The Economic Journal of Nepal, Vol.17, No.2, Issue 66, April–June 1994©DOE TU.

Farmers' Perceptions of Performance in Farmer and Agency Managed Irrigation Systems in Nepal

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INTRODUCTION

Recent studies report that many farmer-managed irrigation systems (FMIS) operate better than agency-managed irrigation systems (AMIS) (Laitos et al., 1986; Pradhan, 1988; Tang, 1992; Yoder, 1986; Hilton, 1990; Ostrom, 1990, 1992; Shivakoti, 1991a, 1991b, 1992a). While more effective organization does not uniformly characterize all FMIS, substantial evidence has mounted at a system level that most FMIS operate more effectively than AMIS under similar physical conditions. Where FMIS lack good operations and maintenance, it appears to be due to a combination of a lack of resources and level of organization (Rai (ed) 1991; Lam, Lee and Ostrom 1993; Ostrom, Benjamin, Shivakoti 1992). Few studies, however, have examined individual farmer perceptions of organizational performance on closely matched farmer- and agency-managed systems. Some of the processes involved on FMIS are difficult to understand without individual level data.

Svendsen and Small, (1990) Stress the usefulness of efforts to improve an understanding of farmers' perceptions of system performance as this relates to their behavior in their role as managers of the system. The role and functions that a farmer performs as a member of the particular irrigation system and the benefit he or she obtains from the system may well reflect the individuals' perception about the particular system effectiveness. Thus, an individual's choice of action in any particular situation depends upon how he or she weighs the benefits and costs of various alternatives and likely outcomes (Tang, 1992). Individual decisions, however, are also influenced by the attributes of the community and the alternative institutional arrangements, which create different action situations, besides physical condition of the system itself.

Well-managed irrigation communities have been described as systems of rights, duties, and roles entirely under local control (Hunt, 1989). Irrigation communities differ in their structure of rights and duties from water-users' associations created within governmentally-owned irrigation systems. A

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farmer -owned and operated irrigation system involves the farmers themselves in defining the duties of their members in regard to operations and maintenance. Farmers also define the rights that being a member of that community entails. When governmental agencies establish water-user committees, the agencies frequently assign duties to farmers but rarely assign substantial rights or the authority to achieve local control. Creating water-user committees within agency-operated systems is less likely to enhance user participation or yield desired equity in getting water to the individual farmer's field, than enabling farmers to own their own systems. Thus, a potential pitfall exists when agencies attempt to create participatory organizations within governmentally operated systems. This is the failure of agencies to recognize the conditions that make indigenous institutions viable when they are able to rely upon shared understandings of rights and duties, and to enforce compliance with an accepted set of rules (Ostrom, 1990).

The present study is based on a comparison of individual farmers' perceptions and reported behavior. Two hundred farmers were interviewed who had fields located at the head, middle and tail end of four irrigation systems - two FMIS and two AMIS. Interviews focused on farmer participation and perceptions of effectiveness and equity under alternative institutional arrangement (FMIS vs. AMIS), and as potentially affected by different attributes of community, such as caste, socio-economic structure, and family structures, in one hill district of Nepal. This study involves a large sample of individual farmers' perceptions which is rare in the literature on social organization of irrigation in developing countries. It is hoped that this paper will contribute to a better understanding of the variables of that potentially affect how farmers perceive important aspects of their world.

The study attempts to analyse the following specific issues:

- In what manner and to what extent the characteristics associated with individual users affect the perceptions of effectiveness, level of farmer participation, and feelings of equity.
- Whether these variations are influenced by physical factors such as the location along a canal of a particular parcel to be irrigated.
- In what manner the variations associated with alternative institutional arrangements affect farmers' perceptions of effectiveness, participation, and equity.
- By what means and in what condition community leadership is developed and associated with the alternative institutional arrangements.

STUDY METHODS AND DESIGN

The study design included a two-month, Rapid Rural Appraisal (RRA) phase of 12 systems, followed by an interview survey phase of 4 systems from the 12. Given constraints of time, money, and personnel, RRA is a useful tool for identifying key issues and problem areas, and also for giving direction for further investigation (Pradhan et al., 1987; Chambers and Carruthers 1986). The RRA was used to gather background information on various types of interventions and external assistance to 12 irrigation systems and to select the four irrigation systems more intensively studied.

