chainpur farmers were engaged in a legal court case for the past five years due to the new irrigation canal diverting water from the same intake to cover an area at the upper side of the present system. The farmers had to spend more than Rs 60,000 for legal expenses. This has further acted as a strong binding factor for the unification of the farmers although they had to spend more money in the legal case than the cost of repair and maintenance. The farmers are highly motivated with the court decision court in their favor.

In both systems all farmers owning a water share are members of the general assembly. The general assembly meets once s year in the month of June in both systems. The date for the meeting is decided by the chairman of the Kulo Samiti. In the case of the Pithuwa system, Pithuwa Village Panchayat is the meeting place. In the Chainpur system, the meeting place is usually "Tilangeko Chhautaro," which is situated in the middle of the canal network. In both systems, at the general assembly a budget for the following year is formulated. Plans are made for major annual maintenance which begins shortly thereafter; new officials are selected/elected; and operating rules for the year are reviewed, amended, and formulated as necessary.

In Pithuwa, the chairman of the Main Kulo Committee is responsible for organizing, supervising, and coordinating the works done in the system. The mahasachib keeps the accounts, records of members, and records of water allocation and attendance at the work assignments, in addition to recording the minutes of the meetings of the Main Kulo Committee.

A similar organizational structure is followed in the branch canal committees. There are chairman, sachiv (secretary) and representative members of the branch. The number of members may vary as needed. The chairman of the branch committee represents the branch committee at the meetings of the main committee. He communicates the decisions made by the Main Kulo Committee to the branch committee and the farmers of that branch. The secretary of the branch committee keeps the records and implements the decisions of the branch committee. He supervises the water rotation schedule.

In Chainpur, the kulo chairman calls the meeting of the Kulo Samiti whenever there is a need to discuss problems related to the management of the system. The members from each branch are responsible for looking after the allocation and distribution at the branch level and the conflicts related to water shares. They are also responsible for repair and maintenance of the branch canal in addition to mobilizing labor and budget at the time of major repair in the main canal.

Resource mobilization for repair and maintenance

There is a major difference in the repair and maintenance practices between the two systems. The Pithuwa system was constructed by public investment and the maintenance of the main canal was done by Chitwan Irrigation Project until 1983. Thereafter Rs 100,000 was allocated by DIHM for the annual maintenance of the system. For the year 1986, the money made available for repair and maintenance was Rs 31,000. This money was handed over to the Pithuwa Main Kulo Committee. At present the Main Kulo Committee looks after the total maintenance of the system which includes desilting of the main canal, repair of the diversion structure, maintenance of service roads, and repairs of outlets. Though repair and maintenance of the

main canal and outlets is done once a year, the diversion weir in the Kair Khola needs frequent repair. The committee has to set aside at least Rs 15,000 to pay for fuel for the bulldozer. The desilting of the main canal and branch canals is done by the farmers themselves. Additional cash required and labor contributions are raised from the beneficiaries on the basis of size of holding. The labor contributed last year for such repair was equivalent to 1,200 man-days.

In the Chainpur system two persons per household are required to wcrk when desilting of the main and branch canals and repairing of the intake structure is undertaken, irrespective of size of landholding. However, the monetary contributions for such works are decided on the basis of cropped area. For rehabilitation works which may include repair of dikes or construction of permanent structures, a contract is given. For such works the payment is made from the budget of the Kulo Samiti. Unlike the Pithuwa system, the budget includes the money collected as water fees (fixed by the Kulo Samiti, not the government fee), fines imposed on defaulters, monetary contributions from the farmers, and sometimes assistance received from local or district panchayat offices.

In both systems, there are standing rules and regulations for resource mobilization. However, Chainpur imposes more severe penalties upon defaulters than Pithuwa does. This is because Chainpur cannot function without effective local resource mobilization. On the other hand, farmers at Pithuwa had the full cost of repair and maintenance supported through government agencies. However, the situation during the last two years has changed and the Pithuwa farmers have gradually taken over the responsibility of repair and maintenance. Since the labor for maintenance work is contributed by the farmers themselves, farmers are reluctant to pay water fees to the government.

Conflicts arising due to water share are resolved at two levels of organization in the Pithuwa system: in the branch kulo committee and the main committee. The general secretary determines the penalty for defaulters depending upon the severity of the violation. Defaulters must either pay a fee of Rs 25 (approximately equivalent to wages for one day) or their share of water is withheld.

In the Chainpur system punishment varies according to the violation. If the water fee is not paid, the water supply is stopped until the fee is collected. If labor is not shared at the time of repair and maintenance a fine equivalent to the maximum wage rate is imposed. In the instances of water stealing, a penalty of Rs 50 to Rs 500 may be imposed depending upon the severity of the violation.

CONCLUSIONS AND IMPLICATIONS

Although the primary purpose of our study was not the comparison of these two systems, in the course of study some recommendations and their implications emerged.

1. An earthen diversion structure in Kair Khola requires huge inputs of labor and money for repair and maintenance as these structures are washed out after every high flood. A permanent or semipermanent diversion structure and river training work at the point of abstraction are urgently needed.

2. There is a remarkable increase in the command area of the Chainpur irrigation system resulting from the selling of water shares to new members who have to share the construction and repair costs. Selling shares was possible only after the source was changed, which made more water available. The system is getting stronger year by year in terms of resource mobilization and hence, more water is available for irrigation. Water is also used more efficiently with increased area and more resources mobilized for repair and maintenance of the system.

In the agency-constructed systems such as Pithuwa, expansions of the system are possible but intensification is extremely difficult once the agency defines the command area. For example, branch number 16 has been recently expanded, but intensive use of water is not possible because it is located at the tailend and was later expanded. Perhaps, as government grants for repairs and maintenance decrease, farmers will realize the need to use water more efficiently and perhaps even expand the area to generate sufficient funds for repair and maintenance.

3. The multifarious uses of water in the Chainpur system have necessitated a continuous supply of water in the canal. The need for drinking water has been acute in an adjoining area and there are instances of conflict between the farmers of the command area and outsiders. There was also a legal dispute over irrigation water. If standard water regulations are enacted by government, unnecessary expenses on legal cases could be avoided and resources spent for such cases could help to build common permanent structures at the source instead.

4. The farmers' intervention in the operation and maintenance of the system has improved the reliability of the water supply in the Pithuwa system. This suggests that perhaps repair and maintenance could be better accomplished with the farmers' participation rather than through government intervention.

5. The Pithuwa irrigation system's Main Kulo Committee and branch committees have had a remarkable influence on the intensive use of water throughout the year. Perhaps this is due to the large size of holdings and tenant cultivation practices. These have resulted in lower cropping intensity although water allocation patterns are similar to the Chainpur system. Chainpur system farmers on the other hand have higher cropping intensity and even higher productivity, particularly for winter crops due to intensive cultivation practices and owner-operated farming.

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