Developing Share Systems for Sustainable Water Users Associations in Nepal

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BACKGROUND

FOR CENTURIES THE farmers of Nepal have been harnessing the country's water resources for irrigation. This has been accomplished through local village water user associations (e.g., farmer-managed irrigation systems) that equitably share water and the cost of operating and maintaining systems (Pradhan 1989). Frequently these associations have irrigation fee receipt books, membership certificates, water ledgers, and even association stationery to attest to their management capability. Although until recently they have not had legal status, they are now being recognized by the government for the important role they play in natural resource management and land development.

As Nepal's population increased dramatically during the late 20th century, the need for more intensive and extensive irrigated agriculture became necessary. From the mid-1960s, the Government of Nepal (GON), with donor assistance, became actively involved in constructing and managing new irrigation schemes, and assisting in the rehabilitation of existing farmer-managed irrigation systems.

During the past decade the donors and the GON began to realize that the new government-built and agency-managed systems did not exhibit the same management capacity as the smaller autonomous association systems of the hill country. At first it was believed the problem was the mere size of the government systems. Criticism has been directed at the irrigation agency for under-management. At other times, inappropriate technology has been viewed as the problem, or inadequate construction, or lack of beneficiary involvement in the design and construction of these systems, or the dependency of farmers on government assistance. Regardless, the large government-donor financed irrigation systems are not as productive as they could be today. This is having a serious impact on food production, particularly in the Terai (plain area) of Nepal where most of these systems are found, and where the country's future production is said to exist.

Only after the onset of democracy did it become possible for the GON to begin developing a policy designed to blend traditional indigenous lessons with the management problems being confronted in large agency-managed systems. It is clearly a learning process, but the Department of Irrigation (DOI), under the Ministry of Water Resources, is now in the process of adopting very innovative farmer-centered approaches to irrigation management, and should be commended. They are drawing upon their own nation's traditional experience in water management to inform the overall management transfer process.

HIS MAJESTY'S GOVERNMENT/NEPAL'S (HMG/N) CURRENT POLICY AND STRATEGY

Management Transfer programs involving irrigation system turnover and joint-management set out in the Irrigation Policy 2049 (1992) are the basis of the GON's strategic objective in the irrigation sector. This policy emphasizes the transformation of agency-managed systems to farmer controlled systems.

In addition to more direct farmer involvement in system management, the policy is designed to expand economic opportunities for increased production and income. These are to be realized through improved irrigation system performance provided by water user associations (WUAs). These are key development objectives in HMG/N's plan to stimulate agricultural growth.

For management transfer to occur, it is necessary to establish viable WUAs. However, the formation of a WUA is only the first step. The association must be financially sustainable. It must operate as a "business house." It must be able to serve the interests of beneficiaries effectively. It must be accountable for delivery of irrigation services through the enforcement of rules and regulations for operation, maintenance, financial accounting, and seasonal planning.

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This poses a challenge to those involved in irrigation development in Nepal. How can such a WUA be formed? How can the policy pay off in terms of productivity? Fortunately in Nepal, as suggested earlier, the answer frequently lies in the indigenous farmer-managed irrigation systems which cover nearly two-thirds of the irrigated area of Nepal.

The issue of sustainability has many dimensions including environmental and economic ones. The scope of this paper is limited to the simple but important topic of sustaining irrigation infrastructure through routine operation and maintenance (O&M), and the generation of funds for this O&M in return for an equitable water delivery program for beneficiaries.

One component of a sustainable WUA is a **share system**. In brief, a share system relates the right to use water in an irrigation system with payment for the costs of managing that system. It provides the driving engine for a productive, long-lasting irrigation system. Share systems are widely found in the indigenous irrigation traditions of Nepal (Martin and Yoder 1983). The present paper focuses on the concept of a share system and how, through beneficiary training, it is now being introduced into agency-managed systems where there is no share system today.