The most important criterion for selecting four research sites from the 12 originally examined was whether the irrigation system was controlled by the users or by an irrigation agency. The systems were chosen from within a single political subdivision (Kaski district) and within a single watershed project area. These included two pairs of systems: one pair each selected from the FMIS and AMIS. Each pair of FMIS and AMIS shared a common water source. Thus, Chaurasi (FMIS) and Hyangja (AMIS) systems diverted water from one stream, *Yamdi*. Ghachok (FMIS) and Lahachok (AMIS) systems diverted water from another stream, *Lasthi*. These four systems were also located within one day walking distance of each other at a radius of 25 square kilometers. The systems were of comparable sizes (within a range of 100-300 hectares).

Three sets of instruments were used to collect data. The first phase included the study of background materials, such as rapid appraisal reports, and applied and baseline studies, as well as descriptions of the systems by the Western Regional Directorate of Irrigation. In the second phase, an inventory checklist was prepared and the information was gathered by using the RRA method. Additional information was also collected in this phase by interviewing different persons working in related agencies. These two sets of data helped the author to select the four systems for more intensive study, and also to prepare background information on the sample villages. The information collected by RRA method include: description of the general area; settlement patterns; irrigation systems, including their organizational structures and institutional rules for operation and maintenance; and

agriculture system and services. The third set of data collected came from a structured personal interview schedule administered to the selected 200 respondent farmers. The variables measured in the survey included socio-economic status of the household, family structure, and demographic characteristics of the respondent farmers. The contextual variable included leadership structure for irrigation related decision making situation in community.

All households owning *khet* (low land) and using irrigation water from the four selected systems were included in the study population. Because the availability of water to a field depends largely upon the distance from the head of the system to the field, the sample was drawn according to the location of a farmer's fields. The sampling unit was the particular parcel of land recorded in the land survey record. The sample was stratified, based on the location of a farmer's field on the water course, employing the categories of head, middle and tail. Sometimes a single farmer had several plots of land in different locations. To overcome this problem, farmers where asked to give the location of the field which was most significant to them in relation to agricultural production. Two hundred households out of a total of 1890 households was considered to be an adequate sample size. Fifty households were sampled from each of the four systems so that there were 100 interviews with farmers receiving water from FMIS and from AMIS.

DEMOGRAPHIC AND SOCIO-ECONOMIC CHARACTERISTICS OF RESPONDENTS

Each of the 200 respondents were asked a battery of question related to the demographic and socio-economic characteristics of the household. In light of this information, one can examine whether the sample of households served by farmer-controlled irrigation systems is similar in demographic and socio-economic characteristics to the sample of households served by agency-controlled irrigation systems as intended. As shown in Table 1, it appears hat the households in the two types of systems are very similar to one another.

Table 1

Characteristics of the Households in the Study Villages by Control Type

Characteristics	Control Type			
	FMIS		AMIS	
	Mean (n = 100)	SD	Mean (n = 100)	SD
Age of household head	52.7	11.4	51.9	13.4
Family size	6.7	2.5	6.9	2.7
Farm size (ropani)	16.8	9.5	16.9	10.9
Parcel size (ropani)	3.1	2.8	4.1	4.1
Total income (in 000 Rs.)	30.4	32.6	22.9	15.9
Average number of years household irrigating field	207	121	96	87

Note: A ropani is 0.05 hectare.
Source: Author's compilation on the basis of field study.

There is no difference between the two types of systems in regard to the mean age of the head of the household, around 52 years, the size of the family, 7 persons, and farm size 17 ropani. (Table 1). The average parcel size of irrigated fields is somewhat higher for nonfarmer-controlled systems than for user-controlled systems. Total income is higher on the farmer-controlled systems (Rs. 30,445 as contrasted to Rs. 22,860) with a higher standard deviation as well. Family income varies substantially on all of these individual systems. As would be expected given the respective ages of these systems, the average number of years that someone in a respondent's family has irrigated a field in the service area is nearly twice as long in the farmer-controlled as in the nonfarmer-controlled systems.

In AMIS, Brahmins and Chhetries constitute nearly 90 percent of the respondents whereas in FMIS Vaishyas also constitute about one-fifth of the respondents (Table 2). The family structure on both types of systems is similar. Most families, whether nuclear or joint, have more than four children in the household. There are more illiterate respondents in the AMIS than in the FMIS, 37 percent and 26 percent respectively.

