PART IV: RESEARCH FINDINGS ON FMIS IN THE CHANGED CONTEXT

FARMER PARTICIPATION IN RAJAPUR IRRIGATION REHABILITATION PROJECT: FROM CONFIDENCE TO CONFUSION

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CONTEXT

Development practitioners the world over have now recognized the fact that there cannot be sustainable development without people's participation. The governments, the donor agencies, the implementing agencies and other relevant agencies in all countries of the world are increasingly involving the people, who are the real stakeholders.

In spite of the participation of the people, a number of development projects and programs have failed. The reasons are not far to seek. There has been a failure or unwillingness on the part of one or all of the parties to a development project or program to internalize the concept and principles of `people participation' sincerely. Contrary to the assumptions of people participation, they do not involve the stakeholders from the very beginning of the intervention. Even if they are involved, it is limited to token representation. The presence of the stakeholders is limited to attendance in meetings or compulsory labor contribution and their views and suggestions are only heard but not listened to. It shows that development practitioners and implementing agencies have still to learn to respect the views and suggestions of the grass roots people, the real stakeholders of any development intervention. As a result, the people are losing confidence to operate and maintain and manage their own projects and programs and find themselves amidst a host of confusions.

Examples galore when development interventions have failed due to the inability on the part of the implementing agencies to internalize the concept of people's participation. One of the glaring examples is that of an irrigation project in Rajapur island, Bardiya district, Far-West Development Region of Nepal, managed by the farmers themselves with indigenous skills and technology and local resources. The systems gradually deteriorated when a government agency intervened. The deterioration was in terms of not only the physical infrastructures but also the institutional aspects. The farmers lost the sense of belonging, sense of

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ownership and the consequent sense of responsibility so important for the sustainability of any development intervention.

BRIEF INTRODUCTION TO THE RIRP

The Mountain Resource Management Group (MRMG) has been conducting Process Documentation Research (PDR) on Rajapur Irrigation Rehabilitation Project (RIRP) since September 1995. The PDR site, RIRP, is located in Rajapur, Bardiya district in mid-western Terai region of Nepal. The implementation of the project started in 1992/93. The main objective of RIRP was increasing the agricultural production through unification and improvement of the six existing Farmer Managed Irrigation Systems (FMIS) in the project area; arresting the loss of land caused by river erosion; and contributing to the environmental protection by reducing the local farmers' reliance on forest produce. The project aimed to seek active involvement of farmers in all stages of project preparation and implementation, and to help them take over the Operation and Maintenance (O&M) responsibility before the project phased out. The executive agency for the RIRP is the Department of Irrigation (DoI), His Majesty's Government of Nepal (HMGN), whereas the Asian Development Bank (ADB) provided financial support and technical assistance through institutional development consultants, NIA Consult, The Philippines.

BRIEF INTRODUCTION TO PDR ON THE RIRP

The PDR on RIRP focused on the institutional processes undertaken by the project agency, the farmers and the consultants. Information and findings from such documentation were made available to the PMC and other actors in the project. The documentation of the activities was to serve as benchmarks for evaluation of the organizational capacity of the irrigation organizations following the rehabilitation. The report tried to answer questions in the context of the RIRP, such as: what are the types of activities and tasks undertaken by the Project participants; how are these activities undertaken; what are the issues and problems that emerge from these activities; what are the constraints being faced by the project participants, etc.

HMG AND THE CONCEPT OF FARMER PARTICIPATION

The DoI has adopted and has been following the concept and principles of farmers' active participation in all its projects. However, in most of the

projects, due to the inability of the project staff to understand or internalize the spirit behind this concept, the participation has been limited to labor contribution in the construction phase of the project. The farmer participation in the decision-making and management aspects is minimal. This has often created confusions and loss of confidence to operate and maintain and manage the system among the users. In many cases, it has led to conflicts among the various groups of actors involved in the development of the project and the stakeholders. These problems surfaced in the case of RIRP, too, and this paper intends to deal with the processes of farmer involvement in the project activities, including the nature and extent of farmer participation, the problems encountered in the process and their outcome, based on the process documentation reports on RIRP submitted by MRMG to the DoI, the funding agency for the PDR, namely the Ford Foundation, and various other actors involved in project development.

FARMER PARTICIPATION IN RIRP

The RIRP envisaged farmers' participatory approach from the very initial stage of project formulation, project implementation to project monitoring and evaluation. The importance of farmers' participation was recognized from the very inception of the project and is manifested in the provision for separate consulting services for institutional development. Institution development consultant (NIA Consult inc., Philippines) has been implementing the program for strengthening local organizations and their capability to participate in the project by information dissemination campaign, farmers' training, felt need assessment of structures, etc.

Institutional arrangements for effecting farmer participation in project implementation were made by creating a Project Management Committee (PMC), which was comprised of Project Manager as chairperson, Deputy Project Manager as secretary and District Irrigation Engineer as one of the members, in addition to eleven representatives from the Central Farmers Committee (CFC) as members. PMC was the decision-making body for the project whereas CFC was the executive body of the Rajapur Water Users' Association (RWUA).

As a result of this effort, the farmers actively participated in the different phases of the project. The role played by the farmers vis-à-vis other project actors and the contributions made by them as also other project actors are documented in each PDR report. The Project Office had even recognized the traditional customs and practices of the farmers and their

organizations, such as *Sekuwa Pakuwa* (income earned by Desawar from any contract work within and outside the system. This money is spent on feasts during the gathering of all Desawar of the system) and had internalized them in the project scope of work. Due to active farmer participation, vital and necessary changes were made in the initial project design and scope of work. Because of their indigenous knowledge and skills, the farmers were able to share and contribute many invaluable ideas to the project officials, which were gratefully considered and incorporated by the project officials, even by making changes in the project's design and scope of work. Without farmers' support and participation it would have been almost impossible to accomplish many of the project activities.

PROBLEMS EMERGING IN THE COURSE OF PROJECT IMPLEMENTATION

Due to a myriad of reasons, however, problems surfaced in relation to and arising from participation in the project. The reasons included the inexperience of both project officials and farmers to deal with each other, to appreciate, understand and respect each other's point of view, different perceptions of the needs and requirement. The situation resulted into wrong attitude and behavior of both the parties and even egoism, and disputes and conflicts between and among farmers over sharing of water and other benefits. There are many examples to illustrate the above, as the different PDR reports have indicated and some of which are described below.

Even at the completion of the construction phase, the farmers had started raising several questions concerning the design, sustainability and type of the irrigation structures after observing them on the field such as whether or not these structures could be operated and maintained easily by them after hand over to them. Whether or not the irrigation structures had delivery capacity as originally designed? It might show that the farmers were not adequately involved in the project designing stage. It also raised the question, to what extent and level should the farmers, based on their knowledge, experience and capacity, be involved in project implementation. Without understanding the spirit behind the concept of participatory approach, and without defining the level of participation, if we insist on farmers' participation, it can encourage the farmers to unduly interfere in each and every aspect of the project, thus hampering project implementation and ultimately defeating the broader objectives of the project.

At the same time, it was also seen that the institutional development consultant had been imparting training to the farmers that were based on blue-print models, without assessing the farmers' felt needs. The training programs would have been more appropriate if they were designed considering the farmers' views and opinions, and capacity.

PMC is the decision-making body of the RIRP, representing both the farmers and the DoI. It was formed to take decisions on the overall planning and implementation of the project activities with consensus, representing the interests of both farmers and DoI. In practice, however, the PMC was divided into two camps with conflicting interests: those of the farmers and those of the DoI staff. For example, the farmers' representatives sometimes insisted on passing their own demands by any means and tried to bargain for deriving maximum benefits from the project--sometimes unjustifiably. So, there was always a conflict of interest in the dialogues and negotiations between the farmers' representatives and the DoI at the PMC meetings. The farmers' representatives on the PMC could be said to be the channel of communication to relay the farmers' views and problems to the project, but they never realized that they were one of the equally responsible decision-makers of the project and all matters concerning the project had to be decided, keeping in view the overall benefit from the project. The project was also stressing on passing its own agenda only. Therefore, it was doubtful that the PMC was fulfilling the purposes behind its formation. The PMC meetings had become only a tool to fulfill the project's requirements. The project personnel always felt uncomfortable and under pressure with the idea what new demands would the CFC members make at the PMC meetings and also hesitated to put forth its own agenda, not knowing what the farmers' reaction towards them would be.

It would have been desirable if all agenda were put forth before the committee jointly by the farmers' representatives and the DoI staff. Both of them equally being responsible decision-makers on the same platform, instead of clashing with each other and blaming each other, they should have tried to solve the problems with consensus by appreciating the other side's view.

Communication Gap between Farmers and CFC

Due to the weakness of the CFC, the farmers were unable to voice their opinions on the design and construction of the structures. Consequently, the farmers always raised such questions such as: what are the first

priorities in the construction work? how will the farmers' problems and needs be incorporated in the design? What are the activities being implemented by the project, etc.?

Increasing Dependence Syndrome among Farmers

Small problems were blown out of proportion due to misunderstandings between the farmers and the Project officials such as the conflicts between Bhimapur and Muraiya, water-sharing conflict between the Tapara and Koili farmers, water-sharing between Shankarpur and Bhimapur, reduction in water level in the Budhi Kulo. The Budhi Kulo conflict was solved after a great effort on the part of the Project Office, farmers and KPCs. Had the CFC been strong and effective, these small problems could have been solved in time by the farmers themselves. Bhimapur and Muraiya conflict had to be taken to the district administration office and police for resolution.

Usually, these types of issues used to be solved by the farmers themselves. After the project intervention, most of the irrigation-related conflicts started to be brought to the Project Office for resolution, which shows an increasing dependence syndrome among the farmers since intervention by the project.

Central Farmers Committee

CFC is an executive committee which represents the farmers in project development. The objective behind the formation of CFC was that it should play an active role in representing the farmers' voice, demands, interests, requirements, knowledge and experience, and mobilize resources in the planning, designing and construction stages of project development. Initially, the CFC was very active in the project planning phase. For example, it held several farmers' meetings, disseminated the project information, entered into agreements with the DoI on cost-sharing, determining the roles and responsibilities of the various actors in the project development and future project operation, formed branch canal committees and mobilized farmers for the construction of roads.

However, when the Project entered the construction phase, the CFC relapsed into inactivity. It could have played an important role in maintaining quality of work in the regular supervision, observation, decision-making, information dissemination to the farmers resolution of conflicts between the Project Office, contractors and farmers during the

construction work. However, the CFC didn't renew its constitution for several years. It did not organize even one meeting for several years. There were several reasons for the weakening of the CFC. They are lack of transportation and communication facility, inexperience and ignorance of KPCs regarding irrigation, political polarization; workload, lack of remuneration/incentives, increasing involvement of the farmers' irrigation office-bearers in politics and lack of capital build up.

The farmers do not understand technicalities. They want speedy implementation of work anyhow without checking the quality whereas the process of awarding contracts and maintaining quality of work as per international standards is a long process.

Farmers' Irrigation Organization

Prior to the RIRP intervention, there were three tiers of farmers' organization in each system, viz. Mauja, branch canal and main intake levels. Each office-bearer of these organizations had specific job and responsibilities for water management and O&M of the irrigation system. These positions were hereditary in nature and were transferred from a father to his son. During project intervention, it was believed that least intervention would be required under the present arrangements. However, after the project intervention, the role of the KPCs has become ineffective in some of the systems due to the active involvement of the branch canal committees. Similarly, the role of the CFC has been reduced and there was no rationale for their continuing after the revision of the project concept. Some KPCs took least interest in the CFC activities. There are many farmers who do not recognize the CFC members. The CFC members are confined only within their branch canals. The local leaders were dissatisfied with the existing modality of the CFC. The CFC was formed by the farmers of the six irrigation systems in 1991 to mobilize the farmer participation in project preparation, implementation and take over the future O&M of the irrigation systems after the completion of the project.

The Rajapur Farmers' Irrigation Organization didn't become capable enough to assume future O&M of the irrigation system.

- DoI has no separate unit for institutional capacity building of the farmers or members of water users or irrigators' associations whereas institutional capacity building is an integral and complementary component of the participatory approach. It contracts out the task of institutional capacity building to private

consultancies. In view of the own priorities of the private consultancies, and as these consultancies do not have long-term association with the water users' or irrigators' associations, the farmers do not have a long-term and continuing mechanism for institutional capacity building as and when need arises.

- In Rajapur, instead of strengthening the existing traditional organization of the water users, a new organization was created. As a result, the farmers lost their confidence of operating and managing their system and confusions were created among the farmers. Before the KPCs were very capable; however, their capacity was not built up; so, they became irresponsible.
- The new organization of the farmers, i.e. the CFC, too, was not viable. Meetings were not held regularly; no general assembly was held for several years and its Constitution, too, was not renewed for years.

In view of the above, it is suggested that the institutional capacity of the farmers and members of the water users organizations should be built up prior to the implementation of the project so that the farmers are fully aware of every aspect of operation and maintenance and management of their system after it is handed over to them and fully understand their role and responsibilities. The institutional development phase and the construction phase should not go together because the construction phase involves too many activities which burden the farmers and they have hardly any time for institutional development activities.

The above case points out at many deficiencies and has several conclusions and learning for the development practitioners, especially those in developing countries. Or may be, the very concept of people participation is a western one that cannot be borrowed and transplanted in toto in the context of Nepal, where the majority of the rural poor are still illiterate and ignorant. May be, the implementing agencies and the development practitioners in Nepal have their own constraints and limitations which they have to keep in mind while designing and implementing a project. The questions then are: to what extent should the people participation be allowed in a poor and developing country like Nepal where the people are by and large illiterate? Should it be allowed in each and every stage of the development intervention, even if the people do not have any knowledge to contribute, just for the sake of a new development buzz word? Or, should it be limited to the development phases where they can make effective and meaningful contribution?

There are many lessons to learn from the Rajapur experience. If the lessons learnt in the course of project implementation are carefully analyzed and honestly considered and incorporated while developing and implementing similar projects in the future, there is no doubt that it will lead to fewer problems and more effective and sustainable projects.

PUBLIC INTERVENTIONS AND CHANGING IRRIGATION INSTITUTIONS

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INTRODUCTION

This paper presents the forms of the public intervention and subsequent changes in the information institution. The case study is presented from Chaurasi Kulo of Hemja Village Development Committee (VDC).

Description of the Village

The irrigation system-*Chaurasi Kulo* is in Hemja VDC area of Kaski District along the Pokhara-Baglung Highway, 10 km. further north-west from Pokhara, the Regional Headquarters of the Western Development Region. The VDC is 827 meters above sea level and lies on 84°00' longitude and 28°13' latitude. The mean annual temperature in the area is 20.7°C and the annual rainfall is 3,306 mm. The moisture regime in the area is humid. The topography of the area is gently sloping from north to south. The settlement in the village is on the both sides of the highway. The total area under the VDC is 1734 hectares[2]. The land use pattern is given in **Table 1**.

Table 1: The Land Use Distribution in the VDC Area

Types of Land	Area (ha)
Khet	594.37
Pokho/Bari	272.91
Minaha	867.0
Total	**1734.28**

Source: District Development Committee (DDC), Kaski, 1995
Cadastral Survey Office, Kaski

The figure indicates that the irrigable area as indicated by Khet in the VDC

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[2] There was some variation in the information published by the Cadastral Survey office, Kaski. The information shows that 501 ha is *Khet*, 284 ha is *Pakho/Bari*, 626 ha is *Minaha*-is the land covered by forest, foot trails, river and other public land. 185 ha is still to be registered with the office. *Khet* is irrigated land suitable for rice cultivation. *Pakho/Bari* is the upland, which is not suitable for irrigated agriculture.

area is substantial. It also shows the potential for irrigation development in the VDC area.

Population and Ethnicity

The VDC area has 1528 households. The total population is 8468. The female population (4271) is slightly higher than the male (4197) population. The average family size is 5.5. The economically active population (15-60 age group) is about 65.0 % of the total population (NPC/MLD/UNDP, 1997). By ethnicity the village is a mixed community. The upper two castes Brahmin (40%) and the Chhetri (30%) constitute the majority. Other castes are Newar (5%), Magar and occupational castes-*Kami*, Gandherba and Sarki make up 25 percent of the total. The settlement pattern is clustered among the ethnic groups.

The main occupation of the people is agriculture. Almost 50 percent of the households however, are not food sufficient according to the VDC estimate. Maskey (1994) noted that 53 percent of the households draw income from other sources in *Chaurasi Kulo*. These include earnings from salaries, shops, wages, pensions and remittances. Poultry raising on a commercial scale is becoming an important source of income for some households due to close proximity to Pokhara.

The Landholdings and Land Tenure

Almost all the farmers are owner cultivators. The average size of a holding for the household according to the VDC record is about 0.49 ha. There is no legal tenancy in the village. Share cropping is also not prevalent in the command area of the *Chaurasi Kulo* due to the small holdings owned by the majority of the farmers. Offering land as collateral for taking a loan is prevalent in the area. This is a contractual arrangement between the farmers and the creditor for some period of time. In that case the farmer who lends the money does not receive interest, instead the earning from the land is the interest. The upper castes hold large portions of the irrigated land. Nearly 255 households in the whole VDC do not have agricultural land but they have a small piece of land for their homestead. These people are mostly from the occupational castes.

The Farming System and the Principal Crops

The type of soil in the irrigated area is alluvial which is suitable for rice farming and vegetable production. The cropping pattern in the area is rice

based. The main cropping patterns for *Khet* land in the *Chaurasi Kulo* are rice-wheat-maize, rice-wheat-fallow, rice-fallow-maize. Farmers plant both improved and traditional varieties of rice in the area[3]. Wheat covers 40 percent of the lands. The Lumle Agriculture Research Centre[4] played a crucial role in the development of the agriculture in the VDC area. Lumle had an out-reach station in the area for 17 years (1979-1996).

Migration

According to the VDC, nearly 10 percent of the total households have one of their members gone for work to India and overseas countries. However, this figure does not include the seasonal migration. The seasonal migration is to Pokhara, Chitwan and other nearby towns for porterage and for working in shops and hotels during non-agricultural seasons.

Physical Facilities

The VDC area is developing into a 'town' due to the availability of the necessary infrastructure. The completion of the Pokhara-Baglung highway in 1991 has contributed to this aspect. The shops in the center supply for the needs of the people from nearby villages. There are one private campus, three high schools, five primary schools and three private boarding schools. According to the VDC estimate, more than 90 percent of the school going age of children is attending the school. All the wards in the VDC area have piped drinking water supply. All the wards except some villages in ward 6 and 8 have electricity connections. Also there is post office and one health post. The services of the Small Farmer Development Program (SFDP) and the *Grameen* (Rural) Bank provide the credit facilities to the marginal farmers and the women. There is one co-operative society organized by the farmers. It use to provide agricultural inputs to the farmers. At present the co-operative does not functioning as it has incurred losses.

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3 The local varieties are *Pahele*, *Jadhan* and *Gurdi* whereas the improved varieties are *Khumal 4*, *Khumal* 9 and *Radha 7*.

4 The research center was established with the assistance from the British Government to support government of Nepal in agricultural research and extension.

Existing Social Relationships

The people in the VDC are satisfied with the relationship among various caste groups due to the interdependence among each other. The relationship between the people in the VDC can be classified into social relations, economic relations, political relations and caste relations. In the social relationship, kinship relation is the strongest one. The social and economic relationship between the descendants of the same family is based on close co-operation. The immediate help in any social event and economic matters comes from the family members, although the nuclear family is replacing the traditional extended family. The caste system is still prevalent, although officially abolished by the *Muluki Ain*. It was evident from the separate places assigned to the upper caste and the occupational caste people in a local teashop.

The economic relation among various caste groups is based on the exchange of goods and services and borrowing money for social events and for the economic activities. This type of relation is more prevalent between the rich and the poor than among the people of same economic status. This economic interdependence is helping to maintain the ties among the various caste groups. Labor exchange, for example, which is known as *Parma* is common in the village. This is practised between all the people irrespective of their economic and social status.

Political relationships were becoming more vivid after the restoration of multi-party democracy in 1990. It would be an exaggeration to say that all the people are active in party politics. The political relationship becomes more open during the local election, which is contested on party ideology. The educated and the identified party workers are more active in local politics. The general mass however, bases their selection of the candidate on merit basis and kinship relation.

ENVIRONMENT OF THE IRRIGATION SYSTEM

The Irrigation System

This Chaurasi Kulo is a river valley irrigation system. The Yamdi *Khola* is the source for irrigation water and the discharge capacity of the temporary canal intake was 1.4 m^3/second. The length of the main canal is 4.30 km. There are 10 outlets at present, which delivers water to the field channels. There is no canal lining in the field channels. The field channels provide irrigation water to the terraced fields. The main canal has five foot bridges.

There are 8 culverts, two drain inlets and four aqueducts. The permanent headwork of the main canal was constructed in 1999. Before that the headwork was temporary. There is lining on some parts of the main canal. The construction of a new irrigation system at the tail end of this scheme in 1983/84 divided the scheme into two (see **Figure 1**).

The Irrigated Land and its Distribution by Ethnicity

The average size of holding within the command area is 0.44 hectares (VDC, 1998). The distribution of land and the size of holdings among the various ethnic groups are presented in the **Table 2** The names of the farmers have been counted only once even if they had several parcels of land in different locations of the command area. The number of farmers having more than one parcel of land is 74.

Table 2: The Distribution of Size of Holding by Ethnic Group

S.N.	Size of Holding (ha)	Ethnic Group (No.)					
		Brahmin	Chhetri	Newar	Gurung, Magar and other Castes	Occupational Castes	Total
1.	<0.25	70 (62.5)	28 (25.0)	5 (4.5)	1 (.89)	8 (7.14)	112 (32.1)
2.	0.3-0.5	89 (66.4)	37 (27.6)	4 (2.9)	3 (2.2)	1 (0.74)	134 (38.2)
3.	0.55-1.0	46 (68.6)	20 (29.8)	1 (1.4)	-	-	67 (19.1)
4.	>1.0	28 (75.6)	6 (16.2)	3 (8.1)	-	-	37 (10.6)
	Total	**233 (66.5)**	**91 (26.0)**	**13 (3.7)**	**4 (1.14)**	**9 (2.5)**	**350**

Note: The figures in parentheses are percentages

Figure 1: Layout of *Chaurasi* and *Annapurna* Kulo Irrigation System

The distribution of land holdings in the irrigated area is highly skewed in favor of the higher caste groups, mainly Brahmin. The occupational caste groups who constitute 25 percent of the village population hold only 2.5 percent of the irrigated land. The information also indicates that almost 90% of the farmers own less than one hectare of land. The majority of the farmers have between 0.3 and 0.5 hectare. Ethnically, the majority of the farmers holding more than one hectare are from the upper castes. Among this Brahmin caste group also, one particular clan group holds most of the land. This is because they are the descendants of the family who were the early settlers in the area. Thus, any decisions related to the irrigation cannot be implemented without their participation.

THE PROCESS OF INTERVENTIONS AND CHANGE

Irrigation under the *Ditthawal* up to 1960

The government appointed one *Ditthawal* from the family of those who constructed the irrigation system. The *Ditthawal* was in-charge of collecting land revenues and operation of irrigation system as well, with the help of the *Mukhiyas*. If he failed to collect the revenue, he had to pay the revenue on his own. The Land Reform Act of 1964, which took away the land tax collection function from the Ditthawal, curtailed his power related to land administration. In other words he could enforce no sanctions with respect to land and water. Besides, the Panchayat System introduced a new politico-administrative structure in the country in 1962, which abolished the traditional system of local governance in which the *Ditthawal* had a key role in village administration. The Village Panchayat (VP) came into existence at the village level. This institution became responsible for managing public property at the local level. Nevertheless, the *Ditthawal* continued to administer the system as part of wider local administrative function still 1966 under the supervision of the Village Panchayat.

The *Ditthawal* was receiving the earnings from the *Birta*[5] land of 26 ha,

[5] The Birta system was abolished in 1959 through the Birta Abolition Act. With the abolition of the Birta the ownership of the land was vested in the government (Regmi, 1978: 27). However, Birta abolition was not a land reform measure and the Birta holders were allowed to retain the land, but they had to pay land taxes (Regmi 1978:361), which was not required before the Act. In this context, it seems natural for the Ditthawal to claim the ownership of the land as he was entitled to the proceeds from it for a long time (see next page).

which was for managing the irrigation system. At present the *Ditthawal* has got the legal entitlement of the land. The abolition of the *Birta* system, the land reform designed to bring agrarian transformation in the country and politico-administrative changes were instrumental for the disintegration of their traditional institution. The issue of the legal ownership of the land and the problem in the management of the irrigation scheme at present was the result of these three interventions. There were no known serious management problems in irrigation scheme before these interventions took place and when the position of *Ditthawal* was in existence.

The Irrigation System under the Village Panchayat from 1964 up to 1990

The VP took over the management in 1964 after the intervention by Department of Irrigation, Hydrology and Meteorology in 1962. The DIHM continued to provide funds for the operation and maintenance of the scheme for 7 years (1964-1971). The officials of the Village Panchayat, according to some of the farmers, were interested in the annual maintenance funds coming from the government and did not mobilize internal resources. Besides, people were not interested in contributing to the maintenance since they knew that the funds were coming from the government. Hence, the VP could not enforce the strict norms for mobilizing the resources, as in the time of *Ditthawal* for operation and maintenance.

In 1980 the king called a referendum to choose between two political systems: existing Partyless Panchayat System vs. a Multi-Party system. This affected the management of the irrigation system according to the former *Pradhan Pancha* (Chairman of VP). The VP could not enforce most of its decisions during the referendum period. Most of the educated people in the village persuaded other villagers not to obey the decision of the VP since they were in favor of the Multi Party System.

The VP formed a *Kulo Samiti* (Irrigation Committee) to manage the irrigation system consisting of Village Panchayat members according to the former *Pradhan Pancha*, after the Partyless Panchayat system won the referendum. The study conducted by Shivakoti (1992:18) confirms this fact. The study indicated that the *Kulo Samiti* consisted of 11 executive members and 30 members at the branch level. A *Pale* (water guard) was employed to allocate water to the branch canals. He used to work under the direction of the *Kulo Samiti*. The effectiveness of the VP was gradually

diminishing after the referendum as the village was politically divided, although the *Kulo Samiti* was functioning. Hence, the VP could not enforce the rules. However, it did manage the system till 1990. The introduction of the Multi-Party system in the country in 1990 brought changes in the local institution and the VDC came into existence in 1992 in place of VP. The *Kulo Samiti* during the time of the VP dissolved with the abolition of Panchayat system, since majority of the members of it were VP officials.