SHARE SYSTEMS

A share system is a water delivery and accounting mechanism whereby an association mobilizes resources from its beneficiaries in return for a roughly proportional share of the usable water supply in the irrigation system (Wilkins-Wells 1993; [Figure 1]). A water share confers legitimate access to the water resources within pre-arranged rules, and it imposes a specified obligation to share in paying the water management costs (Freeman and Lowdermilk 1985; Freeman et al. 1989). A user who receives X number of shares of water from the deliverable association supply will have to pay, in cash or labor, roughly X number of shares of the overall O&M cost of the association.

The administration of share systems requires a system of rules and regulations, rather detailed record keeping, and strongly enforced sanctions when needed. To support the administration of share systems, control structures in the irrigation system are designed and built to deliver shares according to a variety of water delivery methods depending upon the hydraulics of the system.

Water delivery methods in support of a share system can be on a demand basis, delivered through rotations, or managed on a continuous flow basis. None of these water delivery methods are mutually exclusive. They may frequently be combined in the same irrigation system. A share system is **not** a water delivery method. It is an accounting system for water delivery and fee payment. However, water measurement is very important to a share system, and is accomplished in a variety of ways including flow measuring devices like flumes, discharge rating stations, or simple fixed proportional measurement structures. The technologies for measuring water may be very simple, such as the traditional *saacho* weir of Nepal (Martin and Yoder 1983).

In Nepal it is now generally recognized that a beneficiary's sense of ownership in an irrigation system plays an important role in his/her attitude toward its management. Where a government agency manages all or a substantial part of the system, it has been very difficult to generate local funds to maintain the system (Small 1989). Because they are directly affected, farmers, as opposed to government agencies, are the best choice to administer share systems through democratically formed associations. Farmers elect representatives to make rules and regulations, to manage the maintenance of the system, to distribute water, and to impose sanctions.

Given that farmers are logically in the best position to administer share systems, a first step is to put farmers in charge of the system through their own association. The process of shifting management from a government agency to farmers is called management transfer. The Irrigation Management Division (IMD) of the HMG/N's Department of Irrigation is supporting the process of management transfer and is encouraging the development of share systems.

Associations for Administering Share Systems

Government or agency-managed systems are characterized by a general lack of organized groups of farmers for management. One of the first tasks in developing share systems is to work with a group of farmer organization specialists to develop a viable water user association. In Nepal, this initial organization development program is now in place and is described in Neupane (1991) and Upreti (1994). However, developing a constitution, electing a general assembly of water users, and registering the WUA with the government to give it a legal personality, are necessary but not sufficient criteria for a self-sustaining WUA.

A WUA can be likened to a nonprofit business house that provides consumer beneficiaries a service at cost, that of delivering water, and is then able to recover the costs for delivering that service. Farmers, through a share system, are far more inclined to invest in the business house because of the direct linkage between benefits and

costs. For their investment, farmers want to see some kind of return, and that return is better water service. The goal is to encourage farmers to begin the investment cycle in the business house. The business house must have a sufficient degree of discipline, accountability and leadership to attract this investment.

One of the first steps in building the business house is to define the status of a shareholder. All farmers receiving water from an irrigation system would be shareholders in the WUA charged to operate and maintain the main canal. We might call this a parent WUA. Additionally, farmers may be shareholders in other sub-associations or business houses, like branch business houses, in charge of the O&M of secondary or tertiary canals in an irrigation system [(Figure 2)].

However, the parent association is the key to this federation-type organizational model because it oversees and manages the main stem canal. It is important to be aware of the fact that when a farmer is a member of more than one business house, he is also a member of more than one assembly of beneficiaries; that of the parent association and one or more affiliated associations. He would have a vote in, and pay fees to, each business house it was necessary for him to belong to in order to get water from its source to his farm [(Figure 3)].

This is considerably different from federation models advocated in other countries, where elected representatives at lower hydrological levels are automatically representatives in leadership positions higher up in the system (Uphoff 1986). This type of federation model represents a single forced choice for beneficiaries in overall command area leadership, with little opportunity for checks and balances through other elected representatives. In the federation model proposed in this paper, each beneficiary has several votes, one for the leadership in each and every business house needed to bring water to his farm. There are many opportunities for checks and balances to emerge in this form of federation. This type of federation model is widely known in water cultures where share systems are well developed (Maass and Anderson 1986).