Table 2
Socio-Economic and Demographic Characteristics of Respondents by Control Type

(in Percentage)

Characteristics	Control Type	
	FMIS (n = 100)	AMIS (n = 100)
Caste		
Brahmins	54	55
Chhetries	23	32
Vaishyas	21	7
Sudras	2	6
Family Structure		
Nuclear with children dependent	16	15
Nuclear with young dependent	44	45
Joint with children dependent	31	36
Joint with young dependent	9	4
Education		
Illiterate	26	37
Literate	43	30
High School	17	25
College	12	8
Social Participation Level		
None	20	18
Low	27	40
Medium	30	28
High	23	14
Socio-Economic Status		
Low	25	31
Medium	54	51
High	21	19
Location of Parcel		
Tail	23	23
Middle	49	38
Head	28	39

Source: As of Table 1.

Respondents were asked a whole battery of questions about their level of participation in diverse social activities. About one-fifth of the respondents in both types of systems do not participate in any of the activities. Somewhat over half (53 percent) of the respondents on the FMIS are medium to high participants in social activities while around 42 percent of those on the AMIS are similarly active. Respondents were also asked a series of questions about their assets and other indicators of social and economic status. The status distribution of respondents on both types of systems is very similar. A majority of the respondents in farmer-controlled systems had their parcels from the middle fields of the system. In the case of nonfarmer systems, an equal number of respondents had fields in middle and head fields.

It is extremely difficult to find empirical settings where most important demographic and socio-economic variables are perfectly matched while institutional arrangements differ. In this case, however, the distribution of households in the two instances of each type of irrigation systems along demographic and socio-economic dimensions is very similar. Let us now turn to the aspect of what difference the demographic and socio-economic characteristics of respondents make on their perceptions of system effectiveness, levels of participation, and equity.

RELATING RESPONDENTS' CHARACTERISTICS WITH PERCEPTIONS OF SYSTEM PERFORMANCE

In order to examine the relationship between variables, such as family structure, socio-economic status, and location of the irrigated parcel with farmers' perceptions of the performance of their irrigation system, respondents were asked a series of questions about how their system operated. These questions focused on: perceived system organizational effectiveness; reported participation in activities related to maintenance of system; and perceived equity.

To measure organizational effectiveness, the following indicators were included in the survey instrument:

- Farmers' perceived judgement about system design and construction.
- Farmers' perceived water sufficiency in their own and neighbors' fields, and by location of the fields.
- Farmers' perceived water use efficiency by location of the fields and system as a whole.
- Farmers' familiarity with and assessment of the system rules.

- Farmers' assessment of the system in regard to resource utilization and benefit distribution.
- Farmers' perception of rule enforcement and equal treatment.

From the answers to 16 questions on these topics, an index of effectiveness was constructed with a range of 1.39 to 3.30 and a mean score of 2.66. The reliability of this index, measured by Cronbach's alpha, is 0.6516 which is just sufficient to meet the criteria (of 0.65) for acceptable levels of reliability recommended by Nunnally (1978).

The Effectiveness was estimated by perceived judgement on system design and construction using a 4 point *Likert-type scale:* 4 being "very well, no problems" and 1 being "terrible, many problems." Similarly, water sufficiency (availability) was measured with 4 being "always sufficient (available)" down to 1 being "usually insufficient (unavailable)." Statements related to measuring effectiveness in resource mobilization and benefit distribution; "excellent" to "not good at all" *Likert-type scales* were used at a 4 to 1 scale. Statements related to system effectiveness in treating benefit distribution; "very fair" to "very unfair" *Likert-type scales* were used at a 4 to 1 interval scale.

To measure the degree of participation on an irrigation system, questions on the following topics were asked:

- Farmers' knowledge about their operation and maintenance responsibility of the system.
- Farmers' assessment of contribution they made to the maintenance of the system.
- Farmers' satisfaction level about their involvement in solving problems together with other irrigation farmers.
- Farmers' satisfaction level on the job performance by the irrigation leaders.
- Farmers' assessment of involvement in helping neighbors and own field channels maintenance.

From the answers to 10 questions on these topics, an index of participation was constructed that varied from 1.79 to 3.41 with a mean score of 2.74. The reliability of this measure is 0.7776.

Participation was estimated by knowledge and level of involvement in operation and maintenance of the system; "always" to "never" scales were used on a 4 to 1 scale. Involvement of respondent and neighbors in solving problems; "always" to "never" *Likert-type scales* at a 4 to 1 scales were used. Job

responsibility of the leaders and one's own assessment of responsibility; "always" to "never" *Likert-type scales* at a 4 to 1 interval scales were used.