The Irrigation System under the VDC since 1992

The VDC is responsible for the management of the canal since 1992. It prepared a management plan for operating and maintaining the canals. The works for canal maintenance were divided among the wards[6], according to the former VDC chairman. The allocation of labor requirement was on the basis of the land to be irrigated in each ward. The plan did not work well in absence of necessary rules for the governance of the irrigation system. The reasons cited by the farmers were the following:

- The government had commissioned a preliminary study through local consultants in 1992 for the rehabilitation of the canal, and had assured to provide assistance. Farmers were hopeful that the rehabilitation would take place. Therefore they were not interested in contributing to the maintenance.
- Water availability for the farmers at the head and middle was sufficient. Because of this, they were not interested in any operational rules and they were also not interested in spending their resources for the maintenance of the canal. Only the farmers at the tail end who did not receive sufficient water wanted operational rules. Their efforts were not sufficient for carrying out maintenance activities. They do only occasional maintenance.

The farmers were of the opinion that the management under the VP was better, with an exception of the period during the referendum in which its authority was undermined, as compared to the management by VDC at present. This was because the people were afraid of the VP and used to

[6] At present each of the wards have five members including a woman since the amendment in local election by-laws in 1997.

report for *Jhara* (labor contribution)[7]. This was not strictly enforced during the time of VDC management. This shows that an authority of an institution was necessary to maintain social control, which could enforce necessary rules. The villagers gave the following reasons for the break-down in traditional management practices.

- The conversion of Birta land into Raikar (individual ownership) land to the Ditthawal.
- The people did not like to contribute their resources, as they became dependent on government resources after the intervention in 1962.
- Reduction in the number of users after the construction of the Annapurna Kulo at the tail end.

THE INTERVENTIONS IN THE IRRIGATION SYSTEM

The Intervention of 1962

Parts of the canal were completely washed away due to a big landslide in 1960 according to the villagers. The DIHM assisted the farmers with the rehabilitation in 1962 following the royal directives. The objective of the assistance was to restore the operation of the main canal. Parts of the main canal in the head and middle were lined using stones. During the time of rehabilitation the DIHM was operating the main canal. The rehabilitation was completed in two years time. After the completion of the rehabilitation of the system, the DIHM left the village because it did not construct the canal and it assisted in the rehabilitation only.

Farmers however, wanted the DIHM to continue the operation and maintenance of the system because they did not have to contribute for its maintenance. The VP took over from the DIHM. This means the organizational control of the irrigation system was transferred to the local institution. Thus, the management of the irrigation system at this time was

[7] People still call it *Jhara*, which in the past was compulsory labor contribution as demanded by the state. In Nepal three forms of compulsory labor - *Jhara*, *Beth* and *Begari* existed in the past. The labor was used for the public works such as maintenance of roads and bridges, reclamation of waste land and maintenance of irrigation canals. *Jhara* meant requisition of laborers from each family in the village for a certain number of days for public works. *Beth* meant the exaction of unpaid labor on a customary basis, while *Begari* denoted the requisition of casual laborers for emergency requirements (Regmi, 1978:504).

in transition. The VP, which came into existence in 1962, was not in a position to continue the old practices that were lost during the DIHM management. The *Ditthawal* also could not enforce the past norms as his position was not any more legally recognized. According to the opinion of some of the elders in the village, the traditional system of management was lost during this time. The changes in the interface between the existing institution and the users and the establishment of a new interface due to the emergence of new institutions were the causes for this situation.

The farmers constructed a checkdam at the headwork in 1997 through the financial assistance from DDC and the material support from the District Irrigation Office (DIO). The construction of the checkdam became necessary to divert water to the canal as the headwork was washed away by the flash flood. This indicates that the farmers were quick to organize themselves to obtain the external support.

The Intervention in 1998-1999

The VDC on behalf of the farmers was taking the initiative for the rehabilitation of the scheme that took place in 1998. The role played by VDC was encouraging as it was maintaining the momentum, which started in 1992, when the government did preliminary survey of the system. Besides, the VDC provided the cash amount, which was required along with the farmers' demand. This exemplifies how keen the VDC is on the rehabilitation of the scheme. The VDC vice-chairman however, said that the VDC would collect the money from the farmers afterwards. This seems to be unlikely as the amount was from the annual development grant of NRs. 500,000 provided by the government. The farmers from water scarce area in ward 4, 5, 6, 7, 8 and 9 may have successfully negotiated with the VDC to provide the money for rehabilitation work. In return, they will not ask for other development projects in their wards.

The VDC in consultation with the farmers had constituted a Users' Committee (UC) in August 1998 comprising nine members, as it was required for the intervention. The VDC however, was involved in the negotiations with the DIO officials as the VDC was taking the lead. The intervention took place at the initiative of the VDC. It is important to note that the first VDC chairperson, who was elected in 1992, was able to persuade the Department of Irrigation (DOI) to conduct preliminary survey for the rehabilitation. It is learnt from the DOI officials that the government completed its part of the rehabilitation. However, the users did not fulfil their part of work that they have to do through labor contribution.

It is a general tendency that users would not like to contribute to the government program, as they feel that the government has an obligation to fulfill towards them. This is largely due to failure in following the processes required for the participatory approach of the development, in which the users and the implementing agency have a direct contact. The gap was fulfilled by the VDC as an intermediary between the DIO and the users. The involvement of VDC has helped in minimizing direct costs to local people but it became a disincentive for functioning of the irrigation organization, which is UC in this case.

MANAGEMENT OF IRRIGATION TASKS

Water Acquisition, System Development and System Water Allocation

The irrigation system was developed long ago. The work related to water acquisition begins in middle of May every year. The villagers gather to collect materials to construct temporary head works. The users can receive the amount of water they require, as the water available at the source (*Yamdi Khola)* during monsoon is sufficient and it does not affect the water availability to the *Annapurna Kulo* system down stream. There are no other systems operating nearby at the upstream. The materials include stones, twigs and sometimes gabion wire. The gabion wire is usually obtained from the DIO. The work is carried out under the supervision of the VDC. It takes 15 to 20 days for the construction of headwork. With the completion of rehabilitation however, the farmers do not have to contribute labor for headwork construction at present.

User Allocation, System Operation and Water Distribution

The Ditthawal Period

Water allocation during the time of *Ditthawal*, was up to the outlet only. In practice, according to some villagers, there were no distribution rules at the head and middle of the canal. This was due to the sufficient availability of water in the canal as far as they were concerned. The allocation of irrigation water for each field channel at the tail end was proportionate to the irrigated area and the water distribution was on a rotation basis based on the *mato muri*. The irrigation water was provided to each plot on a 24 hour rotation basis from the two branch canals. The distribution at the field level was the responsibility of the farmers, which the farmers decided through mutual consultation. The user receiving irrigation water from that

field channel used to decide the rotation collectively based on the *mato muri*. The rotation used to be generally for 24 hours according to the farmers.

The VP Period

During the management period of the VP, the water allocation was also up to the branch canal on a rotation basis, according to the former *Pradhan Pancha*. He said that the VP used to invite farmers from each outlet to prepare a water distribution schedule at the beginning of the irrigation season. If there was any disagreement, that was solved through discussion among the farmers in order to avoid any conflict afterwards. The VP initiated the position of *Pale* for water distribution, according to the former *Pradhan Pancha*. There were three *Pales* working at that time. The VP paid the *Pale* for his services. The *Pale* used to monitor whether each farmer was complying with the rotation schedule. One of the *Pales* who worked for 5 years (1966-1971) mentioned the following about the management at the time of VP.

A proportioning weir of bamboo and wood was used to allocate water to the branch canals and distribution from the field channels was according to the *mato muri*. The agreement between the members of different branch canals was required for the allocation. The *Pale* used to regulate the water from the main canal to the branch (distribution) canal and from branch canal to the field channels. He used to inform the farmers about their rotation schedule after allocating the water from the branch canal to field channels. The rotation was for 24 hours. The *Pale* system continued till 1990, when the multi party system was introduced in the country. The discussion with users revealed that water allocation and distribution was based on the principle during the time of *Ditthawal* and for some time under the management of VP. There were no written rules, however. Nevertheless, the norms were established and farmers agreed to it.

The VDC Period

There were no allocation and distribution rules. The water availability at the tail end at present is not sufficient for all the land in planting period. This is largely due to the blockage established by the farmers in the middle of the canal. In that case it was natural that the farmers having land near the field channel would not allow it to flow to other fields unless there is enough for their land. Thus, the timely monsoon was very crucial for the farmers at the tail end. Therefore, physical presence is necessary for

getting water at the tail end during the peak period. The farmers at the beginning of the tail end use more water when there is an increase in the volume of water in the field channels. Others could not get the water that they needed. It is because there were allocation rules in the past that do not exist now according to the *Pale*. Users opined that the VDC was not effective in formulating and implementing the allocation rules.

CONFLICT MANAGEMENT

The VP Period

There was a problem in water distribution during the management by *VP* also. Some of the farmers used to steal water usually at night according to the *Pale*. Some used to remove the proportioning weir at the branch canals. Some of the farmers used to divert the water to their field from others' fields, even though it was not their turn. The blockage by farmers at the middle reaches of the canal, to irrigate the land that was above the canal, could lead to fighting among the farmers. According to them the depth of the canal had reduced to half since 1960 due to the deposition of silt[8]. This had been an unexpected benefit to those whose lands were higher than that of the level of the canal. Now they did not have to put so much effort in irrigating their fields. The *Pale* was authorized to detect where the water stealing was taking place and he had to report this to the VP. The farmers also could report to the VP, if someone did not comply with the rules for water allocation and distribution. If the information was true, the *VP* would penalize these concerned. The sanction procedure was to warn the offender for the first time. If he repeated the action again then the penalty inflicted was to cut off the water to his fields.

The VDC Period

During the time of VDC the farmers at the head and middle used to divert all the water to their fields when the monsoon was not good, according to the view of a farmer from the middle. The farmers at the tail end used to quarrel with the farmers at the head and middle. The VDC used to intervene some time and the farmers from the middle agreed to the amount of water to the tail reaches by reducing the height of the blockage. These showed that the farmers from the head and middle reaches were aware of

[8] According to the estimate of the farmer the depth of the canal was 2.2 meter but now it is only 1 meter.

their misbehavior. This indicates that the social interface is important in applying social control. However, the episodic incident of this kind has not been effective for permanent solution of the disputes. The conflict at present was also due to the change in the hydraulic configuration of the scheme after the construction of *Annapurna Kulo*.

RESOURCE MOBILIZATION

The Ditthawal Period

The labor mobilization during the time of *Ditthawal* was proportionate to the size of the land holding inside the irrigation scheme, that is, more land more labor contribution in mandays. The nature of the work determined the contribution. The *Mukhiya* in consultation with the farmers used to decide this. Annual canal cleaning was a regular activity. Each farmer irrespective of his caste and location of his land had to contribute labor. The *Ditthawal* used to fix the working days for the maintenance of the canal and the *Mukhiya*s and *Talukdar* were responsible for mobilizing the people from their respective areas. Those not reporting to the work had to pay in cash (32 paisa for 0.05 ha, NRs 1=100 paisa). This amount would double each day. The *Ditthawal* had the authority to confiscate the land if someone did not report for five days and he would report it to the land revenue office. There was a penalty for the *Talukdar*s also if they could not mobilize people for the maintenance. In other words it was a customary participation and not voluntary. People did participate for fear of losing their land.

The VP Period

In 1962 the DIHM provided NRs 61,000 and farmers mobilized 18000 mandays of labor for the rehabilitation of the canal according to the former *Pradhan Pancha*. This means the cash contribution was NRs. 203 per hectare (300 ha) and the labor contribution was 6 mandays for one hectare. VP used to mobilize the labor contribution for the annual canal cleaning during February and March to get the canal ready for irrigation. The Village Panchayat used to make decisions and the *Katuwal*[9] had to inform the people. People had to report to the work and mark their presence by

[9] He is a messenger paid by the VDC and the farmers for his services. He communicates the VDC instructions by announcing them in a loud voice in main places in the village so that every one will know this.

signing the Panchayat register. The nature and extent of tasks determined the work load. Each ward would have to clean certain lengths of the canal. The division of work was proportionate to the use of irrigation water by the wards and the irrigated land holding of each farmer in the ward. A little more than two persons per ha were required for canal cleaning in the command area of 300 hectare. According to the villagers the *VP* was effective in carrying out necessary maintenance work but was not effective in the allocation and distribution of water. The institutional practices of labor mobilization further disintegrated after the construction of *Annapurna Kulo* due to the decrease in the number of users because the maintenance requirement did not change.

The VDC Period

In the beginning when VDC came into existence (1990), *Katuwal* indicated the time and date for the work. The ward member noted the presence of all those who provide labor at the time of the construction of the headwork. Those who did not report for the work would have to pay NRs. 70 for the labor. The people from the head and middle reaches in fact did not work for water diversion according to users from the tail end. It was only the people from the tail end who had to contribute and still it was difficult to get enough water in time. This exemplifies that labor contribution is no longer considered an obligation to the proportion of water right.

Gradually, the traditional practice of labor mobilization disappeared after the VDC took over the management. There was lack of control under one authority as the VDC leadership was not effective in enforcing strict norms. This reflects the disintegration of the social fabric due to the break-down of social norms and preoccupation of farmers with other works. Mainly the farmers from the tail end were putting in more efforts. They also did most of the maintenance work such as repairing holes in the canal to reduce the leakage. The farmers from the tail end requested the VDC to devise a new system for labor mobilization. Their proposal was that the labor mobilization should be proportionate to the land holding to make the contribution of labor more equitable. The VDC chairperson avoided the request suggested to look into the matter after the rehabilitation. However, this has not happened yet. There was no sanction imposed on those who did not report for work. Now the contribution is 'voluntary' unlike in the past when there was compulsion for contribution.

The VDC formed a UC to take necessary measures to operate the canal in

1997 due to the damage caused by a flashflood. The UC mobilized both external and internal resources to operate the canal. The district committee for natural calamities provided NRs. 150,000, the DIO provided 65 pieces of gabion wire and farmers contributed 2500 mandays of labor. The cash and the gabion wire were used to construct the checkdams near the head works. It indicates that the external resource mobilization is an integral part for emergency maintenance.

SYSTEM MAINTENANCE

The VP Period

The committee formed by the VP during its period of management concentrated mainly on the maintenance work. The work included were the construction of the head work and annual canal cleaning. The VDC did not do major maintenance work during its management. The *Kulo Samiti* used to look after the repair and maintenance of the canal. The committee used to make collective decisions for different type of work to be carried out. The nature and volume of work was determined through spot checking by these committee members.

The VDC Period

According to users, the water flow in the canal has deteriorated since there was no annual cleaning. Sufficient irrigation water would be available for all the land when the canal was maintained regularly. This due to the lack of interest of the farmers from the head and middle reaches as they got sufficient water. Some opined that party politics were affecting every aspect of life in the village. These day village officials do not like to disappoint any one because of the votes. That is why they cannot enforce strict rules for fear of losing votes. Concerning the rules for the maintenance that the farmer also thought that the VDC was not effective in mobilizing sufficient resources as in the time of *Ditthawal.* The decrease in the number of people at the tail end, who now receive irrigation water from the *Annapurna Kulo*, is another reason for low participation for the maintenance work.

GOVERNANCE AND PROPERTY RIGHTS

During the time of *Ditthawal* there were established operational rules in the irrigation system due to the presence of rewards and sanction procedure. Thus, the management of the irrigation system was continuing

without any hindrance. Two types of property rights were in existence in the irrigated area. Some of the farmers at the tail end had water rights for the planting only whereas the water rights of other users was based on *mato muri* in the irrigated area. The *Ditthawal* decided the allocation of water for each branch canal in consultation with the farmers. The water availability in the canal and the area to be irrigated by each of the branch canal was the main criteria for the allocation of water. At the field level the farmers from the outlet used to decide the water distribution, which was also based on *mato muri*. Annual maintenance of the canal was also strictly enforced. Thus, the water right of the farmer was tied up with the labor contribution. The intervention by the DIHM brought changes in the governance of the irrigation system and the collective choice rules were lost during this period as farmers did not have to contribute for the regular maintenance of the irrigation system. However, there was no change in the operational rules, as *Ditthawal* was working side by side. His power to enforce rules was further curtailed after the Land Reform Act of 1964.

The VP took over the management and enforced the operational rules for some time, which was based on the norms during the time of the *Ditthawal.* However, strict sanctions for those not conforming to the rules were not enforced. Thus, there was gradual decline in the enforcement of the rules, which was a pre condition for the successful management of the irrigation system. Annual labor contribution for the operation of the canal was not compulsory for receiving irrigation water. The water right of each of the farmer was not respected. As a result, the farmer from the tail end suffered most. The governance during VDC management was not based on strict rules. The system was functioning but with greater inequity. The water rights based on *mato muri* were not strictly enforced in absence of the proper rules. Several conditions (shared cost and benefit, proper monitoring of the behavior of the users and effective sanction procedure) for the successful operation of the irrigation scheme were violated. The water rights of the users at the tail end were not protected in absence of the operational rules. The users from the head and the middle continued to take benefit out of this situation. They draw the collective choice rules in the irrigation system for their benefit. This indicates how breaking of norms by some of the users could negatively affect the enforcement of rules. As a result the users lost the interest in the maintenance of the irrigation system.

The organizational control in the irrigation system has undergone major changes since the time of the *Ditthawal* and VP, which were discussed in the previous sections. The formation of UC in the process of intervention

is likely to bring new organizational control. However, it is reported that the UC is not functioning at the moment. This shows that the UC could not maintain linkages with the users for regular operation and maintenance besides the irrigation office for emergency maintenance.

CONCLUSIONS

The discussion above reflects the changes in the institutions due to the public interventions in various forms and their effect on the governance structure and irrigation practices. Up to 1962, the *Ditthawal* was working reasonably well as the irrigation system was under his administrative control. This was due to the then existing social control in the isolated village community and the possibility to apply sanctions when farmers were not following the unwritten rules. The abolition of the *Birta* system in 1959 provided the opportunity to the *Ditthawal* to claim ownership of the land, which was kept for the maintenance of the irrigation system. This was the beginning of the deterioration of the rules in the irrigation system. The introduction of VP in 1962 as a lower level of politico/administrative unit due to the political change in the country and the land reform in 1964 also weakened the institutional position of *Ditthawal*, as he could not enforce sanctions against those who did not follow the prevailing norms.

After the first intervention by the DIHM in 1962 it left the management to VP and *Ditthawal* in 1964. Thus, there was a change in the interface situation between the actors. Previously it was between the users, VP, DIHM and *Ditthawal*. Now it was between the users, VP and *Ditthawal*. This was an interim period when both VP and *Ditthawal* worked side by side, which continued till 1966 when the position of *Ditthawal* came to a definite end. The traditional management system began to lose its importance during this period due to the changes in the interface situation. It is because VP was not well established to take control of the irrigation system and farmers did not like to continue the old practices under the *Ditthawal* as the interface between them was autocratic in nature as he was in control of land tax and could impose sanctions. It was natural for the farmers to look for new relationships due to changes brought about by the new political system and the government support in rehabilitating the irrigation system. Besides, the users were not prepared to contribute their resources for the operation and maintenance of the irrigation system, as the VP was successful in obtaining resources from DIHM till 1971 for the operation and maintenance of the system.

The political referendum of 1980 further undermined the position of VP

and it also contributed to the social division among the farmers along political lines. This affected the interface situation between the farmers and the VP, which was basically based on a confrontation of power. This shows that not only the government interventions in the irrigation system but also other political and social interventions affected the irrigation institution due to the changes in the roles of individuals and the VP. However, the VDC effectively controlled the management till 1990. This indicates that the political control is an important factor in strengthening the institutional capability for the management of irrigation system.

The irrigation system was from the beginning overstretched with the result that the tail end was not receiving adequate irrigation water. This aggravated the conflict between the farmers at the head and tail end, which made the collective action weak. Thus, the farmers at the tail end with the support from the VP were able to convince the DOI to implement the *Annapurna Kulo* in 1983 for the irrigation of the tail end of the *Chaurasi Kulo*. The intervention further contributed to the disintegration of the social relationship existing between the old users due to changes in the interface situation.

The irrigation system was functioning well during the time of the *Ditthawal* in terms of management tasks. This was largely due to the existence of collective choice rules and his role in enforcing the operational rules. The change in governance structure took place as VP took control of the system in 1964 from DIHM. The VP was successful in enforcing the rules for allocation and distribution as long as it had the authority. It tried to revive the operational rules through the *Pale* till 1990. The VP however was not effective in mobilizing resources from the people for the maintenance of the system, since it was receiving funds for maintenance of the main canal from the government till 1971. Farmers became less interested in the resource mobilization of their own when they were receiving the funds from the DOI, which also affected the ownership feeling. This led to further deterioration of the operation and maintenance of the *Chaurasi Kulo*.

When in 1992 the VDC came into existence and replaced the VP, it also could not develop and implement the operational rules, as its position became weak due to being elected representatives. The farmers from the head and middle reaches continued to take benefits due to the weaker position of the farmers at the tail end due to the decrease in the number of users of *Chaurasi Kulo* at the tail end as many of them were now in the command area of the *Annapurna Kulo*. In addition, the majority of the

farmers at the head and middle are from one clan group, who has substantial influence in the village because they belong to higher socio-economic strata in the village. This is evident from the blockages they had put in the canal, which in the past led to conflicts between the farmers.

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ASSESSING THE PERFORMANCE OF FARMER MANAGED IRRIGATION SYSTEM: AN EVIDENCE FROM HAKRA 4R DISTRIBUTARY, SOUTHERN PUNJAB, PAKISTAN

NAEEM AKHTAR, ABDUL HAMID AND MIAN ABDUL WAHID[1]

INTRODUCTION

The Indus Basin Irrigation System of Pakistan, the largest system in the world, is now facing multiple problems like high conveyance losses, unreliable water supply and inequitable water distribution (Bhutta et. al., 1992). Both under normal supply and shortage conditions, there were considerable upstream water users receiving more water than their due share, while those in the tail reaches of the canal command received less (Vandar Velde et. al., 1992). Now almost all the system supplies have become unreliable and inequitable, the financial non-viability is there as well though the original design aimed at reliable and equitable water distribution among the distributaries and watercourses.

Keeping in view the problems, the World Bank, in the early 90s, suggested commercialization and privatization of the system for the rehabilitation. However, after a series of negotiations, the Government of Pakistan agreed upon the institutional reforms through the transformation of Provincial Irrigation Department (ID) to Provincial Irrigation and Drainage Authorities, setting up of Area Water Board (AWB) at canal command levels and formation of Farmer Organization (FO) at distributary/minor level (Government of Punjab, 1997).

It is expected that the FO will not only maintain the system but also will lead towards the efficiency of water and sustainable agricultural productivity. The user participation creates "sense of ownership" among farmers (Meinzen-Dick et. al., 1995) and farmers show more willingness towards the system protection, as it is happening at the tertiary level management. There the farmers own the system instead of government so they regularly maintain the watercourse. It contributes in more equitable distribution within the watercourse.

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OBJECTIVES

The objective of the research paper is to present the status of farmer managed irrigation systems along with the examples from Hakra 4R.

BACKGROUND

Site Characterization

The Hakra 4-R Distributary along the Hakra Branch Canal of the Fordwah Eastern Sadiqia irrigation system is located in the southern Punjab of Pakistan. The location map of the research site is given in **Figure 1**.

Figure 1: Location Map of the Research Site

The Hakra 4R distributary has a total discharge of 197 cusecs, and a total

of 124 irrigation outlets serve a command area of nearly 18,000 hectares. The Distributary system has two minors, i.e., 1-RA Labsingh and 1-R Badruwala, each discharging 22 and 43 cusecs, and with 15 and 33 watercourses, respectively. Both the minors and the distributary below RD 72+000 are lined.

The Distributary system supplies water to about 6,000 warabandi shareholders who are residing in 41 villages. These shareholders were facing many problems regarding the irrigation and agriculture (Wahid et. al., 2000). They were looking for alternatives to resolve their problem. In this effort, International Water Management Institute (IWMI) selected the Hakra 4R Distributary as a pilot study area for the participation of water users in the operation and maintenance of the irrigation system. IWMI organized the farmers through gradual and step-wise social organization methodology (Bandaragoda et. al., 1997).

Methodology

Literature review was done to understand the existing irrigation system, importance of users participation in the management and short-term impact of the FO before and after the handing over of the system.

As the FO is properly maintaining its record, so all the data are collected from its record. Then data are analyzed and processed. The FO conducted an informal survey from September 2001 to February 2002. The purpose of the survey was to interact at the grass roots level and know the farmers' views about the operation and maintenance of the system. In the light of the survey findings the new decision for improvement was made. The survey was conducted in 41 villages and 576 farmers were interviewed.

RESULTS

Performance of the Farmers Managed System

The FO which is kept alive for the period of three years with minimal regular activity is itself big achievements (Ralf et. al., 1999). Hakra 4R Distributary was formally handed over to the FO on May 10, 2000. The FO showed considerable improvement in the management of the system. They are mentioned below.

Reliability of Water Supply

Achieving reliability and equity in irrigation water supply was a big challenge for the FO. The unreliability was the main cause of inequity. The problem was continuing from the last few years. The introduction of rotation system distributaries could not overcome this problem. It has even worsen the inequity then increasing more unreliability.

The expectation was that the FO will achieve equity and reliability. Hakra 4R Distributary FO got their nomination in the water allocation committee. The committee was supposed to prepare the seasonal flow schedule for the distributaries to achieve the reliability in water supply. In case the Irrigation Department is deviating from the water schedule, the FO forces the department to stop the rotation when there is ample water available in the parent channel. In this way, FO achieves considerable improvement in the reliability of water supplies, which also indicated that compared to last year, the average amount of water was also more (Hassan et. al., 2000). Improved reliability of water means a guaranteed water supply for farmers, and therefore, they will not tend to over- or under-irrigate their crops as much as possible. The FO survey showed that 85% farmers reported the improvement in the reliability.

Equity in the Water Supply

One of the main purposes of the farmer participation was to improve the equity as well. At the time of handing over of the system, considerable inequity was observed in the system. During the closure period of 1999-2000, Pakistan Army and ID repaired the defective outlets. They focused to installing the outlets with accurate dimensions, without any reference to the water level or bed level, which had changed overtime due to sedimentation and scouring. As the result of the outlets repair, canal started drawing in the head and middle reach less than proportionate discharges and water rushed to the tails. After the FO took over and repaired the outlets, the inequities narrowed down from 70% to 30 % (Hassan et. al., 2000). This shows a gradual improvement in water distribution among outlets. The FO did this job on self-help basis, although a lot of funds were requested for this purpose. The FO survey showed that 73% farmers reported achievement in the equity, 15 % said that equity was narrowed down, and 12% reported no change.