The WUA in charge of managing the main canal, the parent association, will need to recover costs from all beneficiaries in the system command area. Likewise, sub-associations in charge of managing secondary or tertiary canals, and having their own O&M shares in a dry canal to cover the transport costs of their water shares in the parent association, would need to recover costs from all of their respective members. Again, an individual farmer is a shareholder, voting member, and fee-paying member in each and every business house that is needed to get water to his farm.

The farther away from the source of water, the more sub-associations a farmer may have to belong to, and the more fees he may be required to pay to cover the costs of O&M; the transport costs of water. This is not a particularly alarming situation unless the proportion of water he receives, relative to his neighbor who pays the same amount in O&M costs, is dramatically different. This would indicate that the share system was not being properly administered. It is nevertheless true in most share systems found around the world that the farther a farmer is from the source of water, the more expensive his water will be, since it involves that much more engineering and management to get it to his farm (Enge and Whiteford 1989).

Defining Shares

A newly formed water user association needs to define the unit of a share. In the existing agency-managed system of Khageri (4,000 ha) and West Gandak (10,000 ha), where management is in the process of being transferred to farmers, system shares have initially been defined on the basis of land area. The Khageri Irrigation System has nine large branch canals and two minor canals receiving water from a main feeder canal that passes through a forest. Each branch is allocated shares of water from this main canal source. The Khageri System is a run-of-the-river system with no storage, so the supply of water is highly variable over the season. It may even change daily.

[Figure 4] conveys the general logic underlying share systems. Regardless of the sources of water for the parent WUA or its affiliated WUAs, they are pooled and then the approximate conveyance loss is subtracted from the total available supply to arrive at the usable supply that can be divided into shares. The concept is similar to the routine management of a storage facility, where the actual deliverable supply of water for irrigation is not the total storage, but rather total storage less dead storage. Conveyance losses are similar to dead storage, and cannot be used to calculate shares. Share systems which do not subtract out the conveyance loss before water shares are calculated and delivered by the WUA are notorious for imposing conveyance loss almost entirely on tail enders in the irrigation system.

At normal flows there is generally a usable or deliverable supply of 6,000 liters per second (I/s) at Khageri. The usable or deliverable supply is obtained by subtracting conveyance losses in the main canal from the inflow at the headworks. At Khageri, the WUA has defined 120,000 shares of water for the system, initially assigning one water share to one *Katha* of land; 30 kathas equaling approximately one hectare. Provisions in the new association by laws have provided for the transfer of shares of water between farmers, and the ability to add new shares if the water supply increases through future canal improvements.

[Figure 5] shows the share system approved by the newly elected general assembly of the Khageri Irrigation System WUA; the parent association at Khageri. The pro-rated flow of 6,000 l/s that is divided into shares was determined by the farmers themselves, based on their own experience, with support from irrigation agency personnel during an operation and maintenance training program (Kalu 1993). It was estimated to be the average guaranteed seasonal flow for the entire service area, less seepage losses in the main canal.

Stated another way, all conveyance seepage loss (or estimated loss) from the total yield of the river was subtracted out first, in order that this loss did not figure into the more or less guaranteed base of 6,000 l/s that was divided into shares. This figure of 6,000 l/s flow rate is expected to be refined as time goes by, thus providing a more accurate estimate of the actual number of liters per second per share for the association in the future.

The total land to be irrigated (6,000 bighas or 120,000 kathas; approximately 4,000 ha) was simply divided into the estimated average flow rate to arrive at the number of water shares to be delivered by the parent business house (WUA) to each affiliated branch business house (WUA) along the main stem canal. A system share is therefore 0.05 l/s (6,000 l/s divided by 120,000 shares). In [Figure 5], the water per share is 0.1 l/s rather than 0.05 l/s because the entire command area is divided into two rotation sections, and each water share is doubled during a section's turn.