To measure the equity of irrigation distribution, the following indicators were used:

- Farmers' statements of perceived fairness of water share allocation criteria.
- Farmers' statements of perceived fairness in frequency of water distribution criteria.
- Farmers' statements of perception of fairness on water allocation timing in the field.
- Farmers' perception of efficient distribution of water field location.
- Farmers' perception of fairness of system treatment.

From the answers to 10 questions on these topics, an index of perceived equity was constructed that varied from 2.30 to 3.07 with a mean score of 2.84. The reliability of this measure is 0.8423.

Here Equity was estimated by statements related to fairness in water acquisition, allocation, distribution, canal alignment, and system treatment. All statements were ranked "always" to"never"*Likert-Type Scales* at a 4 to 1 interval scale.

The socio-economic status (SES) of a household has been measured by: size of the operational holding; off-farm income of the family; social participation; number of livestock units (LSU); and material level of living. Since most of these variables are interval measures, it is possible to compute a Pearson product-moment correlation coefficient between these variables and the three interval measures of system performance (Table 3). No significant linear relationships exist among most of the socio-economic characteristics of respondents and the three performance measures. Family size, age of the head of the household, annual off-farm income, total annual income, the number and type of livestock held, and the size of the parcel used as reference in the study, made no difference on respondents' participation or their perceptions of system effectiveness or equity. A significant positive relationship was recorded between farm size and farm income and respondent's participation. In addition, annual farm income was significantly related to the index of system effectiveness. These data support the proposition that as farm size and farm income increases so do the participation of farmers and their perceptions of system effectiveness.

Table 3

Pearson Correlation Coefficient for Selected Socio-economic Characteristics and Effectiveness, Participation, and Equity

Characteristics	Correlation Coefficients		
	Effectiveness	Participation	Equity
Family size	-.005	.045	-.005
Age (head of the household)	-.027	-.050	.024
Farm size	.053	.305**	.084
Annual farm income	.191*	.302**	.107
Annual off-farm income	.086	.013	-.026
Total annual income	.125	.085	.002
Livestock standard unit	.092	.113	-.027
Cultivated area of study parce	.022	.090	.120

1-tailed significance: * = .01 ** = .001
Source: Same as of Table 1.

While SES variables, other than farm income and farm size, were not associated with farmers' evaluations of system performance, the location of a farmer's irrigated parcel was related to these measures. As mentioned above the sampling unit for this study was a parcel of land recorded in the land survey office. If a farmer owned more than one parcel, he was then asked which of several parcels was the most important to the farmer in terms of its productivity. Whether this parcel was located at the tail, in the middle, or at the head of the irrigation system affects the way farmers evaluate the performance of an irrigation system.

The relationships between the location of the most important irrigated parcel and the mean index scores of effectiveness, participation, and equity were examined using analysis of variance. Significant differences were observed in the mean scores of effectiveness, participation, and equity depending on the location of the parcel most important to the farmer. Table 4a shows a significant difference in the way that farmers evaluate system effectiveness depending upon where their most important parcel of irrigated land was located. Farmers who owned parcels in the head and middle sections of these four irrigation systems evaluated their system effectiveness more positively than farmers whose parcels were located at the tail end of these systems.

Table 4a
Analysis of Variance of Effectiveness by Location

Source	D.F.	Sum of Squares	Mean Squares	F. Ratio	F. Prob.
Between Groups	2	2.64	1.318	15.96	.000
Within Groups	171	14.12	.083		
Total	173	16.758			

Multiple Range Test: Tukey Procedure

					Group		
Group	Location	(n)	Mean	SD	1	2	3
1	Tail	(44)	2.38	.25			
2	Middle	(78)	2.62	.29	*	*	
3	Head	(52)	2.70	.31			

* Denotes pairs of groups are significantly different at the .05 level.

Source: As of Table 1.

Table 4b
Analysis of Variance of Participation by Location of the Parcel

Source	D.F.	Sum of Squares	Mean Squares	F. Ratio	F. Prob.
Between Groups	2	3.66	1.83	.52	.002
Within Groups	189	53.05	.28		
Total	191	56.71			

Multiple Range Test: Tukey Procedure

					Group		
Group	Location	(n)	Mean	SD	1	2	3
1	Tail	(46)	2.54	.500			
2	Middle	(83)	2.85	.523	*	*	
3	Head	(63)	2.60	.559			

* Denotes pairs of groups are significantly different at the .05 level.