Conflict Resolution

The FO has established its water court for conflict resolution. There is heavy burden on the FO in this regard. The conflict cases are being filed to water court. The farmer avoided filing the cases in the ID due to bureaucratic hassles. The FO has resolved 635 water related disputes until now and tried its best to deliver the justice. There is complete users satisfaction, as no appeal was made against any the FO decision. This also shows users satisfaction towards canal managers compared to government officials. The FO survey shows that 69% reported users satisfaction, 3% reported no change and only 5% showed dissatisfaction while 23% remained neutral as they did not respond.

Maintenance

The FO started maintenance work right from the beginning of the handing over of the system. They had to repair 38% of outlet structures in the period of one month for achieving the equity. They spent 50,000 rupees[2]. Resources were mobilized on self-help basis. This voluntary effort has been continuing since the FO formation time in 1997. The FO did maintenance activity twice on self-help basis (Hassan et. al., 2000). The maintenance work in the year 1997-98 was rupees 400,000 (Zaman, 1998). About 81% farmers reported improvement, 9 % non-improvement, and 10% responded no change in the maintenance of structure in the FO survey.

Discouraging Informal Payment

Establishing a corruption free system was a very difficult and challenging job. It became more severe where the corruption was entrenched in blood. It was not easy to get rid of it. At the Hakra 4R system two million rupees were paid annually to the ID as an informal payment in exchange for assured supply of water (Mudassar, 1996).

The FO tried its best to get rid of corruption. During the period of two years of the FO management, not a single bribery case is reported. The FO survey shows that 75% reported the no case of bribery, while 25% responded as no change in the situation.

[2] 1 US$ = 59.2 Pakistani Rupees

Assessment and Collection

The financial non-viability was the primary cause of reform. There was not enough money for the operation and maintenance of the canal system. The idea was that FO will be financially viable and manage the operation and maintenance task in an effective way. **Table 1** shows the comparison of assessment before and after Irrigation Management Transfer (IMT).

Table 1: Assessment Area and it Value

Time	Assessment (ha)		Value in Rupee(000)	
	Kharif	Rabi	Kharif	Rabi
Before IMT	13191	12088	2795.8	1749.6
After IMT	14361	13001	3223.6	2021.6
Percentage Change	8.9	7.6	15.3	15.5

Source: The FO records.

Table 1 indicates that the FO shows considerable improvement in the assessment despite the prevailing water shortage.

The FO also introduced a new collection procedure of billing system. This was very effective. The collection was done within a month. This shows that the people were fed up with the old procedure, i.e., payment to Numberdar (head man of the village). Numberdar charge 5% for the collection service. The FO saved the collection cost as well. It collected 94% recovery within the period of one month.

Accountability and Leadership

It was very common that the powerful people first fulfilled their own needs and demands. This situation led towards conflict, as happened in the case of Kachcha warabandi in Pakistan. The researchers who studied the IMT process from Kachcha to Pakka Warabandi have endorsed that main reasons behind interest to switch to Pakka warabandi was inequity of water distribution and imbalance of power distribution within the community (Mirza, 1975).

The Hakra 4R the FO first focused on adjusting the discharge to the common farmers. Only then leader farmers' outlets were adjusted. This was the reason that the outlets of the leader farmers are under drawing from their proportionate share (Hamid et. al, 2001). Leader farmers have to adjust the discharge themselves. Now they can not appropriate resources at the cost of others for fear of social pressure by the community. Among

the farmer leaderships a few were benefiting more before the FO. Besides such a development, the FO replaced its inactive leadership through the no-confidence move (Zaman et. al., 1998).

CONSTRAINTS

The FO Hakra 4R Distributary did confront several problems since the very first day. For last three years, they could not better manage the system due to lack of legal protection. After the handing over, the ID did not honor the provisions of joint management agreement that are as follows:

Agreed Share of Money

The ID did not release the agreed share of money, which is supposed to be given to the FO in advance. It is due to this, the FO could not pay first 6 months salary to own employees. The staff threatened the FO with their resignation. This also hampered repair and maintenance work.

Later on, the FO recovered the money from the Abiana (water charges). The ID was not happy as the FO directly deducted their share from the Abiana. According to the Agreement, the FO is supposed to transfer this amount first to the ID account. The FO argued that if the ID deviates from the Agreement, why should only the FO follow it?

Lack of Capacity Building

The ID was not building the FO capacity, though it was clearly mentioned in the agreement. The FO is new in the management, therefore the training on technical, financial and organizational aspects are essential. Whenever the FO submitted the proposal, the department turned it down.

Typical Evaluation Procedure

The ID was doing the FO evaluation on the basis of old performance indicators, like the paper work, unnecessary record and water at the tail. Here the need was to see the reliable and equitable water distribution, improvement in the maintenance of the structures and the user satisfaction as well.

Propaganda against the Reform

Free riders and mostly the irrigation staff were not agreeing with the reform process. They were concocting different stories against the farmer managed system like embezzlement by the FO. As the staff were availing the illegal benefit from the existing system, so they had the fear of check and balance which the participatory program will bring in the system.

CONCLUSION

The paper demonstrates the FO's potential in the considerable improvement in the management of the irrigation system, despite the limited means at their disposal and constraints. There is an important message for the policy makers. The message is to speed up the reform process with proper social mobilization and capacity building, which has been done on the pilot basis. If government is sincere with the reforms, they should protect the reform process. The reform process should be institutionalized rather than personalized.

The farmer managed system is a step towards the poverty alleviation in rural areas so serious consideration is necessary to make it successful and sustainable.

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IRRIGATION TECHNOLOGY AND DEVOLUTION OF WATER MANAGEMENT TASKS

UMESH NATH PARAJULI[1]

INTRODUCTION

In Nepal, during 1970s and 1980s, quite a few numbers of large and medium scaled irrigation systems were developed, whose design were guided by the paradigms of irrigation management dominant at that time. In those days irrigation management was defined as a process of delivering water to farmers at the right time and in the right quantity. This notion of irrigation management helped develop highly flexible types of water distribution network (from the intake of an irrigation system down to the tertiary turnout) with a view to optimize water use efficiency and achieve higher flexibility in water delivery. As a result, such irrigation systems required complicated operational procedure.

In recent years, many irrigation design engineers are promoting a combination of rigid and flexible water distribution network for smooth operation. In this type of irrigation system, certain sections of distribution network operate on fixed proportional basis (rigid distribution), while the other section operates with varied and controlled flows (flexible distribution) to match the dynamics of water supply and demand. This type of irrigation system is termed here as partially proportionate irrigation system.

Despite of such changes in irrigation system design, their management has not been very satisfactory. As a result, performance of these systems in terms of targeted coverage of irrigated area remained less than anticipated.

In the mean time, to improve the management of these systems, policy tools like farmers' participation and, more recently, transfer of irrigation management to users have also been introduced. In this process, in many irrigation systems, large numbers of sponsored users organizations were formed at several hierarchies of irrigation systems. Developments of these organizations for people's participation were largely based on several theories of organization. It was believed that developing such community

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organizations and increasing people's participation could solve all sorts of management problems. However, the viability of such organizations and people's participation with respect to irrigation infrastructure were overlooked. As a result, in many systems, such community organizations and people's participation remained active only as long as the external funding continued.

It is commonly believed that the highest level of people's participation in irrigation management can be achieved only when the community possesses decision-making power, and the irrigation infrastructure be appropriate to local knowledge and skill, and user-focused management objectives. This necessitates examining the factors affecting devolution of decision-making power to users in managing irrigation systems so that the available water resources can be shared most efficiently and equitably.

This paper, therefore, examines the relationship between irrigation technology and devolution of irrigation management tasks to users. Of the several types of irrigation technology, this paper concentrates on water distribution network with especial focus on partially proportionate irrigation systems.

This is not to say that technology is the only factor in dictating overall management of an irrigation system. Nevertheless, understanding the relationships between irrigation technology and management aspects of irrigation system can guide policies for more efficient and equitable use of water resources, and increase people's participation to improve livelihoods of local community.

The concept derived in this paper is based on several researches on Farmer Managed Irrigation Systems (FMIS), which are much smaller in size. Studies on limited large scaled irrigation systems suggest that these concepts are equally applicable even on them. However, some more studies on medium and large scaled irrigation systems are still needed to validate arguments of this paper.

DEVOLUTION OF IRRIGATION MANAGEMENT TASKS TO USERS

An irrigation system consists of several socio-physical hierarchies of canal networks, (main, secondary, tertiary canals and so on) each of which is equipped with a certain type of water division structure at its intake, and irrigates lands belonging to a group of farmers. Each of these groups of

farmers is an organizational unit, to whom water management tasks are to be devolved.

Devolution is one of the forms of decentralization (Fisher, 2000; Litvack et. al., 1998; Cohen and Peterson, 1997). It involves the transfer of authority for decision making to lower-level farmers or groups of farmers in the socio-physical hierarchy of an irrigation system, so that such lower level farmer groups can elect their own councils, raise their own resources, and have independent authority to manage system operation in their sectors.

Operationalizing each management activity involves executing three sets of power: legislative, executive and judicial (Agrawal and Ribot, 2000). Each of these three sets of powers involves decision-making. Legislative power allows farmers to form new rules and regulations or modify old ones. Rules to access and use water, distribute water to users, and mobilize/generate resource for system maintenance are important in managing system operation. Executive power allows farmers to implement or enforce the rules as agreed upon, and to monitor whether the rules are actually followed by the users. It also allows farmers to impose sanctions on those who do not follow the rules. Similarly, judicial power allows farmers to adjudicate disputes that arise while enforcing the rules in operating the system.

The opposite to devolution is centralization, in which powers over system operation are held centrally. Lower level farmer groups may have some tasks to perform without any decisive power.

TYPES OF WATER DISTRIBUTION SYSTEMS

In Nepal, agency managed irrigation systems are designed with upstream control[2] type of water distribution system, which is classified into three types. They are termed here as "fully proportionate", "fully adjustable" and "partially proportionate".

A distribution system is said to be fully proportionate if all individual

[2] Upstream control refers to a situation of supply driven irrespective of demand. This type of distribution system is used when the demand of irrigation water is more than supplies requiring it's rationing. Thus, an upstream control system imposes restrictions on unlimited delivery of irrigation water to synchronise the demand and actual limited supply.

farmers (or a group of farmers at tertiary turnout) receive water continuously (but fluctuating) on a fixed proportional basis irrespective of their demand. A fully proportionate system is only practical for large farms or for field-to-field irrigation for paddy cultivation. In general, individual continuous delivery to small farm result in flows too small to handle and it is suitable only for paddy cultivation. As the cropping pattern in Nepal is changing rapidly from rice culture to more diversified crops, a fully proportionate irrigation system is unsuitable for irrigation development.

A fully adjustable system is equipped with flexible control structures from head works down to tertiary turnouts. As noted earlier, such systems were developed during 1970s and 1980s in order to optimize water use efficiencies and to maximize flexibility in water delivery. Due to unsteady nature of open canal flow in gravity irrigation system, operation of fully adjustable system is highly complicated. It has been accepted that such irrigation system rarely operates as designed despite all efforts to improve irrigation management and the capacity of operating staffs.

A partially proportionate irrigation system encompasses elements of both the above (fully proportionate and fully adjustable) types of distribution systems. In a partially proportionate system, certain sections of distribution network receive continuous or intermittent (rotational) flow on fixed proportional basis, while in some sections flows are adjusted with adjustable control structures to match the dynamics of water supply and demand. This paper concentrates on partially proportionate irrigation systems.

TYPES OF PARTIALLY PROPORTIONATE IRRIGATION SYSTEM

As noted above, in terms of mode of water delivery, distribution network of a partially proportionate irrigation system is divided into two sections: fixed proportionate (rigid delivery) and adjustable (flexible delivery). Depending on the location of fixed proportionate section in a distribution network, partially proportionate irrigation systems in Nepal can be classified into two categories. They are: fixed proportionate at lower section and fixed proportionate at upper section. Following section discusses operational consequences of these two types of distribution networks.

OPERATIONAL CONSEQUENCES OF DIFFERENT TYPES OF PARTIALLY PROPORTIONATE IRRIGATION SYSTEM

Fixed Proportionate at Lower End (Structured Irrigation System)

According to the World Bank classification, a partially proportionate system with fixed proportionate section at lower end is also termed as "structured irrigation system". A structured irrigation system is a system delivering continuous (but fluctuating) flow above a predetermined structured level below which the network operates "on/off" and delivers at full supply level when "on". In a structured irrigation system, distribution network is divided into two sections: upper and lower. The upper section usually consists of main canal. The secondary down to tertiary canals usually forms the lower section. The interfaces between the upper and lower sections are equipped with adjustable control structures.

The lower section is divided into number of blocks varying between 250-2500 ha, the boundaries of which are defined largely by physical features such as roads and drains. A secondary canal supplies water to each block through an adjustable gated head regulator located at the interface. Within the block, all hierarchies of bifurcating canals up to tertiary intake, nomenclature of which differs from system to system, are equipped with several types control structures at their intake[3], which deliver water to branching canals on proportional basis at full supply condition. **Figure 1** shows schematic diagram of a structured irrigation system.

[3] Usually, for higher order branching canal proportional flow divider, with broad crested weir combined with a drop, is used. Depending on the situation, crest level of the weirs in the parent and in the branching canal may or may not remain same. For the lower ordered canals, Adjustable Proportionate Modules (APM) is also used.

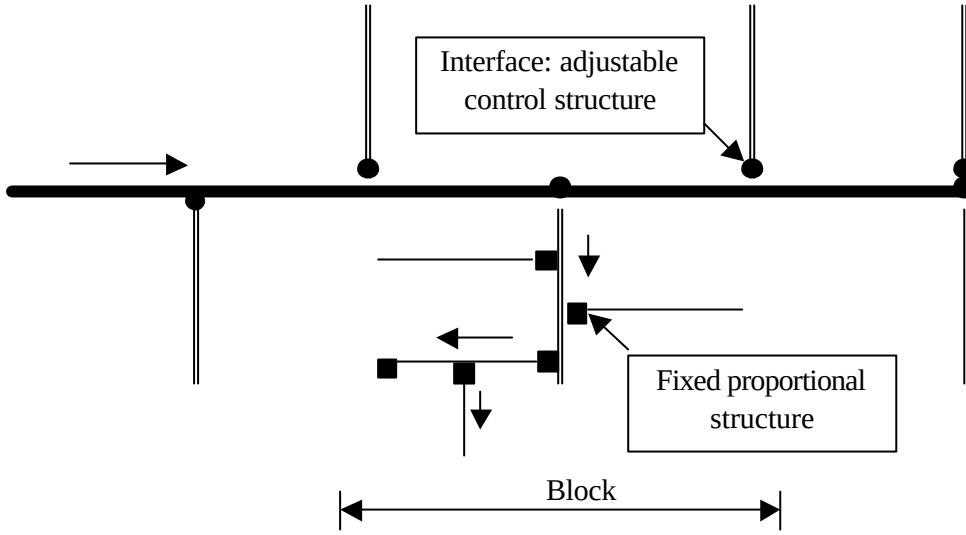

Figure 1: Schematic Diagram of a Structured Irrigation System (Partially Proportionate System with Fixed Proportionate Section at Lower End)

Tertiary canal is the lowest order canal, whose service area is kept at about 28 ha. Each tertiary canal is designed to supply water to seven field channels through an open orifice, each of which irrigates a group of fields of about 4 ha.

This model of structured irrigation system is used in the World Bank assisted Sunsari Morang (66,000 ha), Narayani (34,000 ha), and Mahakali (6,800 ha) Irrigation Systems.

Water Management

The upper section operates continuously but with fluctuating flows, while the lower section, consisting of several blocks, operates intermittently on rotational basis. Basis of rotation depends on the local context.

Depending on the pre-designed water supply condition and cropping pattern, the entire blocks in the lower section are divided into number of rotational groups. Accordingly, system operational plan is prepared. Each group of blocks receives water intermittently. During "on" period, they are designed to be operated at a constant full supply condition, while during "off" period they remain dry. **Table 1** presents an example of grouping of blocks for rotational irrigation for Narayani Irrigation System.

Table 1: Grouping of Blocks for Rotational Irrigation (Operational Plan)

Cropping Season	Rotational Groups	Block Number	Total Number of Blocks
Kharif (Wet season)	Groups A	1, 3, 5, 7, 9, 12	Six
	Groups B	2, 4, 6, 8, 10, 11	Six
Rabi (Dry season)	Groups A	1, 4, 10, 12	Four
	Groups B	2, 5, 7, 9	Four
	Groups C	3, 6, 8, 11	Four

Source: DOI (1995)

Within the block, during "on" period, all hierarchies of branching canals up to tertiary canal operate simultaneously in full supply condition. Delivery of water from higher to lower level canals is done on proportional basis, and thus does not require human interference. As each tertiary supplies water to seven field channels, during 'on' period, each field channel receives water for one day (24 hours) in a cycle of one week, which is distributed to several plots on hourly rotation.

Pre-designed Condition of System Operation

The pre-designed condition of a structured irrigation system is that during "on" period the block or the secondary canal must operate at full supply condition for equitable delivery of water to farmers within the block.

Operational Realities

It is to be noted that most of the irrigation systems in Nepal are of run-off-the-river type, where availability of flow fluctuates considerably over a short period of time. As a result, flow available in the main canals also fluctuates accordingly. Such fluctuation is further aggravated due to dynamics of weed growth/siltation in the canals, and poor maintenance of irrigation infrastructure. As an example, **Figure 2** presents fluctuations of the incoming flows in the Narayani Irrigation System. It has been reported that in individual weeks the incoming flow in this system fluctuates even up to 50 per cent (World Bank, 1998). Such fluctuation has become a major concern in other irrigation systems too.

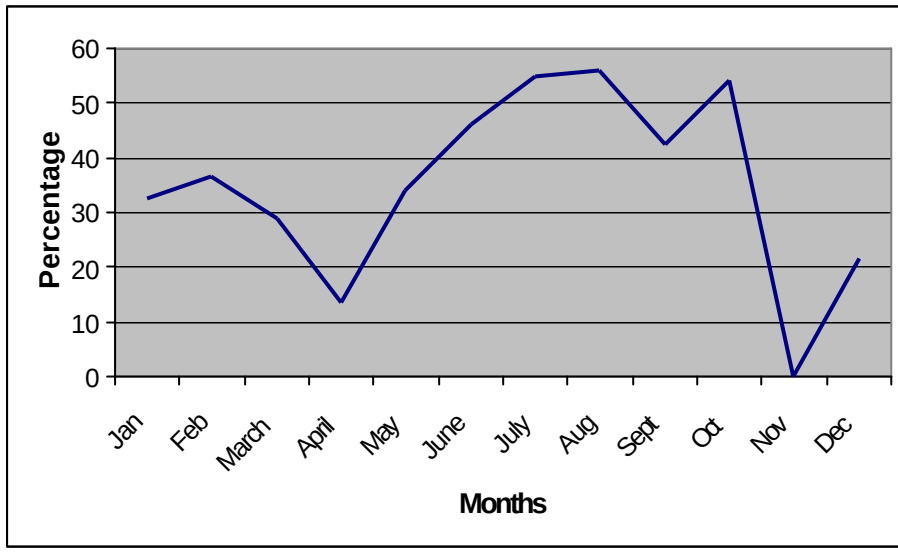

Figure 2: Flow Fluctuations in the Narayani Irrigation System

Source: World Bank (1998)

As mentioned above, one of the pre requisites of a structured irrigation system is that whenever the flow in the secondary canal is "on", it must operate at full supply condition. But, in a situation of fluctuating in coming flow, mode of operation at the interfaces (between the main and secondary canals) needs to be changed frequently for equitable distribution. This can be done in two ways. First, by changing the number of blocks in a rotational group to match the incoming flow, which in turn changes the pre-designed operational plan. This mode of operation however reduces the reliability of flow to end-users. Second, by equitably distributing the available flow to pre-designed number of blocks. With this method of operation, the secondary canals would operate at below the full supply condition, especially during the declining incoming flow. This mode of operation is against the designed principle. This suggests that in a structured irrigation system, irrespective of the above-mentioned mode of operations, the main system above the level of interface needs to be fully regulated and actively managed.

In a situation of scarce incoming flow, as farmers belonging to each block would like to see that their respective secondary canal be operated as per designed operational plan, competitions exist among different blocks for

getting more water. In such a situation, it becomes essential to have certain organization at higher level to coordinate users of different secondary canals and to manage water distribution. Thus, the operation of the entire system needs to be managed and coordinated by the agency or the main users' committee. This suggests that in a structured irrigation system, water distribution management task tends to centralize upwardly.

In actual practice, however, an effective centralized management rarely exist. Lack of which can jeopardize the system operation. Followings are some of the study results of structured irrigation systems.

- HR Wallingford (2001) and DOI (1995) note that in Narayani Irrigation System the pre-designed operational plan is never followed, and deliveries of water among secondary canals (blocks) are done on an ad-hoc basis based on the personal judgment of the operating staffs. Fluctuating incoming flow and poor maintenance of irrigation infrastructure are part of the technical reasons for this. As a result, the secondary canals operate at below the full supply condition and the actual coverage of irrigated area is much below than the designed value. Broken crest of control structures, informal cuts in canal embankments, abandoned tertiary canals, and jeopardized system operation are the end results. These studies further suggest that despite of great effort, there is no sign of farmer participation in maintaining and operating the system.
- In a review of the stage II area of the Mahakali irrigation project, NEDECO (2001) notes that although the cropping intensity and crop yields have increased considerably, WUA's institutional development is lagging behind. This has limited the targeted development. As a result, some areas still have no irrigation water supply.
- World Bank (1998) notes that in a situation of unreliable water supply, the structured irrigation system will not work.

Fixed Proportionate at Upper End

In contrast to the structured irrigation system, in a partially proportionate system with fixed proportionate section at upper end, the interfaces of the upper section with several lower sections (blocks) are equipped with fixed proportional types of delivery structures. As a result, both the upper and lower sections operate continuously but with fluctuating flow. However, deliveries of waters to branching canals within a block are rationed through several types of control structures to synchronize the demand and

actual limited supply. The types of delivery system and control structures used within the block depend on cropping season and crop types. **Figure 3** shows schematic diagram of a partially proportionate system with fixed proportionate section at upper end.

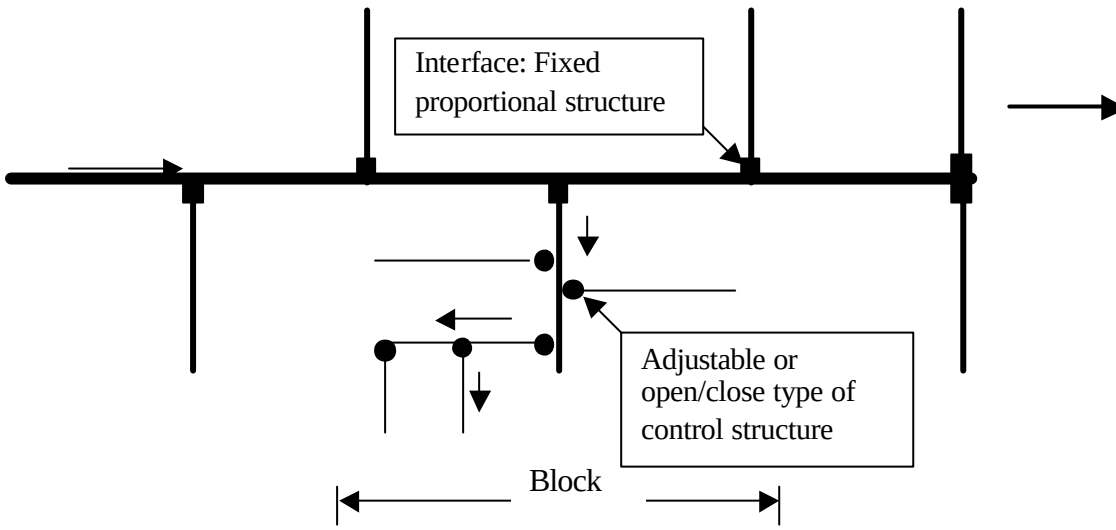

Figure 3: Schematic Diagram of a Partially Proportionate System with Fixed Proportionate Section at Upper End

In Nepal, this type of distribution system is mostly used in FMIS with irrigated area varying between 30 and 15000 ha.

System Operation

In this mode of distribution, as fixed proportionate structures are placed at interfaces, any fluctuation in the incoming flow is proportionally distributed to lower sections. This means that the quantities of water flowing in the main and in the secondary canals are equally affected by any variations in the level of water in the main canal. As fixed proportionate structures work automatically, it does not require any operator to open or close or adjust the flow through it.

As long as the system remain under operation, all secondary canals supplying water to different blocks of the irrigated area flow continuously with their fair share of water. Each of these block functions as an

independent sub-system within a larger system. This means that each of these blocks is self-contained and any irrigation problems could be easily isolated and overcome within such blocks. Thus, managing water within such block does not require centralized institutional arrangements. Farmers within each block can manage water according to their local conditions. This aspect facilitates devolution of water distribution management tasks to the users of each block.

COMPARISON OF DEVOLUTION OF WATER MANAGEMENT TASKS

In systems distributing water by a structured irrigation system (fixed proportionate at lower end) the users' committees at the highest levels needs to be very active and powerful, and organizations at the lower hierarchy of canal system have less roles in distributing water. This is because in such systems, due to competing water demand across several blocks of canal networks a committee at the higher level is required to manage water. As a result, canals of the same hierarchy are not self-contained and cannot operate independently. Change in the operation in one secondary canal affects others. Thus, the operation of the entire system needs to be managed and coordinated by the main users' committee, which in turns tends to centralize water distribution management tasks upwardly.

In contrast, in an irrigation system with fixed proportionate section at upper end, all the blocks (secondary canals) operate independently with their fair share of water. Any change in operation in one secondary canal does not affect the others. Thus, the users of each block manage water independently in their sector. As a result, in such systems, water distribution management tasks are highly devolved to lower level users organizations, and the users committee at the highest level has the limited tasks to perform in relation to water distribution. **Figure 4** compares aspects of devolution of water distribution management tasks in the above-mentioned two types of distribution net works.