If a farmer owns 10 kathas of land, his 0.5 l/s would be pooled with other branch business house farmers. This pooled supply would then be delivered to the branch by the parent association. The branch WUA would then allocate this pooled supply to each shareholder, again subtracting out conveyance loss along the branch before doing so, and perhaps using equalizing basins and timed rotations to deliver equitable delivery streams to each shareholder.

In return, each farmer is expected to pay fees to both the parent association and his branch association, or other sub-groups. If the O&M cost for the parent association were Rs 100,000 for a given year, including salaries for a water delivery workforce, a farmer with 10 shares in the parent association would pay a fee of Rs 8.33 ([100,000\120,000] \times 10).

Likewise, if the O&M for managing the dry branch canal as a water carrier serving his farm were to be Rs 10,000, and he had 10 of 1,000 shares in this business house, he would pay a fee of Rs 100 to this branch business house, and so on. He might even pay another branch canal fee if another carrier canal and association were needed to get water to a second farm [(Figure 2)]. Again, he would also be a voting member in this other branch canal general assembly.

If the discharge from the river is substantially reduced over the course of the irrigation season, each share is reduced proportionally, or a sectional rotation is instituted by the parent association to maintain a more or less normal delivery stream to each branch business house. The Khageri WUA water delivery schedule [(Figure 5)] indicates that if the discharge in the main canal goes below 5,000 l/s, then more strict and supervised branch rotation would be initiated, each branch in each section receiving its normal share over a given time period only. A proportional reduction would involve setting a quota of say 75 percent or 50 percent of a normal share at 6,000 l/s, and then delivering that quota share.

In water cultures throughout the world, it is characteristic for water to be measured as a flow rate at the main canal level, but then to be converted into volumetric or time units at the secondary or tertiary level. Time is a proxy for volume in many of these systems, and a flow rate is more or less guaranteed for a given time/volume unit by the use of equalizing basins along various reaches of a canal or channel. The management of equalizing basins requires a small WUA water delivery workforce which would be paid for as part of the overall O&M cost for each share in the system.

To administer share systems, rules and regulations for water distribution and cost recovery are required. On smaller systems, or for associations serving relatively few farmers, these can be informal, and labor payment can be substituted for cash payment of share fees. On larger systems, record keeping and cash fees become extremely important for share system administration. Any viable business house will need to keep records of water deliveries, fee assessments, expenses and perhaps a small capital fund for emergencies and future improvements.

However, it is not uncommon for WUAs to assess shares in cash and then to convert this into a day labor cost. Farmers would then pay for their shares in labor. Money needed for cement and other materials could be obtained through the payment of delinquent fines. One autonomous WUA in Nepal, the Chhattis Mauja Irrigation System near Butwal, collects nearly Rs 75,000 (US\$1,875) in fines per year, while its share fee assessment is in day labor, and in 1992 amounted to nearly two million rupees (US\$50,000; Wilkins-Wells 1992).

Water measurement becomes vital in the administration of share systems. When farmers pay for water service based on how much water they are allocated, they become very particular about getting their proportional share of water. In contrast to farmer-managed irrigation systems in the hill country, agency-managed systems currently involve little water measurement, although they typically have gated outlets which potentially could lead to better water control. At the Khageri Irrigation System, a flow control structure calibration program was performed, with

farmers and farmer leaders participating, to calibrate diversion points and head gates so that farmer leaders and/or WUA work force employees could later measure and deliver water according to their new share system.

To recover the costs of running the system, farmers must be able to budget for O&M and other administrative costs. The fee per share is determined by dividing the system management costs, plus cost-share rehabilitation or system improvement costs, by the number of shares in the association. In many farmer-managed systems in Nepal, the major maintenance problems are desilting and earthen canal repair, most of which can be done manually. In agency constructed systems, the situation is often complicated by the fact that modern concrete and steel structures are used that require cash to purchase materials for maintenance. For share assessment in these government-constructed systems, farmers must devise a system based on cash and labor.