Source: As of Table 1.

Table 4c
Analysis of Variance of Equity by Location of the Parcel

Source	D.F.	Sum of Squares	Mean Squares	F. Ratio	F. Prob.
Between Groups	2	3.94	1.970	6.97	.002
Within Groups	177	52.16	.295		
Total	179	56.11			

Multiple Range Test: Tukey Procedure

Group	Location	(n)	Mean	SD	Group 1	Group 2	Group 3
1	Tail	(43)	2.66	.56			
2	Middle	(77)	2.87	.54			
3	Head	(60)	3.05	.53	*		

* Denotes pairs of groups are significantly different at the .05 level.

Source: As of Table 1.

Similar procedures were followed to examine the differences in participation scores by location of the parcel. As shown in Table 4b, there were significant differences observed among the respondents with parcels at the head, middle, and tail end of an irrigation system. In particular, the evaluation made of participation by farmers whose parcels were located in the middle section were significantly more positive than either those located in the head reach or the tail-enders. The data arrayed in Table 4c show that there were also significant differences in the mean equity scores between head-reach farmers and the tail-enders. Farmers located at the head end of these systems perceived the systems to be operating more equitably than the farmers at the tail but not more favorably than the farmers owning parcels at the middle.

INTERRELATIONSHIPS AMONG EFFECTIVENESS, PARTICIPATION, AND EQUITY

A further question is whether there are relationships among the evaluations that farmers give to their systems. As shown in Table 5, a significant positive relationship exists between perceived effectiveness and equity. In other words, farmers who perceive their system to be fair also tend to perceive their system as being effective. The other performance measures are not significantly related. In Table 6, we explore whether there are any differences in the strength or direction of the relationships among performance measures in farmer-managed as contrasted with agency-managed systems. There is a significant and strong correlation between effectiveness and equity

in the case of farmer-controlled systems. Although the correlations between effectiveness and participation and between participation and equity are higher in the case of farmer-controlled systems, the differences are weak and not significant.

Table 5
Correlation Coefficients for Effectiveness, Participation and Equity

Variables	Correlation Coefficient
Effectiveness and Participation	.0841
Effectiveness and Equity	.4689**
Participation and Equity	.1439

1-tailed significance: * = .01 * = .001
Source: As of Table 1.

Table 6
Pearson Correlation Coefficient for Effectiveness, Participation, and Equity by Control Type

Control Type	Correlation Coefficient
Between effectiveness and participation	
FMIS	.134
AMIS	-.075
Between effectiveness and equity	
FMIS	.547**
AMIS	.402**
Between participation and equity	
FMIS	.241
AMIS	.166

1-tailed significance: * = .01 ** = .001
Source: As of Table 1.

Whether farmers utilize an irrigation system that they themselves control or that is organized by the national government does make a difference in their overall evaluations of system effectiveness and the levels of participation. As shown in Table 7, there is a significant difference between the average effectiveness and participation scores on farmer-managed versus agency-managed systems. In both cases, systems controlled by the farmers are given higher average ratings than systems controlled by a government agency. On the other hand, no significant differences were found in the equity scores between farmer and nonfarmer-controlled systems.

Table 7
T-Test Analyzing Effectiveness, Participation, and Equity Scores when Considering Control Type

Group	(n)	Mean Score	T-value	Prob.
Effectiveness:				
FMIS	(97)	2.65		
AMIS	(77)	2.51	2.93	0.004
Participation:				
FMIS	(97)	2.85		
AMIS	(95)	2.54	4.11	0.000
Equity:				
FMIS	(90)	2.87		
AMIS	(90)	2.88	0.17	0.863

Source: As of Table 1.

LEADERSHIP STRUCTURE FOR IRRIGATION RELATED DECISION MAKING SITUATION.

As mentioned above, prior studies have consistently found that the performance of FMIS tend to be higher - controlling for relevant physical variables - than AMIS. In the previous section of this paper, it is shown that the farmers obtaining water from farmer-managed systems tend to evaluate system effectiveness and levels of participation higher than farmers obtaining water from agency-managed systems.