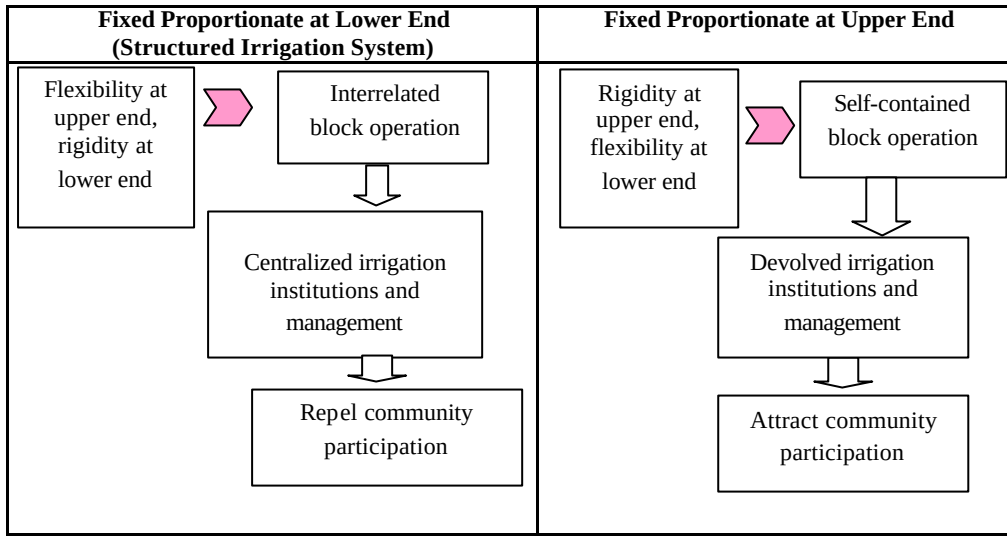

Figure 4: Comparison of Devolution of Water Distribution Management Tasks

CONCLUSIONS AND NEED OF FURTHER RESEARCH

Foregoing discussion suggests that different models of partially proportionate irrigation systems exist, which require different management options. Further, by shifting the level of interface between the two sections, which can be fixed at any point between the tertiary inlet and the head works, each of these models creates different level of partially proportionate system, whose management requirements and aspects of devolution of water distribution tasks also vary greatly in them.

For example, in a structured irrigation system, if the interface is fixed somewhere close to the head works, the system behaves as fully proportionate. In contrast, if the interfaces if fixed somewhere close to the tertiary inlet, the system behaves as fully adjustable. Accordingly, aspects of devolution of water distribution management tasks also vary greatly in them.

Further, in a structured irrigation system, higher the bcation of interface larger is the block size and lesser is the management input required for operating the block. This is because, above the level of interface, an irrigation system needs to be fully regulated and actively managed, while below the interface (within the blocks) system operates on fixed

proportional basis when "on". Larger blocks means less internal regulation and easier management, but less flexibility in providing water needs of diversified crops.

In contrast to this, in a partially proportionate irrigation system with fixed proportionate section at the upper end, larger the blocks means more internal regulation and difficult to manage. Such system, however, has more flexibility in providing water need of diversified crops.

This suggests that management requirements and aspects of devolution of water distribution management tasks to users differ greatly by the change in the level of interface between the two sections of a partially proportionate irrigation system. However, the extent of their variations with respect to levels of partially proportionate irrigation system is still not yet known. At present, although many irrigation engineers are now advocating partially proportionate irrigation systems as an alternative irrigation technology, the questions - how does different models and levels of partially proportionate irrigation system facilitate devolution of water distribution management tasks to users and what conditions shape the level of interfaces between the two sections of a partially proportionate irrigation system? - are not yet fully understood. There is need to continue further researches, especially in medium and large scaled irrigation systems.

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CONTRIBUTION OF IRRIGATION TO SUSTAINING RURAL LIVELIHOODS

JOHN SKUTSCH[1]

INTRODUCTION

Under a current Knowledge and Research project supported by DFID, HR Wallingford and Imperial College at Wye, with partners Local Development Training Academy (Kathmandu) and Bangladesh Agricultural University (Mymensingh), is investigating the impacts of irrigation development on rural livelihoods, the environment and natural resources. Three FMIS in Nepal and three villages in Bangladesh around "clusters" of Shallow Tubewells (STWs), are the focus of the study, which adapts DFID's Sustainable Livelihoods methodologies to identify impacts on the development capitals: financial, physical, human, social, and natural. The purpose of the project is to help reduce poverty in rural areas by providing information and guidelines to ensure that irrigated agriculture secures productive livelihoods for the poor.

Field studies in Nepal have been completed, and similar investigations are currently underway in Bangladesh (May 2002). They will lead to guidelines/recommendations on sustaining irrigation in rural development, for governments and funding agencies.

METHODS

The impacts of irrigated agriculture on each of the five capitals over the lifetime of the schemes/ "clusters" were assessed using:

- Questionnaire surveys of farmers (landholders and tenants or sharecroppers), agricultural laborers, suppliers of agricultural goods and services, and general merchants.
- Key informant interviews
- Focus group meetings
- Longer duration research, by Process Investigators
- Soil and water investigations
- Background analysis of existing reports and documentation

[1] Project Leader, Principal Engineer, Overseas Development Section, HR Wallingford, UK.

Criteria for Field Site Selection

The criteria for selecting schemes were designed to focus the study on the impacts of irrigated agriculture, avoiding some of the difficulties which would arise in trying to distinguish those impacts from the effects of other factors influencing development:

- Irrigated agriculture the main enterprise of the majority of households
- Schemes/clusters to be located in relatively deprived areas
- Schemes/clusters not immediately adjacent to urban areas, to reduce e.g. impacts on land values, land use and employment. However, opportunities for marketing in urban areas, and the associated communications, should be identified.
- Schemes/clusters should be "mature", so that productive practices have become well-established, but should be relatively recent, so that many older people retain clear memories of their lives before irrigation. Schemes/clusters 10-20 years old considered suitable.
- Schemes/clusters to be below 100 ha. so that a good insight into underlying livelihoods processes may be obtained. Complexities introduced by links and interactions with other enterprises and groups appear to increase with the size of the scheme.
- Where possible, background documentation on the scheme/cluster available.

The relatively new schemes investigated under the project particularly highlight the changes which are occurring in FMIS, and more generally, in the agriculture sector in Nepal. For practical reasons, it was not possible to investigate schemes in more remote areas in the west and the mountainous areas of the country. Comparisons between the information collected in Nepal and available national and regional statistics for key parameters, such as land distribution and household size, suggest that the selected schemes (see below) are representative of conditions in the central Terai (plains) and hill regions. **Figure 1** shows the location of schemes in Nepal. In Bangladesh, early indications, derived from the size of the landholdings, are that selected "clusters" fall in relatively deprived areas, where development indices for e.g. income, education and health will be below national averages. The "clusters" therefore appear suitable for determining how irrigated agriculture affects the lives of the poor, and determining where constraints to their livelihoods lie.

Scheme/"Cluster" Characteristics

There are clear differences in the extent and details of development in different parts of **Nepal,** the west and the mountainous areas being particularly deprived. Clearly, in such a relatively limited study, it would be impossible to capture the full diversity of impacts of irrigation in different zones, on schemes subjected to a variety of stresses, particularly where access is very difficult. Faced with these facts, a pragmatic decision was made to select one or more schemes in the hilly area, and the balance of the sample from the Terai (plains). It was also aimed to select schemes which are in varying stages of agricultural development. **Table 1** summarizes details of the selected schemes.

Table 1: Characteristics of Selected Schemes in Nepal

Scheme	Kalleritar	Janakalyan	Yampaphant
District	Dhading	Chitwan	Tanahu
Region	Middle hills	Terai	Middle hills
Area (ha)	66	71	39
Owner-cultivators	199	71	97
Tenants	0	0	n.a
Sharecroppers	40	5	n.a.
Mean holding (ha.)	0.33	0.50	0.37
Categorization	Paddy, part commercial	Commercial paddy	Commercial vegetables

All three schemes are owned and managed by farmers grouped together in Water User Associations (WUAs). Each scheme derives its supply from a perennial source of surface water. The scheme at Kalleritar was selected to replace a scheme at Gadkhar in Nuwakot district, where security became uncertain because of insurgency. Gadkhar was categorized as "Subsistence paddy".

On all three schemes, the distribution of land is skewed, over 80% of households irrigating lands smaller than two thirds of a hectare (median farm size ranges from 0.25-0.35 ha.). Even the largest farms (maximum size 1.35-4.40 ha, depending on scheme) are small by international standards. Most households own irrigated land, the number of tenants and sharecroppers being relatively small. Most of the latter seemed to own a small piece of land which was inadequate to support their family, and they therefore supplemented production by sharecropping on an area of 0.1 ha. upwards. It is clear that they were poorer than those owning land The

direct benefits of irrigation development, in terms of improved productivity, will therefore have been realized by large numbers of poor farming households, and not disproportionately by large farmers or landlords.

Figure 1: Location of Schemes in Nepal

In **Bangladesh**, dry season irrigation of paddy rice by private STWs is now the norm, and is a major success story of the last 15 years. However, another important factor driving development is capital remitted from overseas employment by migrant workers, particularly in the Middle East. The impact has been particularly significant in districts such as Noakhali in southern Bangladesh, where dry season agriculture is constrained by the lack of useable groundwater. Since the study focuses on the impact of irrigated agriculture as a development strategy, it was decided to select schemes where remittances form a relatively small part of average family income, in conformity with the first criterion above. It was considered that the decision would not limit the potential applicability of the study findings to other poor areas, because working abroad requires the right contacts and substantial sums of money at the outset, neither of which are available to the poor.

The Bangladesh Agricultural University (BAU) is located in Mymensingh

district, a more affluent area where agricultural knowledge and practices are relatively advanced. The selected study "clusters"[2] are in neighboring districts Netrakona, Shirpur and Jamalpur, where standards of living are lower, consistent with Criterion 2 above. The clusters selected for the study are mentioned in **Table 2**.

Table 2: Selected "Clusters" in Bangladesh

Village/Cluster	Borni	Talki	Mohanpur
District	Netrakona	Shirpur	Jamalpur
Region	N.Bangladesh	N.Bangladesh	N.Bangladesh

All schemes grow *boro* rice (dry season irrigated crop), cultivating common improved varieties.

SUMMARY OF ANALYSIS

The results of the field questionnaires from Nepal were entered in an access database. Samples of soil and water were tested at Soil and Water Testing Laboratory, (PVT.LTD). From the various investigations listed above, the impacts on each of the five capitals were assessed, and the results cross-checked as judged necessary. Field investigations are currently (May 2002) in progress in Bangladesh. The outcomes will be reported separately.

IMPACTS ON THE CAPITALS (NEPAL)

Financial Capital

The main direct benefit of irrigation development for farm households is the increase in cropping intensity and opportunities from crop diversification. As show in **Table 3**. Prior to irrigation development, the majority of households could cultivate only one main staple crop a year, sometimes supplemented by a following drought-resistant pulse or oilseed crop, and perhaps winter vegetables in small homestead gardens or low-lying plots. Households were thus mainly subsistence or semi-subsistence producers, rarely having significant surpluses to sell, with little

[2] A "cluster" of tubewells was taken to be 10 STWs, each serving some 6-10 acres (2.5-4 ha.) whose command areas are contiguous. Each cluster falls within the boundary of a single village. Cluster methodology has previously been used by e.g. Mandal et. al., 1996.

participation in markets for inputs and outputs. Following irrigation, three crops a year are the norm where water supply is adequate, and higher and less variable yields are achievable. Evidence on crop yields also confirmed that higher and less variable yields are achieved with irrigation compared to rain-fed production.

The resulting improvement in household food security and production of regular surpluses has led to a growing commercialization and orientation towards the market. Production has been intensified, with greater use of purchased inputs; where market access is favorable, farmers have diversified into higher value crops such as vegetables.

Table 3: Cropping Patterns on Selected Schemes in Nepal, Prior to and following Irrigation

Cropping Pattern	Kalleritar	Janakalyan	Yampaphant
Before Irrigation			
Spring	Mostly fallow	Fallow	Maize (some)
Monsoon	Paddy/maize	Maize	Paddy/maize
Winter	Lentils/gram	Mustard	Grams
Following Irrigation (Now)			
Spring	Maize	Paddy	Maize/veg.
Monsoon	Paddy	Paddy	Paddy (some veg)
Winter	Wheat/veg/potato	Wheat/veg/pot/mustard	Veg/potato

Valued in constant prices, gross incomes per hectare per year from crop production have increased by the order of 100-160%. Approximate calculations suggest that farm household incomes before irrigation for the median farm size on all three schemes were below the published poverty line income for Nepal. After irrigation, the estimated income had risen above the poverty line for Janakalyan and Yampaphant schemes, but remained just below it for Kalleritar. Further analysis, to improve the income estimates and compare standards of living, is in hand.

The more intensive and higher value cropping system at Yampaphant represents an advance in irrigation development over the other two schemes. It shows that much higher gross and net incomes per hectare are achievable, but greater integration with input and output markets is required, as well as access to information and adoption of improved agricultural technology.

Irrigation has resulted in higher and more continuous employment for farm labor. Most farm households had surplus labor prior to the advent of irrigation, and irrigated agriculture has thus provided fuller employment to

households' own labor, possibly reducing the need for seasonal migration in search of work. There is also evidence of increased employment for marginal farming or landless households primarily dependent on agricultural work. This labor is drawn from the surrounding uplands, in the case of Kalleritar and Yampaphant and from gangs of seasonally migrating contract labor at Janakalyan.

Irrigation development has also tended to encourage intensification of livestock production, involving improved breeds and stall-feeding, rather than free grazing. Some households have reduced livestock numbers to the minimum needed for their own consumption, while others are commercializing to produce dairy and meat products for the market.

Agricultural goods and service providers report improved demand for, and profitability of, their services following irrigation development. The number of shops and services has increased over recent years at all schemes, indicating an increase in spending and market participation by local farmers.

Physical Capital

The irrigation systems on the three schemes have been developed and improved by farmers, with financial and technical assistance from the Department of Irrigation, local government or NGOs. Improvements such as canal lining (Yampaphant), aqueducts, culverts and drop structures (Kalleritar), river outlet and embankment (Janakalyan) have increased the security of supply, extended the irrigated period and enlarged command areas.

All irrigation systems need regular care and maintenance to provide a sustained water supply to the full command area. The co-operative actions required of farmers to operate and maintain their systems successfully and effectively, constitute a particularly good measure of social capital in action (see below). At each of the three schemes, there are agreed and understood arrangements for operating the system and for mobilizing labor for maintenance work.

Irrigation Operations

At Kalleritar, *jalpas* and *dhalpas* (water management personnel) are appointed to distribute water to the two lower blocks in three months each year (monsoon paddy season), according to rules formulated by WUA. Farmers in the head end block themselves manage water in rotation between their outlets.

Jalpas (field level staff) are selected from amongst the farmers, are appointed by the appropriate block sub-committee and paid in rice according to the area of their duty. *Dhalpas* are appointed by block sub-committees and paid in kind to supervise main canal operations and maintenance. In addition, a liaison person is paid to communicate issues between WUA and farmers.

At Janakalyan, farmers apparently initially learned water management by observing neighboring farmers. They have established a system of managing water on rotation between branches, the length of time of supply depending on the size of the commanded area. Rotational patterns vary between seasons.

WUA at Yampaphant employs a landless laborer to operate the irrigation gates. He is paid according to the area of monsoon paddy farmers are cultivating. Some farmers pay in kind. Water is rotated to three parts of the scheme in turn, for a certain number of hours per day. The time is not proportionate to land area, but may in part be determined by historic claims to water. Yields in the three areas are comparable, indicating that water is relatively plentiful and is considerably over-used in parts.

Irrigation Maintenance

At Kalleritar, WUA aims to introduce fees for members, plus a yearly service charge based on land cultivated. The money, collected in a bank savings account, is to cover maintenance of the main canal.

Regular maintenance principally consists of desilting the canal twice each year. Contributions, traditionally in terms of labor, are based on land holdings. If emergency maintenance is required, each household has to contribute labor or cash. A system of fines for defaulters is linked to size of holding.

All farmers at Janakalyan contribute to costs associated with desilting and

general maintenance, on the basis of land holding. Labor is also contributed in proportion. The system appears very similar to that adopted at Kalleritar.

Maintenance at Yampaphant is limited to cleaning the canals. Repairs are undertaken in response to emergency. Repairs are carried out by mostly by hired labor and paid for according to landholding and location within the scheme. Some farmers contribute labor themselves, for both routine maintenance and emergency repairs.

It is clear that the three schemes have well-defined procedures for maintaining their infrastructure. However, particular problems can still arise e.g. in the upper reaches of the main canal at Kallieritar, where slope instability has caused problems in the past. The fact that water supplies are mostly adequate indicates that the systems are functional.

General Infrastructure

The synergies between road communications and agricultural developments have been of particular importance to the schemes. The construction of the Prithivi highway in 1972 (passing Yampaphant and Kalleritar) and the East-West highway in 1974 (Janakalyan), preceded irrigation and probably played a lead role in encouraging the development of physical infrastructure at each location. The highways have extended farmers' markets, influenced their cropping strategies and multiplied the benefits of irrigation. In the case of Kalleritar scheme, which is separated from the highway by the Trisuli River, the construction of a suspension bridge on the earthen trail significantly improved access. However, all produce from the scheme must still be carried to the road, where there are no regular arrangements for marketing. Development appears noticeably constrained, by comparison with the other schemes as shown in **Figure 2**.

Irrigation itself plays an important role as a catalyst for infrastructure development. In all three schemes, an increase in the development of physical infrastructure such as electricity, biogas units, shops and other services has followed irrigation. Financial gains from irrigated agriculture have provided farmers with capital to spend on improved infrastructure and may also have strengthened their capacity to encourage new development initiatives in their areas. Without greater production from irrigated agriculture, farmers would have been unable to make effective use of the marketing potential provided by the highways. New local shops and services would not have arisen. Higher disposable incomes have

allowed farmers to send their children to new schools, to use public transport, and to visit clinics and hospitals distant from their homes.

Farmers have been able to build and develop infrastructure on, and around, their land. The numbers and standards of housing have risen across the three schemes. Improvements in living standards include additional rooms, weather-proof roofs to their houses, biogas units, latrines and drinking water supplies.

The selected schemes illustrate the positive changes to rural livelihoods which can result from complementary physical developments like roads and irrigation. In remote areas lacking good communications, the multiplier effects of irrigation on livelihoods will undoubtedly be less pronounced.

Human Capital

The main changes in **human capital** which have taken place at all three schemes are: greater food security and improved diet (**Figures 2a**, **2b** and **3a**, **3b**); better family health (**Figures 4a** and **4b**); increase in the number of children attending school (**Figure 5**) and increased literacy. Although not all of these are directly linked to irrigation development, it is clear that they are the result of a process of economic and social development of which irrigation is a key part.

The study has shown that irrigation can lead to improved diet and health for all members of the community, through the production of more food and a wider variety of foodstuffs, through increases in income for farmers and service providers, and through employment for farm labor. Increased incomes tend to be spent on education, family health, rehabilitation of houses, clothing and other household goods. The increased amounts spent on education have contributed to wider schooling and improved literacy, but also to an increasing loss of younger people from the schemes, as further education and non-agricultural employment have become attainable. Departure of the young has reduced the amount of family labor available, creating further opportunities for paid labor.

Social Capital

The net impact of higher agricultural incomes on **social capital** is hard to measure. People tend to spend more on ceremonies, health and education, but affluence may reduce the need for informal help between neighbors.

On the other hand, improvements in education raise the potential for, and the effectiveness of, communication. Better levels of understanding and greater access to information encourage people to pull together to achieve their development objectives. As more girls are educated, allocation of responsibilities and benefits change, and should ultimately smooth some of the early distortions that may stem from the introduction of irrigation. In particular, crop intensification and year-round cultivation often disadvantage women to a greater extent than men. The improved individual skills resulting from formal and informal education have a community, as well as a private, value.

Formal social capital in the irrigation communities studied has measurably increased in terms of active interest groups and complex committee arrangements for continuing functions. The changes are encouraged by a number of development initiatives acting together to support the efforts of local people. Irrigation seems to have been a major influence, allowing sufficient improvement in the general standard of nutrition and income to free people from the preoccupation of survival and allow them to attend to other development issues. People are working harder and longer than they did before the introduction of irrigation, but have the stamina to do so, which was apparently not the case before. They comment on loss of leisure time, but, in general, their increased prosperity is such that they do not complain. The emergence of group activity and formal organization to achieve goals through committees indicates both an increase in social capital, and an acceleration in the pace of development.

The co-operative arrangements for operating and maintaining the three schemes are a good indicator of social capital in action, see Physical Capital (above).

The figures for increased education of children from the schemes suggests that national education policies have been supported by irrigation development. It is forecast that increases in female education will go a long way in establishing internal pressure for greater gender equity in Nepal. Further investigation among women farmers and laborers' wives would be needed to identify the impact of irrigation development specifically on women of different caste and wealth.

The social value associated with infrastructure such as roads, trails and bridges, schools and health posts, and cultural foci such as meeting halls, religious temples and ceremonies should not be underestimated. People are better able to support such projects on the proceeds of irrigation.

Cultural observance and ceremony is important: the emergence of catering committees and the increased ability of communities to fund ceremonies is a positive aspect.

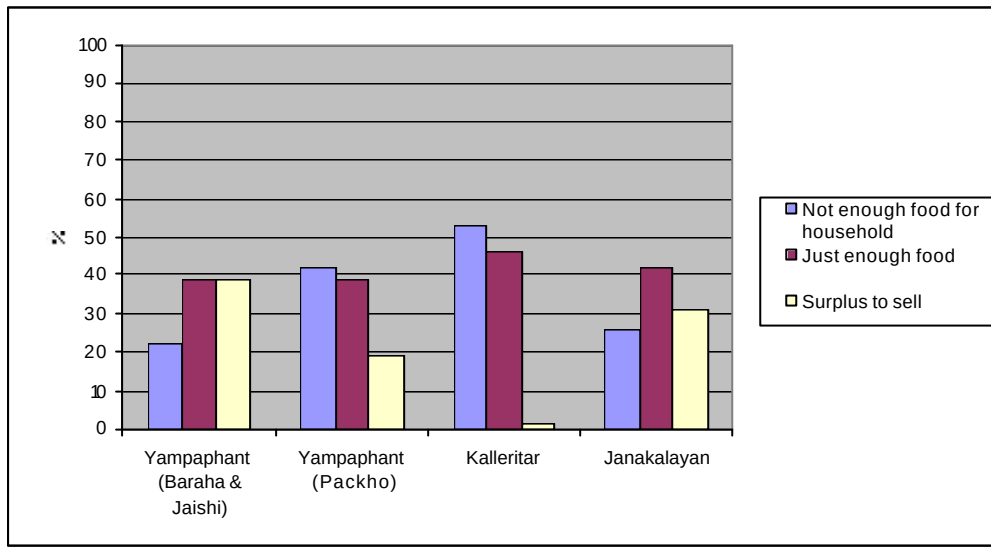

Figure 2(a): Food Available to Farm Households (five years before irrigation)
Source: Questionnaire survey.

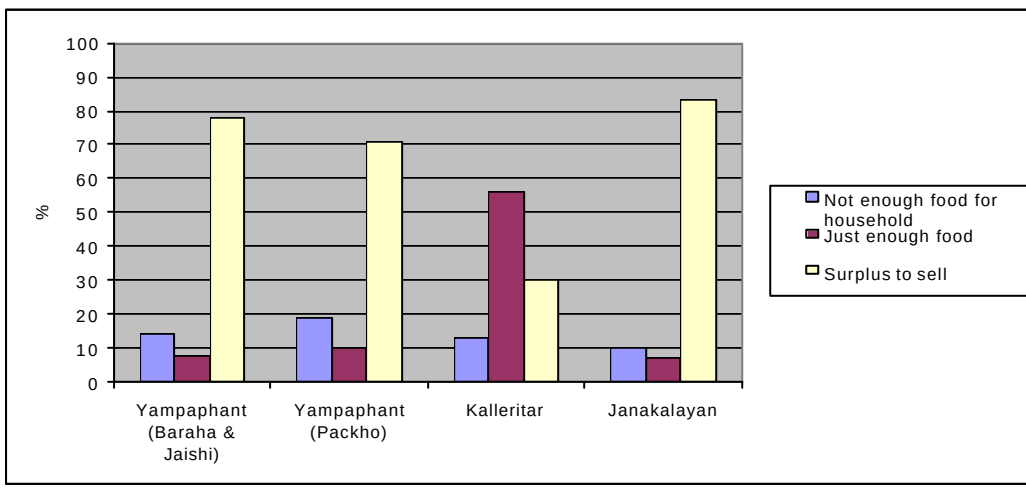

Figure 2(b): Food Available to Farm Households (last five years)
Source: Questionnaire survey.

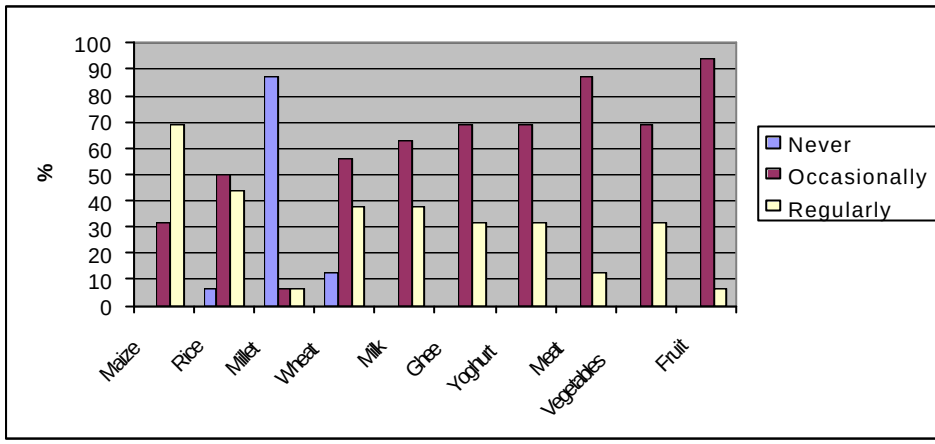

Figure 3(a): Foods Eaten before irrigation (General Merchants, Crafts and Trades People)

Source: Questionnaire survey.