It is often asked whether some farmers will speculate with system shares. It must be remembered that being a shareholder implies a right to use a water share, but also incurs an obligation to pay for its use. Having extra shares beyond what can be beneficially used by an individual farmer automatically imposes extra costs on him. The tendency is for shareholders to want to get rid of excess shares, and use water more efficiently to cut down on seasonal water costs.

The WUA can benefit from this practice by allowing the transfer of shares to new shareholders as long as such transfers do not negatively impact the hydraulics of the main canal. Share transfers can result in an expansion of the command area over time. The addition of new shareholders can have the effect of decreasing the O&M cost per share of water for other farmers; the more shareholders in the system the cheaper the cost per share. This logic is evidenced by the concept of share transfers developed by the Khageri farmers themselves. [Figure 6] shows such a share transfer certificate developed for this use. The practice of exchanging shares of water is well known in the hill country of Nepal.

Experiences with Initiating Share Systems

The overall approach to management transfer and initiating water user associations is a learning process (Skogerboe 1990). WUAs are first formed, then much follow-up work in the form of training and other system management exercises take place. Training activities focus on maintenance, share system development, and managing the hydraulics of the water delivery system. Maintenance and operation training are intended to identify system maintenance needs and to calibrate irrigation structures and measure seepage losses so shares of water can be delivered equitably.

Share system training focuses on understanding the concept of system shares and other organizational concepts, defining shares for the particular irrigation system, developing rules and regulations for O&M, developing record keeping formats, defining the water delivery workforce requirements, and making decisions about irrigation fee payment schedules.

Farmers from farmer-managed irrigation systems are key resource people in this training; particularly "natural teachers" who have an innate skill for communicating their experience in leadership and concepts leading to a successful WUA. Farm resource people are brought from these neighboring farmer-managed systems to the agency system to work with farmers on site specific issues, and to help them with their association development. Additionally, farmers cultivating crops in the agency system that is being transferred over to a WUA are taken to farmer-managed systems to be shown the benefits of a well-administered share system.

Irrigation agency staff can play a key role in developing share systems. Most progress in institutional development has been in those irrigation systems where agency system managers have fostered the growth of WUAs and share systems. The role of the agency is to act as a partner to farmers in their WUA development. Engineering expertise should be provided by the agency as support services in such areas as investigating canal conveyance losses, estimating groundwater depths, developing river hydrographs over time, identifying maintenance needs and cost-efficient methods of maintenance, and administering water rights or quotas between different newly formed associations along a particular reach of a river. Day-to-day and micro-management of the system is to be left to the WUA itself.

The program of establishing share systems for management transfer has just begun, and mature share systems have not yet developed. Farmers have no difficulty with the concept of share systems. Quite elaborate rules and regulations have been developed by the farmers themselves at Khageri, West Gandak and Kankai. Farmers are beginning to realize the requirements of resource mobilization and water control for their association. However, there is a long way to go before true share systems are established and operating.

Share System Training

One of the difficulties in designing training programs for share system development is to make the program truly interactive. That is to say, although the concept of a share system is quite simple, people who must convert the concept into an association financial management and water delivery program often find it difficult to understand how all the management pieces fit together. Surprisingly, even long-time practitioners of share systems, such as association leaders in the hill country of Nepal, often find it difficult to articulate the architecture of their share system, however small and humble it might be (personal observation of authors).

A way of facilitating this learning process is to structure actual training exercises around financial and water delivery record keeping, rather than lengthy philosophical discussions about the importance of water user associations. In the course of working through the various record keeping needs of an association, the participants experience seeing how the various administrative needs of share system management are linked in a logical way. Perhaps an example will illustrate this point.

It is generally true that a new association being developed in conjunction with management transfer efforts needs a record keeping program. Most share systems for larger irrigation systems would require the following:

- 1) A shareholder certificate of some kind.
- 2) An annual WUA budget report.
- 3) A WUA water delivery schedule.
- 4) A WUA share transfer certificate.
- 5) A WUA billing statement.
- 6) A daily water report or ledger for WUA patrolmen.
- 7) Patrolmen gaging and head gate records.
- 8) WUA Identity cards (if needed for larger systems).
- 9) A WUA complaint form.
- 10) Association stationery.
- 11) A WUA fee collection register.
- 12) A water delivery register.