An advantage of using data obtained from structured interviews with a sample of respondents is that one can begin to examine whether systematic patterns of relationships differ among farmers and officials that differ in these two type of systems. And, indeed, substantial differences in the patterns of relationships are found between farmers and different leaders in farmer - controlled as contrasted to agency - controlled systems. Different types of leadership structures have developed in these two kinds of systems over a period of time, and they affect how farmers react to diverse problems.

Respondents were asked to whom they would turn to for help in relation to a series of hypothetical situations. These questions included the following types of situations:

- Emergency situations
  a. When the irrigation dam bursts
  b. When the main canal is washed away

- Dissatisfaction with policies concerning water allocation

- Dissatisfaction with water distribution activities
  a. When water is not available in a canal
  b. When there is no water in a particular field

- Conflict resolution problems
  a. Disputes over labor contributions
  b. Disputes over resource mobilization
  c. Water stealing problems

- Routine filling out of irrigation related papers.

For each decision making situation, the answers given by farmers as to whom they would turn were classified into one of five categories: functionaries related to the water-users' associations (WUA); functionaries related to the village council; neighbors and relatives; district irrigation and general administration officials; and water monitors. The patterns of leadership in the specific work situation were compared in the systems controlled by the farmers; 100 respondents, and those controlled by nonfarmers, 100 respondents.

Emergency Situations

Given the torrential downpours that occur each *summer* in Nepal, it is not unusual for irrigation dams to burst or main canals to be washed away. These situations are extremely serious for farmers. Whether they can bring their crops to harvest depends on getting some kind of an emergency structure in place as soon as possible. Farmers were asked to whom they would turn in relationship to these two different emergency situations. In the case where farmers were asked to whom they would turn if their dam were to burst, there is a significant difference in response between the farmer-controlled and nonfarmer-controlled systems. Almost all, 98 percent, of the respondents in FMIS would seek assistance from their own WUA functionaries or village council members. The majority of respondents in AMIS, on the other hand, chose to go to district irrigation and general administration officials for assistance (Table 8). Similar responses were given to the question of what they would do if the main canal were washed away. Again, almost all respondents in the two FMIS systems responded that they would turn to either the members of their water-users' committee or to their village council while most respondents in the two AMIS systems responded that they would turn to

district irrigation authorities. That at least half of the farmers report that they would turn to those who are officially responsible for the operation of an irrigation system, is not too surprising. What one might not expect to find is that so many farmers on FMIS report they would turn to their own village councils rather than only to their irrigation association. More surprising is that close to half of the farmers on AMIS report that they would turn to their water-users' associations, village councils, or neighbors and relatives instead of to the district irrigation officials under emergency conditions.

Table 8
Leadership Pattern in Emergency Situation and Dissatisfaction with Water Allocation and Distribution Activities by Management Type

Leadership Pattern		Control Type	
When the dam bursts:		FMIS (n = 100)	AMIS (n = 100)
1.	Water-users' association chair/member	50	29
2.	Village council chair/member/secretary	48	13
3.	Neighbor and relatives	2	6
4.	District irrigation and general administrative officials	0	48
5.	Water monitor	0	4
Chi^2 = 79.6642 with 4 df significance .0000			
When the main canal is washed away:			
1.	Water-users' association chair/member	49	30
2.	Village council chair/member/secretary	48	13
3.	Neighbors and relatives	1	6
4.	District irrigation and general administrative officials	3	50
5.	Water monitor	1	4
Chi^2 = 74.7631 with 4 df significance .0000			

Source: As of Table 1.

Dissatisfaction with Water Allocation and Distribution

On all irrigation systems, major decisions have to be made concerning the allocation of water to different parts of an irrigation system. These allocation decisions can adversely affect farmers located on one branch of a system if they feel that they are not being allocated sufficient water. Farmers were asked

what they would do if they were dissatisfied with the policies made in regard to the allocation of water to different branches of canals and different locations in a system. On the AMIS, only 30 percent of the farmers responded that they would turn to district officials; 36 percent indicated that they would turn to the WUA for help and another one-fifth indicated they would turn to the lowest official in the system - the water monitor (Table 9).