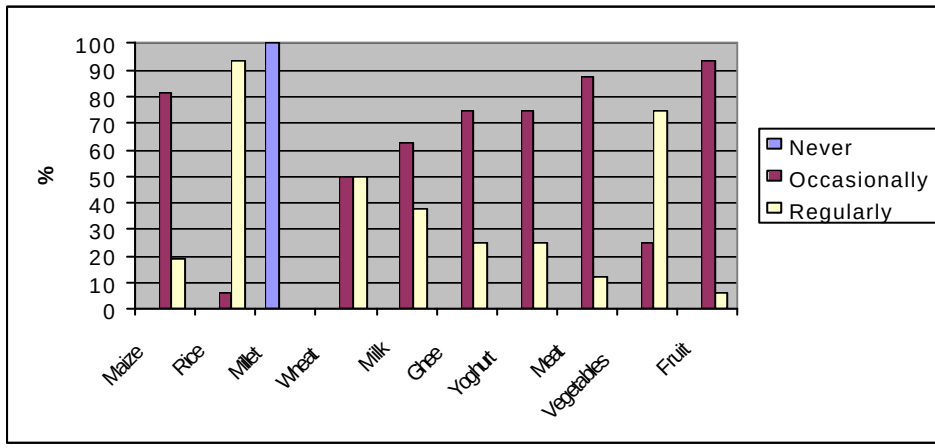

Figure 3(b): Foods Eaten after irrigation (General Merchants, Crafts and Trades People)

Source: Questionnaire survey

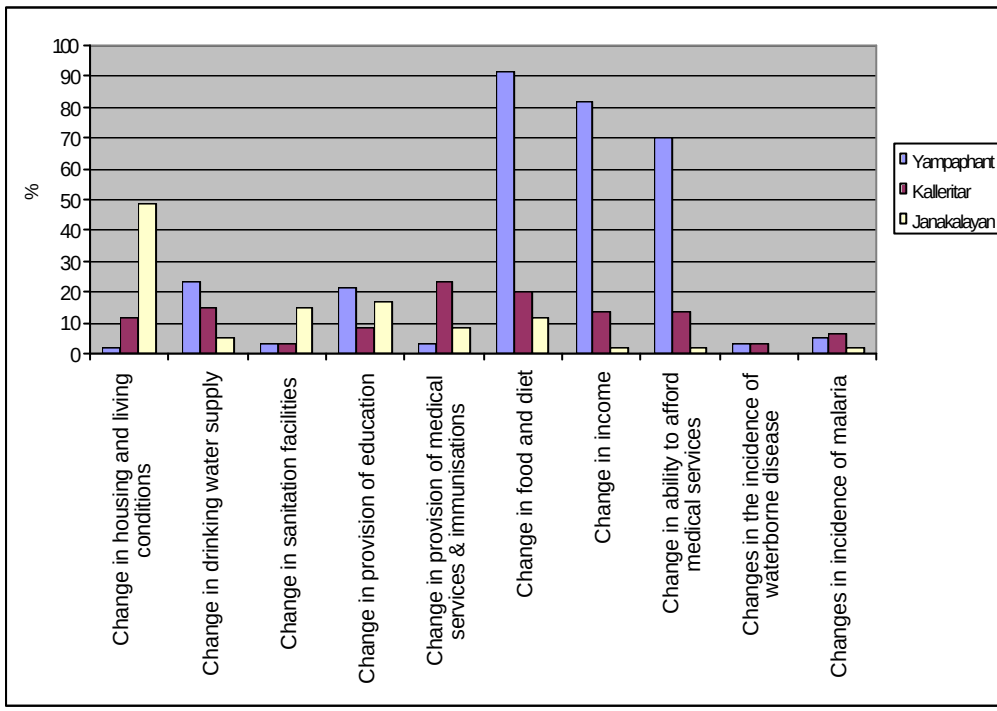

Figure 4(a): Reasons Gives for Improved Family Health (Farmers)

Source: Questionnaire survey

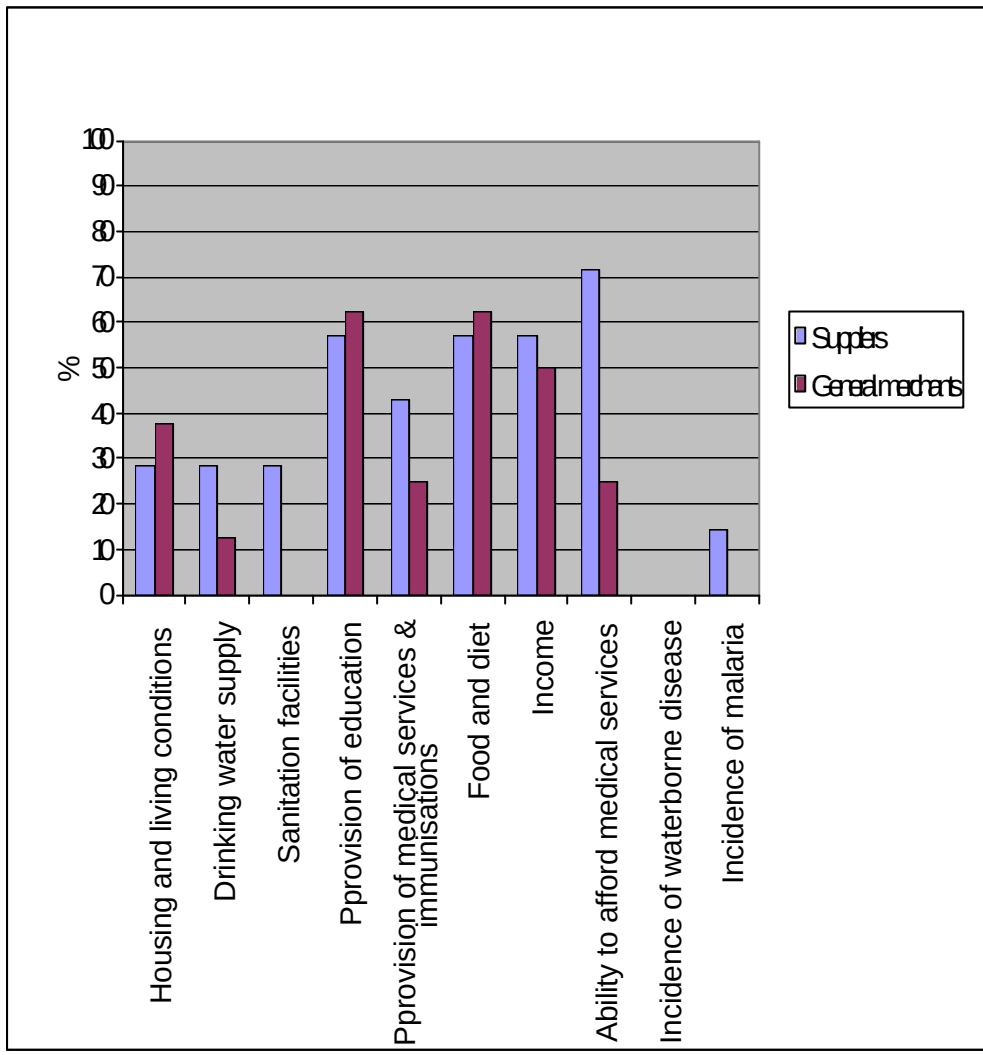

Figure 4(b): Reasons Gives for Improved Family Health (Non-farmers)
Source: Questionnaire survey

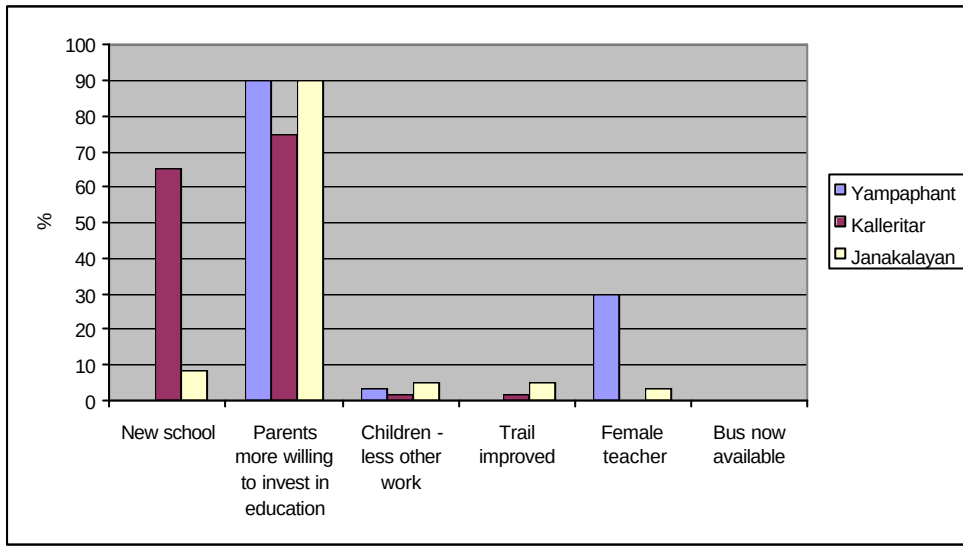

Figure 5: Farmers' Views as to why more Children are now Attending School (% Respondents)

Source: Questionnaire survey

Natural Capital

Considering **natural capital**, irrigation investment has increased the availability and reliability of water during the main growing seasons. In the schemes investigated, there are relatively few conflicts over the use of water. Although testing reveals some decline in the quality of water as it passes through the schemes, the decline appears to be relatively insignificant.

Potentially more significant are the impacts of the intensification of agriculture with irrigation. Farmers on all schemes perceive that soil fertility has declined. Some of farmers' complaints about declining soil fertility may be in fact refer to the workability of the soil, which in some places is deteriorating. However, as a general statement, yields are static or declining. Although the evidence from the soil tests is inconclusive, it appears that soil acidity associated with the over application of urea is increasing. In the Terai region (Janakalyan) it is possible that a reduction in the incidence of flooding is contributing to a reduction in the fertility of soil over time as it is not being replenished with silt and nutrients from flood waters.

Compost is commonly used as an organic fertilizer on all three schemes, and manure from livestock is commonly applied to the fields in Yampaphant, but only rarely in the other two schemes. It is important that manure is better used. Broadly-speaking, there is a decline in the number of cattle held by villagers, partly connected with the fact that young people are nowadays at school, or leaving the villages, and are therefore no longer available to mind the beasts. The amount of available manure is declining in proportion. It is also likely that nutrients are lost from the manure by leaching when it is heaped in the fields, a common practice.

It appears likely that some imported fertilizer is of poor quality, a frequent complaint. However, a minority of farmers seem satisfied with the fertilizer they use. It is possible that poorer farmers are following a minimalist strategy, reducing the quantity of inputs and thus the cost, whilst accepting the resulting lower yield. However, the practice is not necessarily confined to poorer farmers.

There is some evidence of soil erosion, particularly in the form of landslides and terrace instability along the roadside at Yampaphant, but the link to irrigation is not sure.

Against these direct, negative impacts, it is necessary to consider the potential reduction in the pressure on marginal lands as a result of the intensification of agriculture in the irrigated areas. In particular, it has been recorded that pressure on the forest resource has decreased, and that its condition has improved. Were it not for irrigated agriculture, greater extensification of cropping, with detrimental effects for e.g. hillslopes, might be expected. It is concluded that, in the schemes investigated, the net impact upon the natural capital stock has been positive, and that a "without" irrigation scenario could well have resulted in a long term decline in the stock of resources available to the local rural population.

DISCUSSION OF ISSUES

The livelihoods perspective adopted in this study, and the insights gained from the field work, emphasize the complementary effects on social and economic development that arise from improvements in livelihood assets. For example, an increasing number of farming households receive remittances from a family member working elsewhere. The trend has increased over the last ten years, and could be one result of an improved standard of education, funded by increased income from irrigation.

Increased incomes appear to have led to a change in priorities for many farmers, who have encouraged their educated children to move from agriculture into higher paid, non-agricultural employment.

There are also obvious inter-linkages between human and physical capital. An irrigation scheme needs to function well to make farming sustainable. Physical capital, in the form of schools, shops, health posts and roads multiplies the impacts of improved farming. Irrigation may, however, have been the 'pull-factor', which initiated service provision in the areas around irrigation schemes.

Both informal and formal social capital can also facilitate broader distribution of the gains from irrigation, and help to build other assets. Reciprocal exchange of labor (*parma*), whereby households mobilize labor from other households in addition to their own family labor, can help to meet the increased labor requirements of irrigated cropping, while formal networks and groups are important for information exchange and management of shared resources. For example at Yampaphant, the Mothers Group disseminates knowledge about the importance of education, children's welfare and diet, and the forest committee promotes sustainable use of the resource.

On all three schemes, the distribution of land ownership is skewed, the majority of households (over 80 percent) having irrigated farms of less than two thirds of a hectare (median farm size ranges from 0.25-0.35 hectare). The largest farms are relatively small (the maximum recorded irrigated area ranging from 1.35-4.40 hectares across the three schemes). The majority of farm households are also owner cultivators and the incidence of land renting or sharecropping is relatively low. Thus, any direct benefits from irrigation in terms of improved agricultural productivity accrue to relatively large numbers of poor farming households, without disproportionate appropriation by large farmers or landlords.

20-25 percent of farming households have family members in salaried employment. Survey evidence is weak but suggests that irrigating farm households have more diversified sources of income than landless households dependent on working as farm labor.

Fifty percent of agricultural goods and service providers had been farmers before entering the business. Moving with their farmer clients, the business opportunities offered by higher productivity levels and roads

were the main factors encouraging people to migrate to the schemes and/or set up in these businesses. Farmers on the irrigation schemes provide the majority of their customers, and most report that they have experienced improved demand for and profitability of their services with the process of irrigation development. The number of shops and services has increased over recent years across all schemes. This could also indicate an increase in the spending power as the income of local farmers has increased through irrigation.

Permanent settlement and house construction has accelerated since irrigation in each of the schemes (the prior eradication of malaria at lower elevations also facilitated this trend). On the two hill schemes, farmers used to farm by day and return to houses in the hills by night. The extra produce grown as a result of irrigation made it increasingly difficult for farmers to carry their harvest up the hills, whilst road construction provided new and more direct routes to markets.

Making comparisons between the three schemes, there is a notable difference in the current ability to produce regular farm surpluses. Over 70 percent of farmers interviewed at Yampaphant and Janakalayan have been producing a surplus to sell, whereas at Kalleritar this figure was only 30 percent. Kalleritar farmers are thus the slowest to capitalize on the growth and sale of crops for cash, leaving them lagging behind the other two schemes financially and with less to invest in infrastructure, education and healthcare.

Contributory factors to growth at Yampaphant have included an unusual degree of assistance and training to farmers, and strong market development. Even at Yampaphant, where extension support is now sparse, standardized irrigation practices are not appropriate to some of the vegetable crops. At Janakalayan, there has also been some training intervention, a high demand for rice from the Terai, adequate transport infrastructure and market opportunities. At Kalleritar on the other hand, farmers have had less contact with extension agencies; pedestrian access to the scheme imposes a marketing constraint. In addition, farm sizes are slightly smaller and lower yields are reported for some crops, although this in turn may be linked to training, less commercialization and lower input use. Kalleritar also suffers from a poorer water supply, particularly in the spring season and the tail reach.

The impact of irrigation on physical and other capital assets vary with these scheme conditions. Yampaphant and Janakalyan have a more

advanced and developed physical and social infrastructure than Kalleritar. There has been greater improvement in housing and more use of services, such as transport and healthcare. All these are clearly linked with the ability to pay and to the differences in farm productivity, market accessibility and levels of agricultural training and human capital development across the schemes.

At all three sites, parallel developments have taken place, such as improvement to roads and access to transport, provision of drinking water, electricity and biogas, and developments in livestock production. Improved roads, trails and electric lighting support increased social capital, making it easier for people to travel to meetings, ceremonies and classes and participate in events after dark. Non-irrigation government activity and NGO programs in the area have also contributed to social, human and financial capital, as well has helping to conserve natural capital.

Thus, irrigation is most effective as a part of a package of rural development measures. For example, at Yampaphant where other factors have been positive, irrigation appears to have contributed most to livelihoods, and farmers are most enterprising. At Kalleritar, the need for extension advice is clear: farmers diversified into cultivating tomatoes, but the crop was lost to disease. They are now trying chilies. Given the dependence of the majority of rural households on crop production there are few alternatives to irrigation that can bring the same scale of improvement in farm incomes over a relatively short time period.

The results of this study thus tend to support some of the key propositions underlying Nepal's Agricultural Perspective Plan (APP). For example, that the returns to public investments such as roads, or farmer investment in inputs such as fertilizer, will remain low and potentially uneconomic if land is unirrigated (or only seasonally irrigated). Individual adopters may experience improved yields but without year-round use of irrigation and fertilizer there is little impact on aggregate production which can lead to greater market orientation and higher incomes. It is thus the high density of income generation in a successful irrigation scheme that can make infrastructure investment profitable and stimulate consumption and employment linkages in the local rural economy.

Although direct comparisons with non-irrigated areas are not possible, irrigation development appears to have been associated with improved standards of housing and acquisition of physical assets such as biogas plants and improved water supply and sanitation. Irrigating farm

households are clearly better off in this regard than households primarily dependent on laboring. For all three schemes, the time required to reach facilities such as schools, health posts and banks is better than the national average.

The relatively equitable distribution of the direct benefits of irrigation seems to result from the absence of important sources of social and economic differentiation. Although caste and ethnic differences exist within the communities studied, they do not appear to have been significant in influencing the gains from irrigation. Also, with the partial exception of the tail reach of the canal system at Kalleritar, the water supply is adequate, meaning there are not large differences in output between head and tail sections of the command areas.

CONCLUSIONS

1. On the selected schemes in Nepal, the distribution of the direct benefits of irrigation has been fairly equitable. Water is adequate, apart from some shortage at the tail block in Kaleritar, otherwise there are no important differences in supply between head and tail sections of the command areas. Although there are caste and ethnic differences within the communities, they do not appear to have been significant in influencing the gains from irrigation.
2. The increase in cropping intensity and improvement in yields resulting from irrigation have produced a substantial increase in gross income per hectare per year, of at least 100-160% in constant prices. Approximate calculations suggest that median size farm incomes before irrigation on all three schemes were below the published poverty line income for Nepal. After irrigation, incomes are estimated to have risen above the poverty lne for Janakalyan and Yampaphant, but remained just below it for Kalleritar. Share croppers, who are in a minority on the schemes, have clearly benefited less than owner cultivators. A more detailed analysis of the significance of the increases for farm livelihoods is currently in hand.
3. It is generally believed that irrigation leads to higher and more continuous employment for farm labor. Except at Janakalyan, where use of contract labor for peak season operations has increased, households did not consistently report an increase in use of hired labor. However, most farm households had surplus labor before the advent of irrigation. Irrigated agriculture has provided fuller employment for family labor, in some cases removing the

need for a seasonal migration of males in search of work. The overall increase in labor associated with irrigation is confirmed by the responses from a small sample of laborer households, from group interviews and from inquiries by the Process Investigators.

Although households which are primarily dependent on farm labor for their livelihood clearly remain poor, irrigation development has provided increased employment for labor from the surrounding uplands, in the case of Kalleritar and Yampaphant schemes, and for gangs of seasonally migrating contract labor at Janakalyan.

4. Alongside irrigation, the most significant development common to all schemes is the construction of a main road, which provided improved access to markets and services. All three schemes sell produce to distant markets, including Kathmandu, and without the road the size of their markets would be significantly reduced. Farm households also visit market centers such as Kathmandu for shopping and health facilities. Road construction may have encouraged irrigation development itself by providing access for construction and materials. In a similar way, improved accessibility has encouraged other developments that have yet to reach more remote areas of Nepal such as electricity and drinking water. In each case the road has also provided a focal point and market place for local businessmen to open shops and provide services used by the farming communities.
5. Increased agricultural production, either directly, or by increasing incomes, has had significant, positive impacts on diet, health and education, not merely for owner cultivators but also for those involved in supplying goods and services to the farming community. Sharecroppers and laborers have benefited to a lesser degree.
6. Formal social capital in the irrigation communities has measurably increased in terms of active interest groups and complex committee arrangements for continued function. Although these changes are encouraged by a number of development initiatives acting together, irrigation seems to have been a major influence, allowing sufficient improvement in the general standard of nutrition and income to free people from the preoccupation of survival and allow them to attend to other development issues. People are working harder and longer than they did before the introduction of irrigation, but have the stamina to do so which was

not apparently the case before irrigation was established.

7. The introduction of irrigated agriculture has reduced pressure on marginal lands. In particular, pressure on the forest resource has decreased and that the forest condition has improved under improved community management of the resource. It is concluded that the net impact upon the natural capital stock has been positive and that a "without" irrigation scenario would probably result in a long- term decline in the stock of resources available to the rural population.

8. The study suggests that irrigation is most effective as a part of a package of rural development measures. Irrigation can have an impact on the livelihoods of all community members, but the impact will be multiplied if other factors are also in place, for example, market systems, roads, schools and training. Irrigation, thus, cannot be identified as the single cause of change, but without irrigation being present, the other developments may not have taken place. Given the dependence of the majority of rural households on crop production, there are few alternatives to irrigation than can bring the same scale of improvement in farm incomes over a relatively short time period.

9. Overall, from the evidence of this study it can be concluded that small scale irrigation development in Nepal has been an effective tool for poverty reduction. Important pre-conditions for this have been the small farm structure and lack of serious social and economic differences within the command areas sufficient to bias the distribution of benefits.

Despite these positive conclusions, all of the three schemes, with the possible exception of Yampaphant, operate at levels of productivity which remain significantly below potential. A complementary package of rural development interventions is needed for irrigated agriculture to achieve its potential.

GENDER AND POLICY ON FMIS IN THE CHANGED CONTEXT

PRANITA BHUSHAN UDAS[1]

INTRODUCTION

In rural areas, households depend on agricultural practices for their day-to-day livelihood and therefore irrigation is the crucial element. An irrigation system managed by farmers themselves is a community action. The community organizes itself for the acquisition, allocation, distribution and drainage of water from the source to the field through physical structure for controlling water (Martin et. al., 1986). For variety of reasons government agencies, international donors and private voluntary organizations are becoming more interested in Farmer Managed Irrigation Systems (FMIS). One of the reasons for the external involvement is the degrading infrastructures, which need regular maintenance. Rehabilitation of the system can increase system efficiency and enhance agriculture food production (ADB/M, 1998). The involvement of government and external agencies in FMIS and any other government initiated new systems has brought new rules and regulation in the irrigation management.

It is important for the users to be aware about the rules and regulation to have better access to the resource. Rules thus imposed need to address the users' interest for better water management and hence participation of all the users is needed.

In reality, all users are not participating equally in the Water Users' Association (WUA). Especially women, though are recognized water users, are not active in decision making forum of the WUA. In most part of South Asia, the women are trained to take care of indoor household activities together with farm production and male members are responsible for attending official activities. This practice has hindered women participation in the users association (Meizen-Dick and Zwarteveen, 1998). A review of evidence from the WUA shows that organizations often exclude women through formal and informal membership rules and practices (Zwarteveen and Meinzen-Dick, 2000). Women's interests remain aside due to lack of women voice in the WUA. They are in threat

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of loosing their access to water, which they are using, for their day-to-day cultivation. Importance of women in irrigation nowadays is becoming more crucial due to the numbers of male migration from rural areas and increasing agriculture workloads on women (Mehata, 1996).

Women's non-participation in formal forum of decision-making is found to be due to lack of self-esteem within them. Empowerment approaches to help themselves are adopted by development agencies (Kabeer, 2000). Bureaucratic structures have been set up with the purpose of bringing women's interests into policymaking process (Razavi, 1997). National policies were amended to increase women participation in several sectors to assure equal right to both men and women. In irrigation sector, realizing the low participation of women in formal users' organizations, quota system to increase women participation in the WUA committees has been imposed by the governments. Unfortunately, it is easier to write policies than to translate into action (Schreiner, 2001; Long et. al., 1989; and Wuyts, 1992). Formulating a policy does not assure that it will be concretized in the same form at the beneficiaries' level. Formulation of a policy at the central level cannot be said that the beneficiaries (women) have instigated it. Women are already restricted within their households and there are fewer chances for them to make their voices heard. There are centralized groups of women activists advocating in favor of women. The voices of these groups might not be coming from the real users. Policies formed by the influences of the women activists do not ensure that the women water users at village level are aware about the policy change (Bhattchan, 2000). Therefore, there is a need to observe and analyze critically the policies formed in favor of women and its field reality to make the gender related policy process more effective so that providing equitable space for women could create an equitable society.

Addressing the problem, this paper explores gender related irrigation policy formulation and translation in a field reality of Second Irrigation Sector Project (SISP) in Nepal with empirical evidences from Tukucha Nala Irrigation System, Kavre. This paper is mainly divided into two sections. The first section gives short description on policy formulation and how gender concerns are inducted in the context of Nepal. The second section draws empirical evidence from the study conducted on Tukucha

Nala Irrigation System under SISP[2]. It analyses the constraints for the policy implementation and places the argument in the present political web.

GENDER CONCERNS IN NATIONAL IRRIGATION POLICY

Nepal is a small mountainous country with tremendous latitudinal variation ranging between 600 AMSL to 8848 AMSL covering an area of 1,47,181 sq. km. Over 85% of 22 million people of the country living in rural areas are dependent on agriculture for their livelihood. The economy and livelihood of Nepalese thus is based on agriculture. About 81.1% of the population are engaged in agriculture activities. Agriculture accounts for 40.2% of national Gross Domestic Product (GDP). Population of the country is growing at the rate of 2.6% (CBS, 1999). Agricultural production is growing by about 2.3% on average as compared with annual population growth of 2.5% during the period 1980/81 to 1990/91 (NPC, 1994 cited on Pant, 2000) whereas the inflation rate (consumer prices) of Nepal currency is 11.8% (F/Y 98/99 est.). The demographic configuration of the country indicates that of the total population women share 50.13%. Women population includes 50% of the total labor of the country (CBS, 1999). The contribution made by women to household income directly and indirectly has been up to 53%. Of total women population about 91% are engaged in agricultural tasks including irrigating fields whereas active male population engaged in agriculture is only 75%. Women contribute between 50-80% of total agricultural labor depending upon the geographical and socio-economic variations. Of total literacy percentage, 62.5% of the total literate is male and only 37.5% is female (CBS, 1999).

Though women contribution in managing water in agriculture field is remarkable, their participation in formal WUA meetings is very low, almost minimal. Realizing less number of women's representation in formal forums of decision-making, the eighth national five-year plan provided guidelines to amend legal documents to provision legal space for women to participate (Pradhan, 1999). The irrigation policy, 1992 (first amendment, 1997) states that

'Women participation in the WUA will be encouraged and it

[2] Second Irrigation Sector Project covers greater number of surface irrigation with large hectarage in Nepal. It targets to improve 41000 ha of land in Central and Eastern Development Regions of Nepal. The total budget of the project is 33.3 million US$ of which 75%, 13%, 12% is contributed by Asian Development Bank, Government of Nepal and the WUA respectively.

would be intended to increase by at least 20% in executive board of the WUA.