In the course of the IMP training, WUA executive committee members and other participating beneficiaries are given the task of putting together these records. This includes defining the nature and purpose of ledger column entries and why such information would be necessary to the association. In doing so, they begin to understand how the association is to function as a business house.

The concept of an association with the management capacity to perform important administrative functions, and to maintain records of these functions, is better understood through a training process which focuses on this WUA record keeping need. Otherwise, trainees tend to find it difficult to develop a vision of what the functions of a viable, autonomous, association would be in the future. The process of defining column entries, and linking these column entries to other administrative record keeping needs, results in a clear vision of the WUA as an administrative business house.

In doing so, participants in the training program may more easily see the complementary role played by the irrigation agency in instructing the WUA in how to operate and maintain system structures, measure water, and better determine conveyance losses through the system command area over the years. The latter is especially necessary to determine what will constitute a fair share of water for each beneficiary shareholder in the system. There is a need for simultaneous training in water delivery and financial record keeping, and in the operation and maintenance of the irrigation system.

ISSUES FOR THE FUTURE

The share systems being developed in agency-managed irrigation systems such as Khageri should be carefully linked to future rehabilitation programs funded by the government or donor agencies. The WUA share system development and training program described in this paper has facilitated the implementation of a share system at selected training sites through beneficiary agreement with the following tasks and future needs. These include the development of a WUA water delivery and irrigation fee record keeping program; through agreement by the elected Executive Committee and General Assembly of the need to hire a competent water delivery workforce for the WUA; through a clear recognition of the need to collect annual WUA irrigation fees to meet such costs; and through agreement to deliver water by unit volume or time in proportion to the contributions made by each shareholder to annual O&M costs.

It is recommended that the cost of rehabilitation under any future rehabilitation or assistance program give recognition to these newly developing share systems. The cost of rehabilitation to be born by the farming community should be divided by the total number of shares in the WUA, and each shareholder should be required to make his/her percentage cost-share contribution to rehabilitation. Likewise, following completion of rehabilitation, each shareholder should be allocated new improved water supplies in proportion to the number of shares contributed to rehabilitation.

It is important that future rehabilitation programs obtain compliance from the WUA in implementing their share system. Farmers participating in such training programs have generally agreed to: 1) keep records of water deliveries; 2) collect fees based on the share concept; 3) hire a water delivery workforce, and; 4) fully implement a share system of water delivery. However, commencing a share system is often faced with overcoming substantial skepticism of any proven ability of the WUA to perform such tasks. A rehabilitation or assistance program can strengthen these newly formed WUAs by assisting their governing bodies, the Main Committee and General Assembly, in withholding rehabilitation benefits from system beneficiaries until full WUA compliance is obtained on the four deliverables mentioned above.

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Figure 1. The "Floating" Components of a share for share systems.