Table 9
Leadership Pattern in Water Allocation and Distribution Problems

Leadership Patterns	Control Type	
When there are water allocation problems:	FMIS (n = 100)	AMIS (n = 100)
1. Water-users' association chair/member	37	37
2. Village council chair/member/secretary	40	11
3. Neighbors and relatives	6	2
4. District irrigation and general administrative officials	0	30
5. Water monitor	17	21
Chi^2 = 48.9249 with 4 df significance .000		
When there are water distribution problems related to field channels:		
1. Water-users' association chair/member	16	20
2. Village council chair/member/secretary	25	6
3. Neighbors and relatives	28	8
4. District irrigation and general administrative officials	0	16
5. Water monitor	31	50
Chi^2 = 43.6575 with 4 df significance .000		
When there are water distribution problems related to water in the field:		
1. Water-users' association char/member	5	8
2. Village council chair/member/secretary	18	2
3. Neighbors and relatives	31	21
4. District irrigation and general administrative Officials	0	7
5. Water monitor	46	62
Chi^2 = 24.7857 with 4 df significance .0001		

Source: As of Table 1.

On the FMIS, almost 4 out of 5 farmers would turn either to their WUA or their village council, and most of the remaining farmers would turn to their water monitor. Thus, water allocation problems in the case of agency-controlled systems were viewed as being solved both by insiders and outsiders as opposed to only insiders in case of farmer-controlled systems.

Farmers were asked what they would do in regard to two different types of water distribution activities. In the first instance, they were asked about problems related to water in the field channels. In the second instance, they were asked about problems related to water in specific fields. Water distribution in the field channels and on individual farmers' fields is primarily the responsibility of the water monitor. The criteria for distribution were decided either by WUA members or the village council functionaries. When there were problems, the farmers of the FMIS had a multiplicity of reliance as opposed to the water monitor being the major leader in the case of AMIS. There was a significant number of farmers who responded that they relied on relatives and neighbors in the case of FMIS as opposed to a negligible number of farmers from AMIS relying on their neighbors. Findings in Table 9 show that farmers of FMIS approached different community leaders when there is no water in the field whereas a majority of the farmers in the AMIS relied mostly on water monitors. Thus, there was diversity of leadership patterns in FMIS as compared to AMIS to solve the problems related to field water availability problems.

Conflict Resolution Problems

Farmers were asked about three types of situations in which there were disputes. The first had to do with labor mobilization. The farmers were asked whom they approached when there were labor contribution disputes. The second had to do with resource mobilization related problems and the third had to do with the problems associated with someone stealing water. It is usual practice among the farmers to approach leaders to resolve conflicts.

No significant differences exist in regard to the reliance of the farmers on local leaders to solve problems of labor contribution disputes between the FMIS and AMIS (Table 10). Both groups of farmers indicated that they would approach functionaries of village council or the members of the WUA. A similar pattern is observed related to the farmers' responses to conflict over resource mobilization problems. What is extremely interesting, however, is the lack of a difference in these dispute resolution problems. What it means is that farmers being served by AMIS do not think about approaching governmental authorities when there are disputes over labor or resource mobilization problems. In both types of problems, more than 90 percent of the farmers in both types of systems indicate that they would turn to local institutions or neighbors and relatives rather than to the district officials or to a water monitor.

Table 10
Leadership Pattern by Control Type Solving Conflict Resolution Problems and Filling Out of Irrigation Related Papers

Leadership Pattern		Control Type	
		FMIS (n = 100)	AMIS (n = 100)
When there are labor contribution disputes:			
1.	Water-users' association chair/member	45	50
2.	Village council chair/member/secretary	50	39
3.	Neighbors and relatives	3	5
4.	District irrigation and general administrative officials	0	1
5.	Water monitor	2	3
Chi^2 = 3.3028 with 4 df significance .5085			
When there are resource mobilization problems:			
1.	Water-users' association chair/member	37	25
2.	Village council chair/member/secretary	50	60
3.	Neighbors and relatives	12	9
4.	District irrigation and general administrative officials	1	6
5.	Water monitor	0	0
Chi^2 = 7.2317 with 4 df significance .0649			
When there is a water stealing problem:			
1.	Water-users' association chair/member	5	8
2.	Village council chair/member/secretary	18	2
3.	Neighbors and relatives	31	21
4.	District irrigation and general administrative officials	0	7
5.	Water monitor	46	62
Chi^2 = 24.7857 with 4 df significance .0001			
Routine filling out of irrigation related papers:			
1.	Water-users' association chair/member	23	7
2.	Village council chair/member/secretary	57	62
3.	Neighbors and relatives	20	26
4.	District irrigation and general administrative officials	0	4
5.	Water monitor	3	20
Chi^2 = 24.7857 with 4 df significance .0001			

Source: As of Table 1.