The irrigation regulation, 2000 further makes women participation in Executive Committee of the WUA mandatory. It states:

"The users desirous to use any irrigation system developed and operated by His Majesty's Government shall be required to constitute an User's Association having the Executive Committee not exceeding nine members including at least two women members…"

Similarly the Memorandum of Understanding (MoU) between Department of Irrigation and Asian Development Bank for SISP implementation has realized the importance of women in irrigation and has prioritized gender sensitization training for implementers and water users. It further emphasizes recruitment of female Sociologist and Association Organizer (AO)[3]. Further, the SISP implementation strategy was amended in 1999 with the provision of recruitment of Community Based Organizers (CBO), after dissolution of a moratorium imposed in year 1998/99. For increasing women participation, SISP emphasizes on recruitment of women CBOs.[4]

TRANSLATION OF POLICY: A CASE OF TUKUCHA NALA WUA

Background

Tukucha Nala Irrigation System, a small farmer managed hill irrigation system is located in Tukucha Nala Village Development Committee (VDC) at Northwest of Kavre district of Bagamati zone at Central Development Region. The location is approximately 34 km. east of Kathmandu, the capital and 10 km. west of Dhulikhel, the district headquarters. Punyamata Khola that feeds system is a perennial non-snow river having catchments area of 6.5 sq. km. The command area of the system is 34 ha. The main canal is designed to carry the discharge of 85 l/s without having any type of fix diversion structure. There is only the provision of side intake in left bank of the river. The length of the main canal is 2.05 km. It used to irrigate land area of 67 households at the time

[3] Memorandum of Understanding, Department of Irrigation and Asian Development Bank for Loan no 1437, Second Sector Irrigation Project.

[4] Out of 68 CBOs appointed under SISP, at present only 5 CBOs are women. Source: SISP Tenth Progress Report.

of construction and at present it irrigates 71 households due to formulation of single families from two joint families. The system irrigates three wards out of nine in the VDC i.e. whole of ward number three and part of ward numbers two and four. The head works lies at ward number four. The ward number four is situated at highest altitude followed by ward number three and two almost at base of the hill. Therefore, users at ward number four are the head ender, followed by users at three two are the tail enders.

Caste and Community Structure

Majority of households are of *Newar* caste (45 households i.e. 63%) and they are inhabiting at ward number three and some at four. Other 13 households are of castes *Mijar, Magarati, Sarki* and *Tamang* who are considered as lower in social status and represent 24% of total users living at tail end. Remaining 9 households (12%) are *Chettries* who are least in number, but holds higher social status[5] and lives at ward number four.

Female Headed Households

Out of 71 households with 34 ha command area, 14 households belong to de jure and de facto women headed households i.e. 20% of the total households. Three households are headed by widows and are head of the households. These women cultivate part of their land and rest is under tenancy. Discussions with them reveal that they participate in the WUA activities but do not represent in the WUA executive committee.

Cropping Pattern

Before 1998, when there was no irrigation system, farmers used to plant paddy seeds in July from monsoon rain. Farmers used to harvest this crop in November/December. After that, field was kept fallow till February. In February, Mediterranean rain helps to broadcast wheat, which used to be harvested in the month of May. The production was of a subsistence type. The produce was seldom sufficient for annual household consumption. After irrigation was introduced, cropping intensity has increased. Farmers started to grow paddy from April to September. After harvesting paddy two crops of potato are planted. The first crop is planted in October to

[5] Data based on Village survey and the WUA database. It is found that there is slight difference in this data and socioeconomic survey of District Irrigation Office (DIO) done for pre-feasibility study.

December, which is followed by another potato plantation in month of January to March. Potato is grown as a cash crop, and potato growing has helped increased farmers' income. The majority of the farmers sell their potato as soon as they harvest from the field whereas some rich farmers store them to fetch higher prices during the off-season.

Formation of the WUA and Process of Registration

Farmers from ward number four had started irrigating their farms from Punyamata River in the year 1982 with their own effort. In 1992, the river flooded violently and washed away the fertile land. DIO assisted farmers for rehabilitation with small budget. The farmers contributed their labor and could collectively saved NRs. 10000 out of the allocated budget from the Department of Irrigation (DOI). Both men and women contributed to the labor equally according to the village elders. The following year was a drought year that hampered agriculture production badly. It made farmers to realize the need of water/irrigation and to avoid risk associated with erratic rainfall. Ward president of that time and local leaders who were men took lead to divert water from the river. The watercourse flows from ward number four to two and passes through three. During that phase, women also participated in digging the canal. With the money saved from the River Control Program and their own effort, farmers bought hume pipes and guided water into their field. The repair and cleaning of Hume pipes were quite troublesome as the pipes got clogged time to time.

In case of Tukucha Nala, the villagers file petition to DIO in 1996 for system rehabilitation. The system was referred to Phanalphat irrigation system. The first president of Tukucha Nala WUA was an active local leader and he was also elected as ward president. The WUA constitution was drafted in the presence of two local leaders who became president and secretary of the WUA later. The process of formulation of the constitution and registration suggests only few WUA members (who were all men) and Irrigation Staff, (also only men) were involved in drafting the constitution of the WUA. Finally the WUA was registered in the month of October 1996 with District Water Resource Committee. The process suggests that how women members were excluded from the process of the WUA formation where they were recognized as the equal partners. Despite the specific policy of women participation, women were excluded in the process. A male AO called the first meeting of the WUA on behalf of DIO to discuss about the future WUA activities on 22 April 1996. None of the women members were present in the meeting according to the WUA records. It is simply because the villagers understood attending meetings

for irrigation is men's responsibility as household head. The executive committee of the WUA was formed in the second meeting on 24 April 1996. In the meeting, eleven women were present out of 58 members who participated. Among them, one woman was selected to represent in 11 member executive committee. Selection process is the nomination from male local leaders and AO. It was not a voluntary candidacy by the women member who got selected in the executive committee. Finally the WUA was registered in District Water Resource Committee, Kavre in October 1996.

Organizational Structure of the WUA

The WUA constitution empowers the general body to elect the office bearers and approve the decisions taken. It also suggests the formation of 11member executive committee. It states that 20 percent of the Executive committee member should be women members. That means at least two women members should be elected/represented in the executive committee. The constitution also suggests the formation of five sub committees as shown in **Figure 1**. However, in the study of the WUA, it was found that there were three women who were nominated as members in the recently formed committee. No interest among the WUA leadership was found in forming the sub committees.

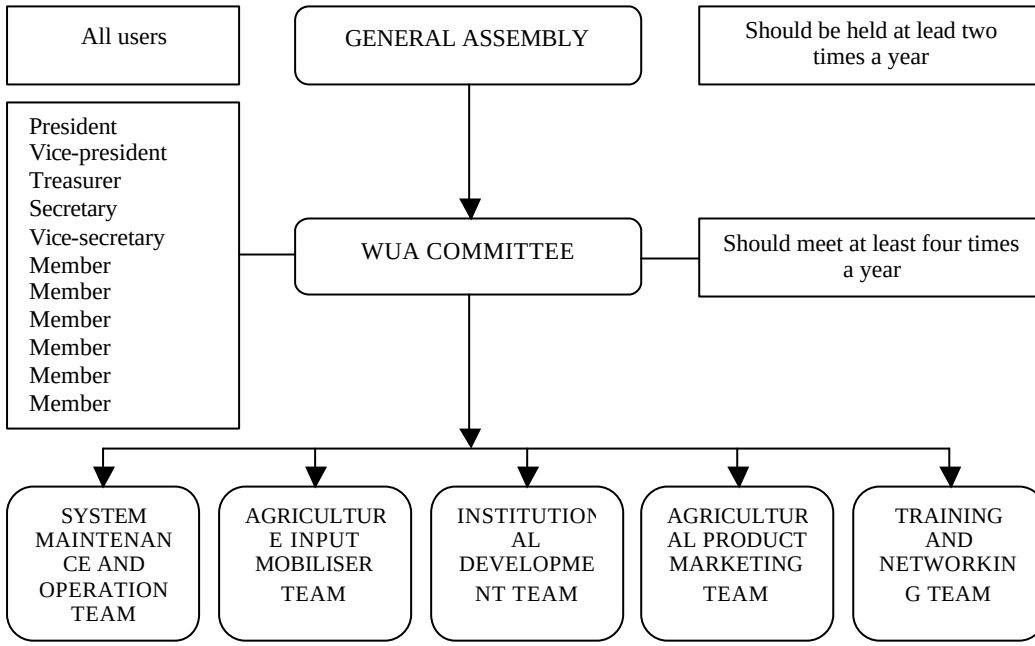

Figure 1: Organizational Structure of Tukucha Nala WUA

Membership

The constitution of the Tukucha Nala WUA describes water users' right, the command area, and formation of different committees for system management. According to the Constitution of the WUA, a farmer who is more than 18 years old and holds land under cultivation, tenancy or any landholding and share within the irrigated area is considered as a member.[6] Tenants, irrespective of the contributions made to the system construction loose their membership as soon as they stop being a tenant, or as soon as the agreement with the landowner terminates. The WUA membership is based on land utilization rather than just land ownership. Since those who cultivate lands are families, membership should refer to families rather than individual. However in practice, the man is considered the household head and membership is usually given in his name except in the case of de-jure woman headed household. Membership can nevertheless be replaced

[6] Tukucha Nala Jal Upabhokta Samiti ko Bidhan,2053 (The Constitution of Tukucha Nala Water Users' Committee)

by family members in the WUA activities. This right is not mentioned in the constitution, but exists in practice.

Women Participation in the WUA Activities

The WUA was registered in the year 1996. However till September 2001, the policy provision i.e. 20 percent representation of women members in the executive committee was not evident in the WUA. During the third general assembly of the WUA, three women, one from Sarki (cobbler) and the other two women from Newar were selected (**Table 1**). Out of three women nominated, two belong to women headed households. It came out in the study that the preference towards women headed household is due to their participation in the WUA meetings when compared to the other women whose head of the households are men. When inquired how the women committee members feel about their participation in the WUA meetings, they said they can learn something new for being in the committee, but at the same time they are in doubt that they might not be able to work well as they think they are not educated.

Table 1: Women Participation in Executive Committee

Time	Size of Executive Committee	No. of Women Present	%Women Representative
1996-4-24 to 2001-8-19	11	1	9
2001-8-19 onwards	11	3	27

The reasons for increasing trend of women participation in meetings can be analyzed based on the following information is given in **Table 2**. The letter that is distributed by CBO to call third general assembly in 2001 had mentioned that either male or female of a household should attend the general assembly, which otherwise always mentioned household head to participate in the meeting. It is one of the influencing factors to increase women presence in third assembly. The representation of women in the first WUA committee was only 9% and it has increased to 27% in the recent executive body. The reason for 27% of women representation in present executive board is due to the influence of first president of the WUA.

Table 2: Women Participation in Formal Meetings at different time Period

Time	Meetings	Total Participant	No. of Women	% of Women Participation
1996-4-22	First meeting to organize the WUA in presence of AO	29	Nil	0
1996-4-24	Meeting held to form the WUA for registration	58	11	19
1996-9-17	First general assembly	88	8	9
1999-7-1	Second general assembly	38	5	13
2001-8-19	Third general assembly	45	8	17

Source: Filed survey and the WUA Records

Participation in System Maintenance

The WUA is performing activities like water delivery, canal cleaning, and distribution of improved seed provided by District Agriculture Office under SISP. Based on the date, they can decide among the family members to participate on canal cleaning activities. This suggests the WUA activities are mainly confined to cleaning of the canals. This is one of the reasons for lower women participation in the WUA meetings. The women felt that the meetings conducted only to decide the date for canal cleaning, which they come to know from others. The other reason is that the WUA rule demands a participation of a household member that is often men. Apart from these reasons women are traditionally loaded with their ascribed household responsibilities. Regarding the time and the day to hold the meetings, women were not consulted. Their participation in different WUA activities is shown in **Table 3**.

Table 3: Participation of Women Members in different Activities of the WUA

Time	Activities	No. of Women	Total	% Women Participation	Remarks
1999-6-20	Training on system operation, maintenance organized by DIO.	4	23	17	15 households (21%) has not participated yet
2001-9-20	Canal cleaning				
	First day cleaning	15	45	33	
	Second day cleaning	2	11	18	
	Total	17	56	26 (Av.)	

Source: Observation and secondary information available from the WUA

The women participation in the WUA meeting is found to be less than their role in canal cleaning activity. Of the seventeen women who participated in canal cleaning, only 8 were present in the meeting held to decide the date for the cleaning program. Their elders represent who ever

are not present in the meeting. The usual practice is that the elder males who are the head of the households participate in the member where the labor contribution for maintenance is done by the females usually the daughter-in- laws or the daughters. The practices suggest the reason why there is a low participation of the women in the meetings but comparatively more in the works that demands hard physical labor laden on women. The male members who represent the household prefer to attend meetings, which restrict the opportunity for the women to attend the meetings. One does the decision-making and others carry the real work in this case. To strengthen the WUA, actual members who participate in the WUA activities should be encouraged to participate in the decision making process in the WUA.

Reasons for Lower Women Participation in Decision-making Forum

Based on above observation, the reasons for lower participation of women in the WUA meetings can be summarized as follows:

Heterogeneity of Women Group

In reality, not all the women of a household or village are a homogeneous group. Mother mostly of age group 40-60 who can be termed as mother has different level of access to resource **Figure 2** and level of understanding about taking part in the meetings than the daughters-in-law of age of 18-30 and daughters of age 18-25. Similarly the level of communication between mothers and fathers is more hierarchical and less interactive compared to sons and daughters-in-laws in case of Tukucha Nala Irrigation System **Figure 3**. Consideration of the fact that women in the village is a heterogeneous mass during designing the project implementation strategies will help increase women participation in the WUA meetings in practical way. The key point is, that the policy implementation strategies need to consider these facts. In practice, it has been ignored during the program rehabilitation in Tukucha Nala Irrigation System.

Societal Attitudes

In Tukucha Nala WUA, women participation in the WUA is also hindered by the prevailing general attitudes in the society and understanding about women. One of the perceptions about women in the village is that ‘women are uneducated, do not know official matters, and are poor in accounting.' The role and the activities of the women were considered to engage in the

indoor household activities besides the reproductive activities. These understandings are being internalized by the women and they themselves feel low among others at the time of their participation in public domain**.**

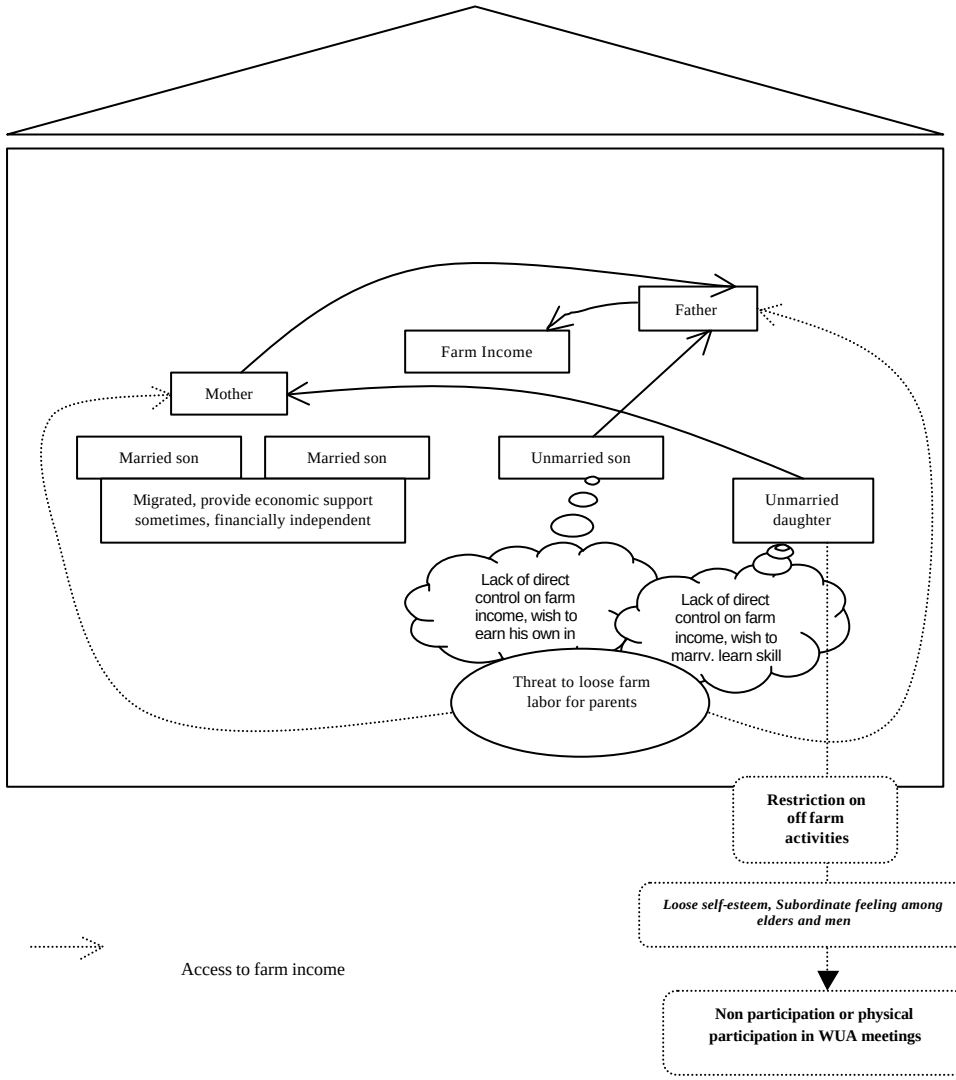

Figure 2: Intra-household Relationship and Access to Resource

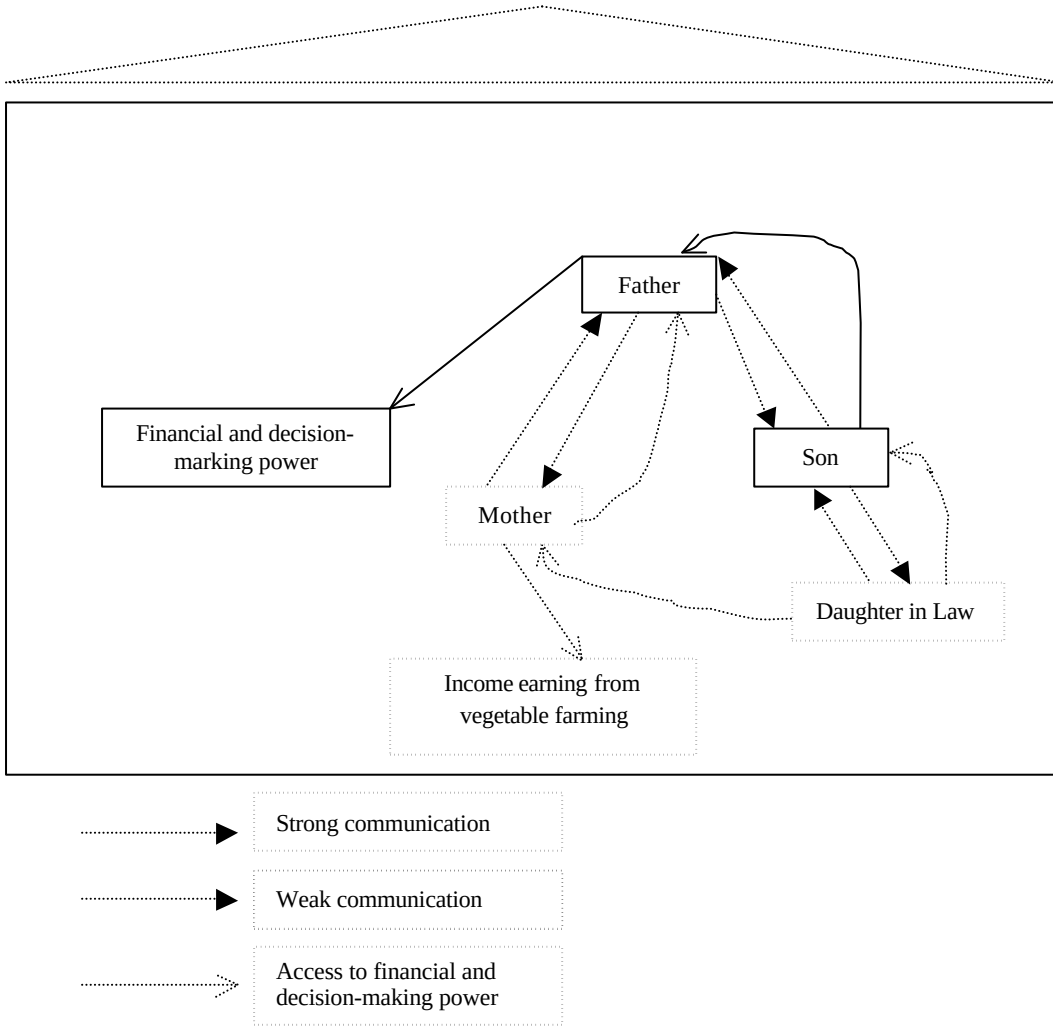

Figure 3: Intra-household Relationship and level Communication

Flow and Access to Information

The policy formed at national level needs to be translated at field level. Though the quota system as a policy tool has been implemented to increase women participation in the executive committee, none of the women members and many of the men members are not aware. The

implementers at district level, regional level and central level are also not serious about the gender issues. The seriousness of the implementers are very much guided by their social norms and values towards women. For example, women of 35 years who came from a village to make inquiry on availability of iron mesh at DIO got the question from Chief District Engineer "Is there no male persons in your village who can come for this work?" Asking this question to a woman is not to embrace her, it's a politeness that he could offer as if he is concerned about her hard work. But in other hand, the women will be discouraged to come next time with the same statement. To change this attitude of implementers, there is an urgent need to design strategies for policy implementation in such a way that will help make the implementers aware on the ways to encourage women to participate. One of the important tools to achieve the objective is designing the best ways to transfer the information from the central to the regional to the district level and then to the users.

In SISP project, there is a gap in information flow at central and district level regarding gender concern. The MoU between Asian Development Bank and His Majesty's Government clearly mentioned that:

"Although women are widely involved in farming activities, particularly in the Hills, they have traditionally had little involvement in irrigation system operation. In many cases, irrigation management is thought to be a task for men, and women would prefer not to be involved. However they do have needs for water, particularly for washing and bathing, and would like to have these needs recognized. The project approach therefore needs to be flexible. Encouragement will be given to the involvement of women in the design and implementation of the project.

To achieve this objective, female sociologists, AOs, field organizers and consultants will be hired by DOI to assist in the formation and strengthening of WUAs in each sub project. DOI, Department of Agriculture and the WUA officials will be trained in gender awareness and in recognizing the needs and role of the women in the community Training packages for women will be prepared by DOI. An appropriate provision concerning women's participation in the project implementation will be included in the memorandum of agreement between DOI and each WUA and linkages between ongoing projects and women in development

projects will be strengthened."[7]

While the MoU is explicit about its objective in increasing women participation in WUAs, the same objective is not found in the Project Procedural Manual (PPM). This is important, since District Irrigation Officers work on the basis of PPM for implementing projects. If the gender component would have been clearly mentioned in Project Procedural Manual and would have explicitly provided the guidelines, the implementers would be sensitize more to implement the policy.

At village level, the flow of information is through the local leaders more than any other sources. The village leaders like ward president, his assistances etc. spread and modify the information according to their interest. The local leaders are the key source of information that act as link between the bureaucracy and the users. The local leaders use this access of information as the tool to influence the decision in the WUA management. Since from the beginning women are supposed to take care of household responsibility, women in politics are very less active **Figure 4**. However the women members are astute enough to materialize their right given the right to policy information. In the changed context, there is a need to have a proper two-way communication channels in order to strengthen FMIS/WUA management.

CONCLUSION

The gender issues in FMIS in the present changed context demands equal participation of women in formal WUA functioning to secure their right to irrigation water. Government effort to increase women participation in the WUA meeting by imposing quota system has not been achieved as targeted in the last eight years. However it has provided space and opportunities for women to physically represent in the WUA meetings instead of the social norms and values that hinder their participation. Introduction of the quota system as a policy tool only is not enough to increase women participation in the WUA activities. A holistic developmental planning is required to achieve the policy objective. Strategies made to implement the policy objective should aim to create proper channel to flow the information from central level to the field level

[7] Source: MoU, Second Sector Irrigation Project (1996-2002), Loan No1437 NEP (SF), His Majesty the Government, Nepal and Asian Development Bank, Manila, Philippines

and from bottom to top. It helps individuals who are involved in policy process to sharpen their ideas and understanding about the local realities. At village level since the local leaders are the key actors for information flow, they can be used as a tool to disseminate the information to users, especially women. The conscious efforts to increase the women participation in FMIS are a future challenge for all of us who are involved in policy making and implementation.