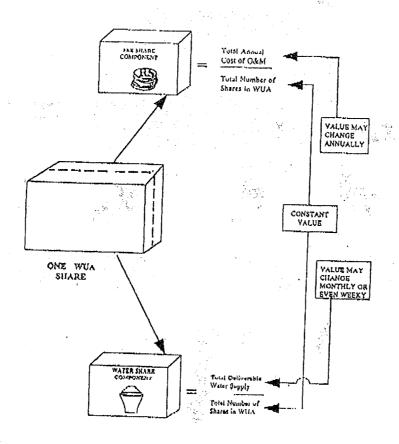
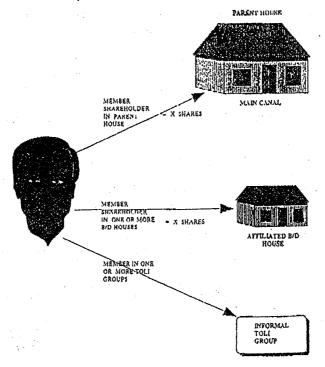
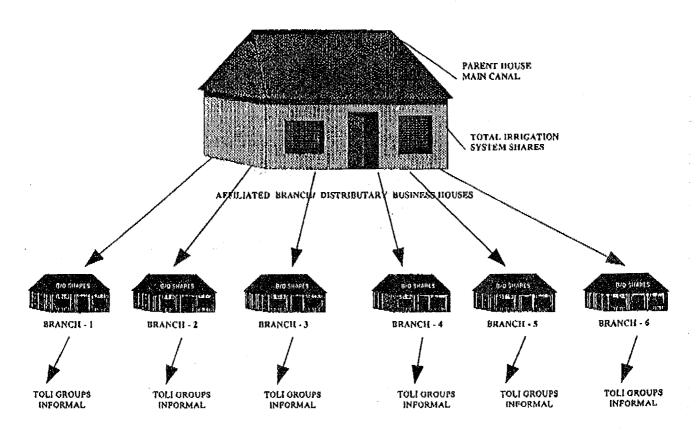


Figure 2. The meaning of membership status.

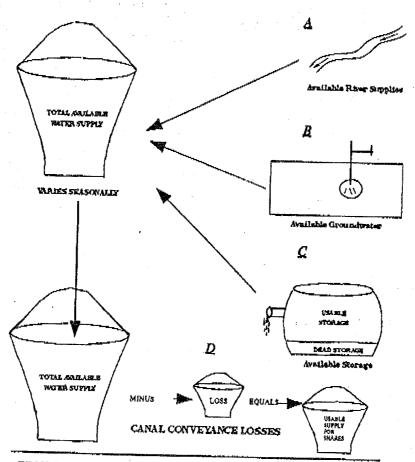


EACH INDIVIDUAL FARMER IS A MEMBER IN AT LEAST ONE HOUSE, POSSIBLY TWO OR MORE AND IS USUALLY A MEMBER IN AT LEAST ONE TOLI GROUP.

Figure 3. The parent business house and its affiliated branch/distributary business houses.



DEPINING THE USABLE WATER SUPPLY



THE DEPARTMENT OF IRRIGATION USES ITS TECHNICAL EXPERTISE, IN CONSULTATION WITH THE MAIN CANAL COMMITTEE, IN DETERMING THE ABOVE VOLUMES.

RIVER HYDROGRAPH

Ē HITGED RETAW ÖNÜĞRD

C AVAILABLE STORAGE CONVE

D CONVEYANCE LOSS

Figure 5. Khageri Irrigation System WUA, Shivanagar, Chitwan.

Water Delivery Schedule

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Total Land Irrigated: 1000 Shares to be Distributed: 120,000

6000 Bigaha

(1 Katha = 1 Share)

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3	Branch No. 3	0.1	17790	1779	Branch Na. 2	0.1	15180	1518	
3	Branch No. 4	0.1	6840	684	Branch No. 6	0.1	15900	1590	
4	Branch No. 5	0.1	8850	115	Branch No. 8	0.1	8640	864	
5 ,	Branch No. 6 West	0.1	13260	1376	Minor No. 1 Minor No. 2	0.1 0.1	6540 7710	654 771	,
4	Breigh No. 7	0.1	6450	643	Minor No. 3 Minor No. 4	0.1 0.1	3000 1830	300 183	
		Total	60336	6033		Total	59670	3967	

Note

- Before each section rotation, water measurement shall be carried out in the head reach of the system. The quantity of water for each share shall comply with the variations in pro rated value of flow in the source.
- If the discharge in the source becomes less than 5000 liter per second then section rotation shall be imposed and every branch shall receive water according to the shares allocated to it's branch.

Figure 6. Khageri Irrigation Systems WUA, Shivanagar, Chitwan.

Previous Share Certificate No:

SHARE TRANSFER CERTIFICATE

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Signature (Buyer):

Signature (Seller):

Signames (Chairman):

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