The third type of dispute that was discussed with respondents had to do with someone stealing water. Stealing is one of the major sources of conflict among farmers on most irrigation systems. There was a significant difference of

the farmers' reliance on leadership to settle this problem. Nearly half of the farmers from FMIS approached their neighbors and relatives to solve the problem. In other words, stealing was perceived as something that one relied on social sanctions to resolve rather than turning to officials by almost a majority of farmers on farmer-controlled systems. The other half of the respondents on farmer-controlled systems relied either on WUA functionaries or village council functionaries. The leadership patterns involved in the case of AMIS are significantly different from those of the FMIS. What is very interesting is how few farmers on the AMIS indicate they would turn to district officials or even to the water monitor in times where someone steals. Almost 80 percent of the farmers on the AMIS turn to their own water-user committee, the village council, or their neighbors and relatives.

Routine Filling Out of Irrigation Related Papers

When we get to a routine problem such as filling out irrigation related papers, there is no significant difference in the responses to this question across the two types of systems. The majority of farmers from both groups relied on either the village council secretary or their neighbors and relatives.

CONCLUSIONS AND IMPLICATIONS

From the study findings and the analysis, it may be concluded that:

- The only significant difference in reported participation levels among different groups involved the assets and income of respondents. Farmers owning larger parcels of land tended to respond with higher levels of participation and were more likely to perceive system equity; this could be attributed to the combination of factors including the fact that water was distributed according to land size on the AMIS. Thus, these farmers received a higher proportion of available water while facing relatively lower levels of obligation to provide labor and other resources for system repair. In the case of the two AMIS, contributing labor and other resources was not required. Water allocation and distribution was based purely on the area of the land to be irrigated. The finding that farmers owning more land tend to participate more and evaluate equity more favorably might also have been influenced by exercise of their higher status on water monitors and other project officials.

- Among the independent variables, location of the irrigated parcel showed a significant difference in the mean scores of perceived

effectiveness, participation, and equity. Tail-enders reported lower mean scores than the middle and head-reach farmers. Middle-field respondents reported higher mean scores for participation and equity. This may be related to the fact that head-reach farmers have the advantage of receiving water first in their fields.

- FMIS manifest relatively higher interrelationships among effectiveness, participation, and equity. The effectiveness and participation scores are strongly associated with the control type.

- The differences in organizational effectiveness by control type were more closely associated with perceived effectiveness and level of participation than with perceived equity. Equity seems to be related to locational advantages or disadvantages, rather than to the type of control. Also, equity, defined here as the perceived fairness of the system, could have been treated by farmers more as a given factor, while effectiveness and participation were influenced by control type. Basically, the farmers may not expect equity - it is not in their experience.

- The two FMIS and two AMIS in the Kaski district of the Midwestern hills in Nepal are organizationally different in terms of leadership patterns for solving major problems related to dam and canal repair, water acquisition, allocation and distribution problems. The farmer - controlled FMIS have developed different types of leadership structures over a period of time by exercising higher levels of control in the community situation. The FMIS have adopted an approach of self-help and looking inward at varied types of local leadership for assistance.

- In the case of AMIS, on the other hand, leadership lies with outsiders for major activities. Thus, extensive development of irrigation leaders within the system itself does not take place. The feeling of our irrigation system as opposed to the project-run irrigation system seems to be a critical factor for the development of local irrigation special task-related leadership.

- There is a difference in the level of participation and feelings of equity among farmers from different socio-economic status groups. If there is no perceived equity in water allocation and distribution criteria, obligatory participation could become a burden to farmers. To increase the levels of participation, systems managed and controlled by nonfarmers might be turned over to the farmer. The experiences of more equitable systems elsewhere within the country could serve as the models for guiding principles of rules and roles.

- Perceptions of system effectiveness and levels of participation are associated with who controls an irrigation system. To increase the organizational effectiveness of nonfarmer-controlled AMIS, farmers could be given more control. Decision making related to irrigation activities, and water acquisition and allocation could become the function of local leaders. This might provide more reliable water delivery and familiarity of the farmers regarding system rules, and it could develop a system that could be free of political influence and thus be an independent irrigation organization.

- The diversified leadership patterns established by farmer-controlled FMIS have developed a feeling of ownership of the system. The nonfarmer-controlled AMIS may be able to increase their systems' effectiveness by decentralization of decision making. The agency responsible for irrigation system maintenance should reconsider the present policy of creating a dependency syndrome in the nonfarmer-controlled systems.

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