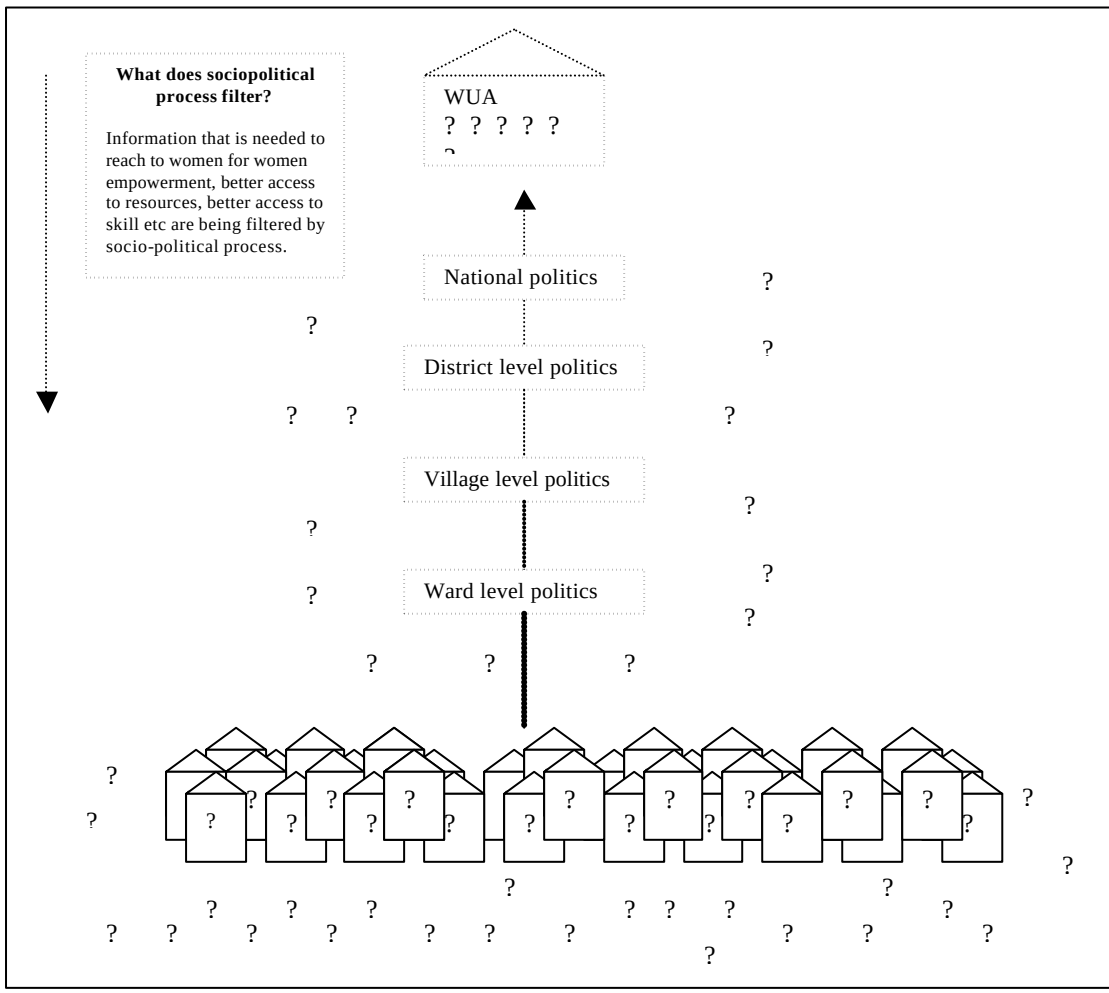

Figure 4: Socio-political Process Filtering Women Activities in Water Users' Association

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COMPETING FOR WATER: THE IMPLICATIONS FOR AGRICULTURE IN VIEWING WATER AS AN ECONOMIC GOOD

SYNNE MOVIK[1]

INTRODUCTION

This paper attempts to delineate some of the current thoughts in the literature regarding the increasing competition for scarce water resources. The focus will be on the needs of agriculture versus the requirements of other sectors, such as industry and energy, and emphasis will be placed on the situation of smallholder and communally managed irrigation systems in this respect. The framework within which these issues will be explored, is one characterized by the emergence of water management schemes practised according to the principles of economic rationality, where emphasis has shifted towards economic profit rather than social gains. This represents a major alteration in the thinking about water. In the past, the social nature of water tended to dominate the debate, whereas current discussions center a round efficient economic management of the same resource. Policy prescriptions arising from this new intellectual perspective of water range from simplistic calls to make water and water rights entirely private goods, to more selective approaches aimed at particular uses and aspects of water (Svendsen and Small, 1992).

The main reason for such a shift may be attributed to the increasing perceived scarcity of water. As much of current research will attest to, water scarcity, whether real or manufactured, is an increasing problem in many parts of the world (Mehta, 2000). Hence, many researchers have in recent years concerned themselves with how water should be managed, whether according to principles imbuing water with an economic value, a paradigm endorsed by the World Bank, or viewing water as a basic human right that should be guaranteed to all citizens, as proposed by Peter Gleick, a renowned water specialist (Gleick, 1998). His argument is that water greatly differs from other 'commodities', and in view of the growing scarcity, there needs to be put in place a 'rights-based' approach to protect

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the poor and vulnerable 'from having an essential ingredient of life priced beyond their ability to pay' as Derman and Ferguson (Derman and Ferguson, 2000) put it. However, even though numerous studies have documented the capacity of farmers to negotiate rights and rules of access among themselves, and to craft sustainable institutional arrangements to govern communal irrigation schemes, less attention has been paid to the accommodation of other uses and corresponding use rights, or how water is allocated optimally between different systems.

The paper will start out with a discussion on the valuations of water, and what implications this has on using water for agricultural purposes. An approach of public responsibility regarding allocation decisions is argued for. However, conflicts may arise, as a result of the government's inadequacy in certain contexts, hence there is a need to develop a clear framework of rights and responsibilities. The issue of property rights in relation to the allocation question is thus touched upon, and examples from the literature where competition between agriculture and other sector requirements have raised critical questions of how water should be managed to satisfy alternative needs are provided. The ensuing section discusses pros and cons of the views presented, before concluding with the main points that have been made.

ALLOCATING WATER AS AN ECONOMIC GOOD

The Dublin principles, 1992, famously proclaimed that water 'should be treated as an economic good' (ICWE, 1992). Since that statement was made, the debate has raged on how to understand it, as it is vague enough to allow for various interpretations. The dogmatic stance assumed by some on the issue has brought to the fore a schism in opinions not only relating to water resources, but also touching upon the relationships between humanity and its natural environment in general.

In the book 'The Allocation Imperative', written by Richard Lee of the UNDP, a passage runs thus: 'the most serious issue among the many matters which water management has to consider, is that of the allocation of water among competing uses and users. The issue of allocation overshadows all other aspects of water management, including the difficulties of managing water quality, controlling flows, and all the remaining myriad questions involved in managing water.' The allocation process is defined as 'deciding who should receive how much water' (Uphoff, 1986, cited in Meinzen-Dick & Bruns, 2000). Lee goes on to argue that failure to allocate water efficiently stems from the lack of proper

economic appreciation of the water in the different sectors. Water cannot continue to be treated as having a 'unique importance', but must take its place as an economic good among other natural resources. And, as most economic goods, the best way to manage water efficiently is through the market. The increasing private participation in water management has brought with it as a corollary the wider opening of water management to market forces. It has also greatly augmented the interest of directly employing prices and markets as the main tool for allocating water among different uses. The amount of literature discussing the experiences in the few places where such an approach has succeeded reflects this interest (Lee, 1999).

The 1993 World Bank policy paper on water resource management emphasized the need for a comprehensive analytical framework for managing water, and achieving increased efficiency of water use. Greater involvement of users, decentralized management, and increased privatization, were advocated as ways of tackling the problems of scarcity. Appropriate pricing and charging systems had to be implemented, the Bank advised, and the emergence of water markets encouraged where feasible.

Consequently, the IMF and the World Bank have advocated the increased participation of private actors and corporations in the water sector. The 'water sector' in this respect refers primarily to delivery of drinking water, often coupled with sanitation services. The argument is that public utilities in general have a history of bad management practices, resulting in poor delivery routines or failure to deliver at all. The remedy, it is hoped, is to involve the private sector to a much greater degree. However, even though there are successful examples of privatized water utilities having improved service delivery and cut costs, there are several problems with this line of action to increase efficiency. One problem obviously relates to the ability of poor customers to pay for services, and concerns have been raised that low-income communities will be deprived of access to affordable water. The World Bank's claim that cost recovery will provide the resources necessary to expand services to poor areas have yet to be documented empirically, and thus remains a belief rather than a truth. Another problem is that governments often view privatization as a way of getting rid of their debts – by handing over all responsibility and assets to private entrepreneurs, they also absolve themselves of the responsibility of having to guarantee customers a stable water supply at the expense of the public coffers. Hence, privatization may be primarily regarded as a means of balancing national budgets. Thirdly, a private corporation, whose aim is to

generate profit for its shareholders might not be the best institution to manage what many view as a 'natural' public good. Water is crucial for public health, social equity, food production and the environment, to mention a few issues that indicate the 'publicness' of this resource. The involvement of corporations may cause fragmentation and a loss of overview of the entire resource, an overview that would be desirable in terms of making sensible management and allocation decisions, especially regarding intersectoral management. Hence, government agencies should, in one way or another, be held accountable to the broader public interest in matters concerning water management and allocation.

As stated, the issue of privatizing water has largely remained in the realm of drinking water and sanitation. But what implications does this trend, based on the school of thought that water should be viewed as just another commodity with an economic value, have on the agricultural sector?

The economist John Briscoe (Briscoe, 1996) has outlined in a clear manner what 'economic valuation 'of water actually entails when applied to different sectors. The major point he wants to bring across to his readers is the issue of opportunity cost, in addition to the oft-quoted use costs. Use costs are the costs incurred when building up the infrastructure of an irrigation system, for example. Opportunity costs, on the other hand, are the value of the use foregone when allocating water to its next-best use. Based on a review of data from various irrigation regions, he posits that water used for irrigation has a much higher opportunity cost than water put to other uses, such as industry. The output value of irrigation for basic foodgrains is quite low compared to the value of water used for e.g. manufacturing purposes. The relative magnitude of use costs and opportunity costs vary quite widely from sector to sector – urban water consumption is a low-volume, high-value water use, whereas irrigation is a high-volume, low-value activity. The use cost of irrigation is modest, but the opportunity costs, when in competition with urban and industrial uses, are high. He postulates that market-like allocation mechanisms are efficient and equitable, and should be promoted. That might be true in some cases, but, as we shall see in the following, this perspective omits certain characteristic features of the agricultural sector.

Contrasting the views of Briscoe, Desmond McNeill observes that, although being an economist readily recognizing the economic value of water, he views the 'increasing tendency for more and more decisions to be left to the market with deep concern' (McNeill, 1998). He believes that the heated debates on whether or not water should be regarded as an

economic good mainly to stem from fundamental misconceptions and differences in perspectives. He contends that to view water as an economic good does not imply that it should be allocated according to market mechanisms – it simply means that water is scarce, and therefore a valuable resource that should not be wasted.

According to Perry, Rock and Seckler, however, the case is not whether water is an economic good or not – because it definitely is an economic good in that it has an economic value – but whether it should be regarded as a public or private good (Perry, Rock and Seckler, 1997).

Hence, we may round off this section by stating that water is truly an economic good in that it has an economic value. However, the question is how it should be managed – as a private or public good, enlisting the services of the corporate sector or relying on government management. The point is that, if market forces, represented by the actions of private entrepreneurs, prevail unchecked, it will cause the agricultural sector in many developing countries to shrink due to the reasons provided by Briscoe. So, even though there might be increases in efficiency to be had within the specific sector by involving private entrepreneurs, it may have unprecedented consequences when faced with the issues of allocation between sectors - if not checked by a strong regulator.

But why is this so? Why shouldn't one sector be prioritized over another, by the means of the market, if it implies that this sector produces a more valuable output at a lesser cost? Why shouldn't industry be allowed to compete for a larger share of available water for manufacturing purposes, especially from the agricultural sector, which is widely regarded as inefficient? Does not privatization then represent a threat to agriculture well grounded, and should not the market forces be allowed to prevail? Many opine that subsidies to the agricultural sector should be scrapped, as it encourages the wasteful use of a scarce resource – what marshals against such a view? These are some of the questions that will be addressed in the following.

THE CASE FOR ADMINISTRATIVE ALLOCATION OF WATER TO AGRICULTURE

Some basic facts about irrigated agriculture - irrigated agriculture accounts for 18% of the world's farmland, but has double the output of non-irrigated agriculture, and provides 1/3 of food production. Add to these facts that roughly ¾ of irrigated agriculture is located in developing

countries (Ceña and Fereres, 1997), and the picture emerges of a sector that serves as a means of survival for many poor countries.

Rosegrant and Ringler have done a study that focuses on the impacts on rural communities of transferring water out of agriculture (Rosegrant and Ringler, 1998). Water, if treated as an economic good, will gravitate to more worthy (in economic terms) uses than irrigated agriculture, as has already been noted in the previous section. The authors observe that competition is increasing at all levels, in particular between agriculture and other uses. Maintaining the belief that water will be increasingly taken out of agriculture because of its higher value in other sectors, they have reviewed the limited number of case studies dealing with the impact of water transfers at the micro level. The evidence largely concludes that water transfers will negatively affect rural communities. Certain parameters were identified, that decided the impact on rural households - they included whether or not the water was transferred out of the vicinity, and whether or not proceedings from the transfers were reinvested in that particular region. If rural activity declines as a result of water transfers, the rural tax base will also diminish. Moreover, transferring water out of agriculture reduces the return flows of irrigation, which may affect a third party or result in unpredicted environmental consequences However there were also some positive examples, where rural dwellers had sold water previously used for agriculture to urban households with profit (Dinar, Rosegrant, and Meinzen-Dick, 1996).

Having considered the high opportunity costs of water used for irrigation as compared to other uses, and give a cursory glance at potential consequences of this fact, it is now timely to take into account the multiple uses of irrigation water. As Ruth Meinzen-Dick has pointed out (Meinzen-Dick, 1997), the singular attention to crop output omits the fact that irrigation water is not only used for watering crops, but also for domestic purposes, watering home gardens, keeping fish, and livestock, as well as replenishing groundwater reservoirs. Hence, efforts at improving the efficiency of irrigation could prove counter-productive, as it may undermine some of the other activities and strain rural livelihoods further. The problem is that these other issues are not codified, and hence not visible when attaching some (arbitrary) vale to irrigation as such.

Bhatia, in his paper on irrigation systems in Haryana, has attempted to develop a method to fix valuations on non-agricultural uses of irrigation water by using conventional economic methods. He argues that farmers should not be charged the full costs of irrigation, precisely because the

other uses of irrigation water possess a societal value. Hence, only the amount needed to cover Operation and Maintenance (O & M) costs should be incurred, not capital costs or opportunity costs. That latter view runs counter to what others have advocated, namely that opportunity costs should be reflected so as to provide incentives to sue water more efficiently. Ceña and Fereres (1997) also argue along the same lines as Bhatia, offering the statement that 'if water is only considered as an economic good, the impacts on agriculture would be very negative in the short run', and thus, farmers should not bear the economic costs alone.

The basic question here relates to the relative importance of irrigated agriculture for developing countries. It has been amply demonstrated that agricultural growth has a major impact on poverty reduction (McCalla, 1998). Agricultural growth reduces consumer prices of non-tradable and semi-tradable goods (given that markets are not heavily protected or monopolized). Growth in the agricultural sector also has demonstrated beneficial multiplier effects, in that it generates employment opportunities both in the agricultural sector itself and in other sectors delivering services and inputs to agriculture (Mellor, 1998). A rise in employment rates in rural areas will in general lead to tightening labor markets, which in turn will lead to a rise in rural wages. Countries that have successfully made the transition from developing economies to more mature economies have in common that they have taxed their agricultural sector lightly, and have invested generously in agricultural research and extension activities. The benefits accruing from investments in irrigated agriculture does not apply merely to poor countries - for example, in southern Spain, irrigation has been the engine of growth in the past, and still provides much of employment in agriculture-dominated areas. Irrigated agriculture tends to be much more labor-demanding than non-irrigated agriculture, and thus offers greater scope for multiplier effects. Alternatives to irrigation for rural development are scant (Ceña and Fereres, 1997). The substantial decline in rural poverty in some developing countries also stems from the fact that they have pursued smallholder-friendly policies.

Water used for irrigation, then, can be a powerful means of reducing food costs to poor people, and, under the proper circumstances, should be subsidized (Chambers, 1998, quoted in Perry et. al., 1997).

Another issue of overriding importance relates to food security. Given that people's food needs are likely to double within the year 2025, assuming current population growth rates, it seems foolish not to pay closer attention to rural agriculture. Research done by the International Water Management

Institute (IWMI) suggests that the agricultural sector would need 15-20% more water in order to meet the projected demand, although the researchers also point out that improved crop husbandry and water management may go some way in meeting needs. It is plain to see that there is an enormous productivity challenge facing the agricultural sector. Increasingly, urban competition for water is forcing water transfers from the agricultural sector to the rural sector, resulting in declining agricultural outputs.

The economic paradigm has as its mantra the increased efficiency of water use. Relating to water for irrigation, there is an increasing pressure for farmers involved in irrigation to focus on the efficient use of water. The only way to achieve this, argue economists, is by charging farmers the real cost of irrigation water, so that they will have an incentive to use water more prudently. Keeping the question of prices apart, the efficiency logic sounds plausible enough. But as an interesting study on the Maipo river basin in Chile by Cai, Ringler and Rosegrant demonstrates, depending too much on efficiency indicators at the micro level might lead to serious mismanagement at the basin level. This is because classical irrigation efficiency estimates ignore the potential reuses of irrigation return flows. As water is abstracted from a river and used for irrigation, a substantial proportion of it will return via drainage or percolation to recharge aquifers or streams, and will thus become available for other uses at a later stage. Transferring water out of irrigation districts, therefore, will disturb all the secondary effects of irrigation water, such as recharging and recycling, and dilution of potential pollutants (Cai, Ringler; and Rosegrant, 2001; Perry et. al., 1997). Moreover, when water becomes increasingly scarce and prices increase to high levels, the price incentive is less effective because farmers are not able to adjust their production structure in response to the increased prices at such high levels of water loss. Another point that is made, is that increases in physical irrigation efficiency actually leads to increases in overall water consumption. Hence, the potentials for water savings from improved irrigation efficiency is lower at the basin level than it is at an individual command level, and should be kept in mind when advocating increased physical efficiency of irrigation water. The point being that what is often perceived as wastage, may in fact not be so. However, there are definitely situations where efficiency should be improved, e.g. where it has been documented that crops are being watered far in excess of their needs, resulting in wilting crops and saline soils.

It seems appropriate at this point to return to the policy paper of the World Bank quoted earlier on. An interesting notion was expressed in the paper,

as it states that when 'non-economic objectives' - such as biodiversity, food security and equity – preclude using the full economic value of water to guide decisions, the need for transparency in the decision-making would be served by measuring the economic benefits foregone. And herein lies the crux of the problem: by placing a price tag on water, only the direct economic benefits of the sale of products generated from irrigated agriculture or the payment for services by consumers to a water utility are taken account of. The indirect benefits that accrue to society as a whole of pursuing water management strategies that promote food security and equity are not easily valued in a market based on the principles of economic rationality.

Water has some unique characteristics, it is bulky and not easily transported or 'commodified' (except in the case of bottled water for drinking), it is a common good in that it is not easily excluded from use by other parties, and its management is subjected to a range of market failures due to its inherent monopolistic nature. Adding to this the fact that intersectoral allocation demands an institution that maintains the overview of all the interdependent uses, and the case becomes quite strong in favor of adopting an administrative allocation mechanism, rather than e.g. a market-based one. As has been seen in the preceding sections, letting allocation decisions he guided by the economic value of the output that water generates in different sectors, will seriously underestimate all the indirect benefits and non-quantifiable aspects associated with irrigated agriculture, and especially small-holder irrigated farming in rural areas.

TO IRRIGATE OR NOT TO IRRIGATE: WHOSE RIGHTS PREVAIL?

Having thus made the case for administrative allocation of water rather than a market-based one, the question of access rights appears natural to address, even though it comprises a whole field unto itself. The issue of rights will be briefly discussed within the context of this paper's main subject, as one cannot assume that the state in all events is an omniscient benefactor without an agenda of its own (Lee, 1999), and therefore it is important that the constituents of the states be vested with formal rights in order to facilitate negotiation in case of conflicts of interests of water allocation.

Access to water is crucial for the livelihoods of individuals, households and communities, and is threatened in many contexts. Water rights may be informal, embedded in local practice, or formally framed in water permits

(Bruns, 1997). However, customary water rights often make little or no provision for reallocating water. Strengthening access rights to water represents one way to gain control over a valuable resource - hence there is increasing pressure on governments to formalize water rights.

Particular attention has been devoted to how institutionalized rights evolve in community systems, and how such rights are negotiated within these specific systems. Less attention has been paid to how rights are conferred at the interface of separate systems; particularly if such systems differ in scale. Even though it is widely acknowledged that increased competition among different sectoral users, the issues raised are less clearly focused on, and raises fairly complex issues involving rights, regulations, and development goals. As water becomes increasingly scarce, and competition intensifies, the resulting problems must be dealt with on a larger scale than the scope offered by community management. Of particular interest are scenarios where sources for farmer managed irrigated agriculture are being contested.

Water rights are a basis for claim on the resources. The two most basic claims are riparian rights, or prior appropriation, and these different bases of water rights have implications for management of the resource. For example, formal riparian rights typically limit the possibility of transferring that water to other uses, and pure private ownership is also often ineffective and inadequate where it is difficult or impossible to exclude users, or where strong economies of scale encourage natural monopolies.

The interesting book 'Negotiating Water Rights' (Bruns & Meinzen-Dick, 2000) offers a host of various case studies where water rights have been negotiated in a variety of ways, often outside of the formal arena. It introduces the concept of 'legal pluralism' to denote the fact that, although *de facto* water rights may not be in place, informal systems of allocation of use and access rights may be thriving. It is argued that, in almost all settings, rights exist in one form or another.

In view of the escalating contestation by other parties of water used for irrigation, irrigation farmers must increasingly involve themselves in negotiation of rights with strangers. One of the key tasks of governance is to create an institutional framework within which strangers can peacefully agree to co-operate and co-ordinate their actions (North, 1990; cited in Bruns & Meinzen-Dick, 2000). A fact which is often overlooked, is that such negotiations is not always an 'us' against a 'them'. Often,

stakeholders may derive part of their income from irrigated farming, and part from working in the industrial sector. Not much research has yet been done on how rights between competing uses, rather than users, are sorted out.

Hence, even though the State is the main custodian of the water resources, it might sometimes not be pursuing the ends of maximizing long-term social welfare, but rather the goal of maximizing short-term profits. As we shall see in the following examples, an unfair distribution of rights or lack of a clear framework for property rights will compound problems of allocation, leading to frustration on the part of those that feel themselves usurped.

CASES OF ALLOCATION CONFLICTS

India

The journal *Down to Earth* (Down to Earth, 2001), recounted a story from the Indian state of Rajasthan that may serve to illustrate the conflicts between communal farmers and the state. In a village in the Alwar district of Rajasthan, traditional water harvesting structures called *johads* are used to aid cultivation for its own and the need of 12 neighboring villages in this drought-prone area. However, Rajasthan's Irrigation Department deemed the structure illegal – the underlying reason for halting the village's water harvesting activities was the government's fear that it would reduce river flow into Santhal Sagar dam downstream. A government study has actually demonstrated that this will not be the case, but this has not assured the Irrigation Department.

'The government never asked us how we survived previously' an incensed villager was quoted as saying; 'but now that we've taken our fate in our own hands, the government sees fit to demolish our structures'. A crisis was averted with the help of CSE, a New Delhi-based NGO. The incident has raised serious doubts over the government's approach to people's initiative in managing their own water needs.

The panchayats have the right to natural resources in its jurisdiction, but the Panchayati Raj act of Rajasthan, stipulates that, in cases of conflicts, the state has the right to override its decisions. Who, then, does the state act on behalf of? There seems to be severe collisions between state-level and national-level development goals as contrasted to improving the well-being of rural dwellers.

Zimbabwe

It is perhaps unwise, given the current circumstances in Zimbabwe, to use the country as an illustrative example. But regardless – or rather, because of - Mugabe's meanderings, Zimbabwe serves to show how historical injustices affect water management, and how difficult it is to sort out the tangle of interests that are represented in different sectors' claim to the same water sources. Water rights in Zimbabwe are tied to land tenure, and a history of colonialism, racism and suppression, whereby rural producers have had little opportunity of gaining land titles – and, as a corollary, water rights – for subsistence production. The figures speak for themselves - in 1997, 82% of irrigated land belonged to commercial farmers, 2% were communally farmed, and the government owned the rest.

The vast majority of Zimbabwean farmers thus do not have water rights in the legal sense of the term. What they do have, are primary use rights, which entitles them to use water for domestic consumption such as drinking, washing, water livestock and small gardens. Zimbabwe is currently following World Bank strategy, with emphasis on water pricing and demand management, adhering to the 'user pays' and 'polluter pays' principles. Hence, water for productive uses must be paid for, but this is not easily enforceable, as a price for water reflecting its economic and social value has yet to be agreed upon. Moreover, many Zimbabweans view water as a fundamental right, which should not be paid for (Derman & Ferguson, 2000).

The new Water Act of 1998 and the National Water Authority Act, also 1998, 'rest upon several not necessarily compatible ideas' (Derman and Ferguson, 2000) and do away with the riparian principle, and instead propose that all water be regarded as a public good. However, this has created new problems as, although many farmers are riparian, the water flowing in the streams is now government property, and little is left to them after the government has favored its own schemes.

A central question is; whom does the government represent? Traditional small-scale farmers who argue that water should not be treated as an economic good are sidelined, as the government continues to insist on the development purposes of its various schemes. A claim that rings hollow in the ears of many rural farmers who have already suffered much injustice at the hands of its government.

Tanzania

Tanzania is now trying to frame a participatory, demand-management approach to its water resources (Huggins, 2000). The availability of water is declining due to an increasingly familiar set of trends; accelerating population growth and poor management. In addition, a boost in the number of small-holder irrigation schemes further strains resources. Conflicts frequently arise because of the uncertainties of 'ownership' to water. Water has now been categorized as a national resource, to be allocated by the State on behalf of the people.

Historically, water was an integral part of overall customary laws and the behavioral norms of each tribal society, which did not necessarily imply an established equitable management system. Some tribes viewed water as 'God-given', and families with riparian access were allowed to abstract water freely, even if it were to the detriment of the rest of the society. But, at the risk of generalizing, it may be said that the most common practice was for water to be an 'open-access' resource for limited uses such as drinking, washing, and the watering of livestock, whereas other uses were regulated by the community.

Agriculture being the major water consumer, it is also rather 'inefficient' in its water use, in that up to 70% of water may be lost to seepage and evaporation before reaching the fields. But ongoing projects, such as e. g. the TIIP – Traditional Irrigation Improvement Project - in Arusha, seek to redress this wastage by educating farmers on conservation methods and precision irrigation. Even though the strain on water resources stems from the increase in smallholder irrigation schemes, such schemes improves food security and raise rural income levels. There is still 1 million ha. of potential irrigable area, mostly to be found in the fertile Rufiji basin.

Hydroelectricity is crucial to the Tanzanian economy, generating over 60% of the indigenous commercial energy production. The government's aim is to completely replace thermal power plants with hydroelectric power. However, there are problems related to the development of hydropower, including the increased siltation of dams due to deforestation and erosion, and also due to abstraction of water for agricultural purposes from the rivers that feed the hydroelectric reservoirs. For example, the Pangani River, which supplies the Nyumba ya Mungu dam, is regularly affected by abstractions of water for irrigation, leading to nation-wide power rationing. Many of these abstractions are illegally performed, i. e. by farmers without any water rights. The Tanzanian Electric Supply Company demanded that

all irrigation projects upstream of the dam be closed. But the Government did not oblige, as so many farmers were dependent upon irrigation for their income.

The Tanzanian draft water policy recognizes that water allocation should be done in an optimal and equitable manner to promote food self-reliance and food security. Small-scale farms shouldn't be 'trampled on' by the more powerful Tanzanian Electric Supply Company.

Trade-offs between water uses should be made between regulatory bodies and representatives of different water uses, in an atmosphere of shared information. The lack of adequate information clearly serves to intensify nascent conflicts, and should be more strongly addressed than has hitherto been the case (Huggins, 2000).

South Africa

South Africa has been in the limelight lately due to its relatively recently-fangled White Paper on Water Resources Management (Government of South Africa, 1997). Many view this policy model to be a model for how reforms should be implemented, but some (Derman & Ferguson, 2000) consider it a shade too optimistic, and do not believe that the ambitious goals set out in the paper are achievable in the short-term. However, the exercise itself is highly commendable, and shows that some serious thinking has been taking place regarding water resources management.

In essence, South Africa is replacing the concept of riparian water rights, introduced by the British, with a system of dynamic, competitive water allocation; with the aim of achieving 'optimum economic growth and social equity' (Government of South Africa, 1997). The Government has assumed the role of a public trust, and has done away with ownership of water *per se*, but has decreed that everyone has a right to meet their basic human needs, while also taking into account the ecological water requirements; the resulting aggregated quantity of needs being dubbed the 'Reserve'. Other uses are authorized on a non-perpetual basis.

The increasingly meager water resources may only be used for the most worthwhile purposes, which obviously begs the question what purposes could be considered most worthwhile.

Agriculture is by far the biggest consumer of water, with mining, industry and power generation consuming about one-quarter of available stock. In

many places, irrigated agriculture is already overshooting limits, and interventions are called upon to secure the ecological needs.

Mining and industry are higher-value activities, and create more jobs than does irrigated agriculture, the productivity of which has declined over the last decade. However, the government recognizes that future populations cannot rely on the extraction of depletable minerals, calling for inventive thinking on new ways to secure people's livelihoods.

Some activities that are being promoted include water conservation and recycling, as e.g. dryland agriculture tends to reduce river flow significantly, thereby imposing negative effects on downstream users. But due to a history of government support for irrigation infrastructure, stemming from the protracted period of economic recession after World War I, the sense of being entitled to state assistance for irrigated agriculture is a deeply-rooted one, and hence does not induce farmers to regard their water as something to be valued as a precious resource. But the fact is that limits to growth in irrigated agriculture are coming closer, and fast.

However, South Africa considers a diversity of farm sizes as beneficial, and it has been observed that, in areas where maintenance is poor, enhanced traditional methods have proven to be more profitable than sophisticated installations. Small farmer managed schemes are considered to have a great potential to stimulate rural development, a trait not shared with large, commercial enterprises.

DISCUSSION

At the outstart of this paper, the term 'water as an economic good' was briefly examined, with the intention of exploring how interpretations of this term impact upon water management and allocation mechanisms. It was argued that, although water is an economic good in that it has an economic value, it is not necessarily conducive to the idea of free trade. Some of the problems related to the trend of privatization in the water and sanitation sector were highlighted to illustrate the fact that, when incentives are based on the wrong principles, failure is often close at hand (cf. the 'getting rid of debt' rather than 'promoting efficiency' on the part of governments handing over responsibility to private actors).

Regarding the implications for agriculture, the point that water has vastly differing values depending on the sector of analysis, and that water

consumed by agriculture is in general considered a low-value use was made to underscore the fact that letting market forces prevail would likely lead to reduced agricultural output as a consequence of lower water shares. Arguments were then presented in favor of continuing allocation of water into the rural agricultural sector, for reasons of food security, stimulating rural development, and the difficulties inherent in recognizing all the indirect benefits from irrigated agriculture. Regarding improvement of efficiency of water used for irrigation, focus must be on the basin level rather than the individual command level. On the basis of these observations, the sentiment was expressed that the state is best placed to assume the overall responsibility of water allocation between sectors It is the only institution with an overview of all the interdependent uses and thus theoretically best able to make the optimal allocation decision, where social welfare and equity are taken account of.

However, a dogmatic posturing of either the 'water as a private good' or 'water as a public good' perspective would be a 'waste of intellectual resources', in the words of Perry, Rock and Seckler (1997). Hence, even though there is a strong case for promoting the 'public good' and advocating an administrative allocation approach, there are pitfalls in such a view as well, which will be dealt with in a moment. The primary concern in this instance has been to show how important it is to recognize the non-quantifiable aspects of agriculture, its function as a 'primus motor' for rural societies, and its vital role in feeding the ever-growing number of people. And in this respect, small-scale farmers in particular need the continued support of the state, as the agricultural output they produce would most likely not be sustained in a free market. Hence, the 'threat of privatization' to farmer managed irrigation systems, simply put, lies in the single-minded emphasis on the worth of their output.

However, the case is not always a clear-cut one, and one should beware of becoming a dogged advocate of irrigated agriculture at whatever the cost. In the case of Tanzania and South Africa, for instance, the energy and mining sectors are undoubtedly at loggerheads with rural farming. Given that, in South Africa's case, rural farming is on the decline, and cannot compete with industry neither in terms of value generated nor jobs created, is it wise to continue supporting it? The answer should be a tentative 'yes', but with a strong preference for smallholder and communal irrigation systems that stimulate rural activity, rather than large commercial holdings. In the case of Tanzania, farming may be to the detriment of electricity production, with the consequence that some alternative solutions should be sought, such as e.g. compensations to farmers who

have to cease tilling their land, if other solutions cannot be arrived at. But for such negotiations to work out, the farmers have to be vested with use rights to water in the first place, and the farmers as a group need to recognize their common interests in confrontation with representatives from the electricity industry. A 'one-to-one' negotiation procedure, whereby individual farmers are brought to the negotiating table and agreements are made without the support of a peer group will probably result in unfair settlements and a feeling of deprivation on the part of the farmers.

To get back to the discussion on water as a public vs. private good: Even though the case has been put forward in favor of viewing water as a public good best placed in the hands of the state, this is not to say that there are not problems with this view. Consider the cases cited, where conflicts arose because of a clash of interests on the part of the government and the governed respectively, resulting in uncertainties and confusion regarding who is acting on behalf of who – because of a lack of a clear framework outlining the respective rights and responsibilities of the parties involved. This is clearly shown in the examples taken from India and Zimbabwe, where denoting water as a public good to be managed by the government on behalf of its people does not necessarily ensure that water is managed to the satisfaction of the very people it is supposed to serve. In essence, the people have no rights to decide what to do with water resources in their vicinity, as their decisions need to be sanctioned by the government.

Public administration is problematic in that it is seen as 'omniscient' and a benevolent maximizer of social welfare. It does not seem appropriate to assume that governments are sufficiently efficient, fair and wise to be capable of adopting the optimal intervention prescribed by public-interest theory (Lee, 1997). As we have seen in some of the previous examples, the view of government as some disinterested champion of the general public is flawed – rather, it is subject to the pressures from various interest groups that will influence the outcome of its decisions. Moreover, government management will often lead to expensive projects when serving water-deficient areas, and a failure to appreciate the value of water as a consequence of its scarcity may lead to misallocations and wastage. Also, governments might not be very supportive to user participation. So, even though the assertion that the State should retain the ultimate responsibility including responsibility for initial allocation, regulation and monitoring, is a credible one, decentralized management should be strongly encouraged to counteract potential problems. For example, as Reidinger (1974) formulates it: '…water management is better done at the level of the

community, as the community is best equipped to handle risk calculation and grasp opportunities than the State is.'

Hence, water as a public good is misleading unless accompanied by rights of access on behalf of the users of that good. The case of Zimbabwe underscores this, where people living next to the river cannot make use of the water flowing in it, because that water has been earmarked for government projects. Without rights, they do not have any other recourse but try to get by on the meager water they are able to lay hands on, and in some cases resort to illegal abstractions. Not exactly conducive to rural growth.

So much for the merits and drawbacks of 'government as custodian' and decentralized management. Given that a clear framework of access rights is in place, what about the merits of allocation mechanisms that do take as their point of departure that water should be paid for according to its perceived economic value?

Regarding privatization and market mechanisms, a much-favored model is that of tradable property rights. Given that property rights are ascertained, tradable water markets are a means of achieving efficient and optimal water allocation according to Matheen Thobani (1995), among others. It is a flexible mechanism of allocation, which will result in increased productivity of water, as well as increased investment and growth. However, such tradable property rights, although elegant in theory, are tough to implement in practice. Some widely quoted successful examples include Chile and Arizona, but when it comes to the conditions in most developing countries, these are seldom particularly conducive to establishing well-functioning markets for the trade of water rights.

Hence privatizing water, in the sense of giving markets a greater role in both the financing and allocation of water, could be a promising development in the long run, but it assumes that certain conditions are met which they are not in most developing countries at the moment.

All this points towards the necessity of negotiating water rights at the sector level, whereby representatives of different user groups meet as equal partners. But for such a process to be facilitated, the notion that water is a public good needs to be accompanied by access rights, as is the case in the new water act of South Africa. Without such rights, the negotiating power of small-scale farmers will be nil, and they will be subject to the greater clout of government agencies and private actors who

have more to gain in economic terms from supplanting the needs of the farmers. Ideally, such an arena for negotiating water uses should be overseen by an independent body. The benefit of such an approach as compared to free water markets is that the representatives, acting on behalf of their interest groups, are representing the interests of whole groups rather than that of an individual (Huggins, 2000). By acting as groups, it is easier to show the detriment to society at large if irrigated agriculture were to succumb to water uses of greater economic value, as the increased income generated from using water in industry would often be accompanied by declining living standards in the countryside, and increasing inequalities.

Convening stakeholders is one of the options with the greatest potential for improving water allocation (Bruns and Meinzen-Dick, 2000) However, the challenge, in the context of competition between sectors, is to convene meetings in such a way as to effect the representation of all interested parties. It promotes the view that 'disputants can create win-win solutions, rather than the zero-sum outcome often anticipated to be the norm; where if one side 'wins' the other must lose correspondingly. Relying on government agencies alone to allocate water in basins may fail to respond to the interests and priorities of water users, and might incur high transactions costs compared to bringing contestants together to settle disputes and implement decisions reached. The much higher economic value of other uses than agriculture, in association with the bulk of water being used for irrigation purposes in many developing countries, creates good prospects for such win-win situations to occur, at least in theory.

However, the outcome of such negotiations would be contingent on the availability of reliable information that could serve as groundwork for decision-making. Data are just data until they are interpreted. A sustainable water resources framework will need to take into account future uses, not only the current ones, in order to be tenable. For example, if analysis geographical information shows that a particular area is not very well suited for the purpose of irrigated agriculture, other solutions should be sought. Moreover, analyses where e.g. the economic consequences of dam-building may be shown could also attest to the consequences in labor terms of such projects.

Hence, methods that help to define 'optimal' trade-offs should be developed. Again, it is not sufficient only to gather data and disseminate them, they must also be interpreted. GIS tools present powerful ways of producing data sets that may then be analyzed, but they are first and

foremost tools of representation, not of data analysis. For example, the benefits accruing from stimulated rural activity as a result of allocating water for rural farming should ideally be presented in such a manner as not only to reflect the economic value of the products/foodstuffs that are actually produced, but also the benefit to society of invigorating its rural areas where typically most people reside. Bhatia has tried to do just this, but more research is needed in order to develop models that could produce empirical data that could prove useful in allocation decisions.

Concerning investments in agricultural research, the importance of promoting investments in participatory research projects that aim, e.g. at improving land and water conservation techniques, cannot be stated strongly enough. Currently, such investments are relatively minute, typically less than 0.5% of GDP, and only 20% of this figure goes to water-related research. In order to improve the efficiency of agriculture, more funds are clearly needed. It has been proved time and again that returns on investment in agriculture-related research are large. Developing drought-resistant crops and varieties tolerant of saline environments would undoubtedly release more water from agriculture into other uses. The same goes for improvements in irrigation technology, whereby large seepages are curbed due to improved technology. However, it should be kept in mind that the simple and less costly technology is often the most profitable, especially in rural areas.

CONCLUSION AND SUGGESTED RESEARCH NEEDS

Water is an economic good, as it has an economic value because of its scarcity. However, this does not necessarily imply that it should be allocated according to market principles. If the view that 'water is an economic good' is followed by '…and therefore it should be managed as a regular market commodity' as has been increasingly done in the water and sanitation sector, this essentially implies that water is viewed as a private good rather than a public one. The implications of such an allocation approach for farmer-managed irrigation systems would most likely be negative due to the high opportunity costs of agriculture.

In the poorest countries of the world the agricultural sector remains the most important in terms of both employment and income generation. Increased productivity in subsistence and smallholder agriculture is a powerful engine of growth, income improvement, and better access to food. However, the agricultural sector is also viewed as a 'wasteful' and low-value use of precious water, in comparison to other sectors, and

proposals to allocate water according to market mechanisms in order to ensure that it is put to the highest-valued use are gaining ground. This paper has argued strongly in favor of administrative support allocation of water to ensure that goals of social welfare and equity are met. However, there are many unanswered questions relating to the impacts of allocating water to the most high-value uses, and more research needs to be done at the macro and sector level, as well as at the household and community level.

Rights to water are crucial no matter what allocation mechanism prevails, and secure and unambiguous access rights are needed in order to ensure that all parties have a voice in conflicts of interest, where it is often the case that discrepancies in perceptions of water – as an economic commodity to be used as input for the most profit-generating purposes, or as a public good whose management and allocation should be guided by moral norms – are the underlying cause of disputes. More research is needed to explore how rights may be negotiated at the sector level, as well as the level of the community.

To alleviate the problem of scarcity, merely using prices to induce prudent water use appears to be a simplistic solution. However, there is no doubt that measures are needed to 'free up' water for other uses, and hence it is of utmost importance to step up both the amount of financing and level of activity devoted to agricultural research.

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A STUDY OF RIVER WATER ECONOMICS OF TWO VILLAGES IN BORDERS OF TWO STATES IN SOUTH INDIA

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INTRODUCTION

India is an agriculture country with abundant natural resources and good climatic conditions. The green revolution brought changes in agriculture. High yielding varieties, irrigation and chemical fertilizers are made available.

In South India, four states share large water bodies. There is competition of use of water among those four states. The zeal and enthusiasm of the state governments one matched by the participation of people in these areas. In the present study, thempt is made to understand and document the processes that shaped present day status of water resource management in two villages which are adjacent to each other but divided by the boundaries of two states, and connected by a single river for their livelihood.

The study deals with Village Petivakkam in Tamil Nadu and its neighbor, Village Karani in the state of Andhra Pradesh. It is interesting to observe their needs and efforts made to solve them. These two villages are some 75 kilometers away from Chennai city, near a town called Uthukottai. **Figure 1** gives the locational details of the villages.

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Figure 1: Location of Study Border Villages

BACKGROUND OF THE VILLAGES STUDIED

Village Karani

This village is in Andhra Pradesh, in the district of Chittoor. It is a border village between Andhra Pradesh and Tamil Nadu. People in this village speak Tamil as well as Telugu. This village has sloppy land structure and filled with boulders of various sizes. This land is basically divided into four major physical divisions Kurinji or mountainous region, the Mullai or forest region, the Palai or arid region, the Marudham or the fertile plains. There is a river called Arani running through this village and entering Tamil Nadu at a place called Surtupalli and reaching Petivakkam thereafter. This village has around 175 ha.

Village Petivakkam

This village is located about 6 km. from Uthukottai, which is about 65 km. from Chennai, in the district of Thiruvallur, and Uthukottai Taluk. Lands of this village are plains locally called, Marudham. All the land area in this village was under the irrigation system served by a reservoir built on the same river. It is called Arani Reservoir, which is non-functional now as water doesn't reach the reservoir from upcountry. As such, it has switched over to other irrigation sources. The land is suitable for growing different kinds of crops. Farmers grow cash crops, food crops and vegetables. Total cropped area of the village is around 164.75.5 ha.; wet land: 90.54.5 ha. (land by tank bed). There are other types of land as well in this village.

Common Characteristics of these Villages

Land

As these two villages are adjacent to each other. The general soil structure and texture, weather and agro-climatic conditions are similar. The river flows from west to east, covering Karani, crossing the border of Andhra Pradesh and Tamil Nadu at Surtupalli and turn south to reach Petivakkam and then further flow towards east to merge in Bay of Bengal.

Crops Grown

As the land and climatic conditions are similar. The same type of crops are grown in the earlier days, but with the availability of larger quantities of water in the later periods through various measures, people switched over to crops like paddy and other crops in both the villages. However, as the means of securing water varied, their economy also differed.

Community Structure

In both villages, they have similar class-caste systems. However, their political affiliations different as these two villages are in two separate states.

Both the villages used to practice lift irrigation to lifting water from the river on individual basis by using diesel engines or physically lifting water. Now, Karani village continues to do the same, while Petivakkam had to discontinue.

- People in both the villages have similar literacy levels, as the post independence India has provided access to similar educational opportunities to all across the states.
- Both the states pursued the green revolution. The agricultural extension services reached both the villages. Moreover, as people have free access to move and interact, even the word of mouth spread of modern agricultural practices empowered them to seek similar enhancement of production efficiencies.
- Both the villages have now electronic media access to information. There is cable network telecasting about 15 channels.
- People in these villages are getting urbanized.
- Both the villages interact with the Uthukottai village for market support. (though Karani is increasingly moving to Satyavedu or

Puttur towns, which are in its state. Access to government agencies of the state are located in these towns.

NEEDS OF VILLAGERS FOR IRRIGATION WATER

Andhra Pradesh government has taken a lead in watershed management program implementation. The government asked all the village panchayats (local bodies) to build small check dams on the rivers/brooks through which surface run-off moves to larger rivers under the watershed management programs of wasteland development. Karani village went in for construction of eight check dams across the river Arani, resulting in stoppage of the flow of water from the Arani river to Petivakkam, resulting in drying up of Arani Reservoir and forcing the villagers to switch over to other alternative sources of irrigation.

Genesis of the Problem

As noted earlier, the problem can be traced to the formation of states on the basis of the language spoken, in 1950's, which resulted in these two villages going to two sides of the borders. Andhra is prone to irregular monsoons and climatically dependent on weather. In order to assure consistent water supply for irrigation purposes, Andhra Pradesh government took measures to regulate the available water, especially in this region as it was known to be a drought prone area. This has resulted in imbalance in water supply between the two studied villages. The shortage of water for farming used to lead to intermittent political tensions between the villages and to some extent between the two states regarding the issue. The political pressures from the local political leaders on their respective parties have called for political intervention. While the Andhra Pradesh pursued the policy of stopping the surface flow of water by building check dams, the Tamil Nadu government encouraged well water irrigation, initially by deepening the open wells in the area, and later by drilling of bore wells and supporting this with fully subsidized electricity supply (i.e., free electricity for farmers). However, it may be noted that farmers tried several ways of addressing the water requirements before finally depending on ground water tapping. The various options tried by the farmers for obtaining water in these villages were:

- Open Well irrigation;
- Channel irrigation;
- Community run and rain water-harvesting method;
- Drip irrigation; and

- Bore well irrigation.

EVALUATION OF THE OPTIONS BY FARMERS

Well Mode of Irrigation

This had been the traditional mode of irrigation adopted in the area. Villagers have responded that they use these wells to fetch water for both agriculture purpose and also for house hold purposes. In order to lift water form these wells they have deployed centrifugal driven by electric pumps or by desel engines. The government banks and societies financed the farmers to dig the wells.

Traditionally, farmers dug the wells to a depth of 3 to 10 meters to capture the sub-surface flow of rain water and also to collect the excess water that runs off from the farms. As the years passed by, they have started digging the wells deep to store more water from the same sources. With the advancement of technology in building wells, they have finally gone to the depth of about 40 to 50 meters in order to collect more percolated water. This mode of irrigation, freed them from depending on other farmers for water. This has helped the farmers to store more water for future use.

Cost/Benefit Analysis

Traditionally, this mode of irrigation has been widely followed in this area as the benefits from this type of irrigation are observed as follows;

- Labor cost is comparatively lower for digging wells.
- The low cost materials like bricks, cement blocks, etc are available in plenty.
- Historically, the success rate is higher for wells.
- Pump- sets and skilled labor to implement such activity are available.
- People in this locality prefer this type of water source because they have to be less depended on others for their water requirements.

Costs

- Opportunity cost of the land allocated for constructing the well.
- Break up of the community inter-dependence for individual betterment.
- Cost of setting up the infrastructure.

- Incremental costs in agriculture such as additional expenditure on fertilizers, pesticides etc.

Channel Irrigation

Both the villages have once upon a time, depended on channel irrigation. These villages have developed their own channels to distribute water from one location to other. They have also used cement pipes to carry water from one location to the other. The people in these villages have now switched over to PVC pipes to fetch water from the nearby tanks. There prevails a general opinion in these two villages that channel irrigation could not be continued any more as the level of interdependence and relationships amongst the farmers have declined over the years. One of the reasons for such change is rapid urbanization in these villages. The other factors are, improved education alternative employment opportunities, less interest to work in the farm and manage water and other inputs; increasing nuclear families making it difficult for single families to take care of farming. These factors resulted in decreased practice of channel irrigation. It was also interesting to note that farmers felt that media and urbanization have made them to seek more independence in their operations rather than to develop cooperation.

Cost/Benefit Analysis

This has been the latest addition to the irrigation system of this locality. This mode of irrigation was first promoted by government authorities, when there was enough water flowing in the river. The advantages of this mode of irrigation are;

- This mode of irrigation, as told by farmers, helps the farmers to carry the water to areas that are not accessible to original water source.
- They feel that it is a one-time investment and returns form this investment are assured for long period of time.
- This mode of irrigation helps the farmers to carry water from a preferred source to wherever there is requirement.
- This mode of irrigation helps the farmers to share the water with other farmers along the channel thereby increasing the interdependence and commitment amongst the farmers.

Costs

- The prime cost of this mode of irrigation is the cost involved in setting up the infrastructure for carrying the water.
- The exploitation of water available at one source increases drastically.
- The inter farmer community conflicts resulting from sharing the water as well as from stealing water passing through their farm.

Community Run and Rain Water-harvesting Methods

Community run water-harvesting methods and community rainwater harvesting methods are not widely practiced to store water in this location. Hardly any farmers have taken initiative to accumulate rainwater and store it for future use through development of watersheds in the common land available in the village. The farmers in these villages have not paid attention to community based water harvesting methods as there was no initiative or leadership in that direction. With regard to have private lands for this purpose, no one is interested to divert a prime extent of their small holdings for such a purpose. The farmer opting for this method of storing water has to set apart at least 10% of his total land area which has to be in the center on the land.

Drip Irrigation

Only one farmer in this whole locality has adopted this mode of irrigation. He claims that this mode of irrigation has been very effective for him but it would not suit the kind of crops that are cultivated in this locality. The cost of installing a drip or sprinkler irrigation system was very costly, as the number of users are less and the service offered by companies was customized. All the farmers interviewed were aware of drip irrigation system but reluctant to adapt it because of unsuitable crops, lack of capital and non-appreciation of its advantages.

Bore Well Irrigation

This mode of irrigation is widely practiced in this locality. Due to the changing monsoon conditions and non-availability of water from tanks, channels and reservoir or the river, this mode of irrigation has been popular.

The reasons for popularity are:

- Independence: Farmers claim that the relationship, cooperation and interdependence amongst the farmers do not continue to exist now. Farmers also feel that due to urbanization, the new generation do not like to continue with farming for their livelihood. This necessitated seeking independence in their operations. There is no commitment from them towards agriculture as the prime occupation but they continue farming because they have land or their family were involved in farming. So, the farmers in this locality have opted for bore well irrigation. They feel that this mode of irrigation helps them to operate independently.
- Intensive farming: Historically, farming was dependent on the monsoon. The green revolution of Indian agriculture and increase in population have demanded for productive operations. Intensive agriculture needs more water. Farmers claim that the only possibility of assuring round the year water supply is either through bore wells or through digging wells.
- Political dynamics: One of the key reasons for increasing use of bore well irrigation is due to the tension that prevails between the politicians in these two villages. The genesis of the problem was traced to be in the late 50's when the states have been separated on linguistic basis. The politicians in these two villages have tried to impress their respective vote banks by devising strategies to block the water from flowing into other state or through the river.

  The politicians have employed their influence on their respective government in getting grants for building check dams, reservoirs, and artificial channels that result in blocking the water flowing along the river. This resulted in creating a shortage water supply in the villages that fall along side of the river bank. So the people in these villages switched over to other modes of water supplies to meet their demand.

Economics of Bore Well

For the farmers in these two villages, construction of bore wells is found to be a feasible solution to meet the water demands. Economics behind this sources of the irrigation, according to the farmers, is that it promotes round the year cultivation resulting in better output from farm and financial returns.

CONSEQUENCIES

Some of the consequences of the irrigation options pursued by these two villages are listed below:

1. The ground water table level in Karani village has increased. On the contrary, in the villages in Tamil Nadu, the water table level has gone down from 45 feet 100 feet depth.
2. Secondly, the reduction of flow of water through the river, resulted in drying up of river causing the villagers who depended on fishing for their living to migrate or search for new jobs;
3. Accumulation of waste material in the river bed caused environmental impact.
4. Illegal occupancy of river bed and quarrying started. When water stops flowing through the river, it creates an imbalance in the river based ecosystem.
5. Due to the changes in water availa bility, farmers switched over to cultivation of different crops, resulting in creating an imbalance in supply of farm outputs and the price for the same.
6. The result of stoppage of water flow in the river raises two challenges to the government; one is how to improve the technological aspects of the infrastructure to distribute surface run-off across the villages, and two is, how to control the local mismatches between need and supply of irrigation water.
7. Due to the changes in the ecosystem, the immunity levels of population decrease.
8. Farmers show a trend in switching cultivation of food crops to non food crops like teak plantation, mango orchards, coconut plantations resulting into over production of non-food outputs and decrease in food output.
9. Due to la ck of attractiveness in farming, the farmers' migrate to cities putting pressure on existing infrastructure.
10. Effect of Check Dams on Karani Village: In Karani village, the check dams resulted in overflowing of wells and in increasing the water table leading to failure of the pump sets. The overflowing of the river led to washing away of four out of eight dams constructed. This situation calls for reinvesting in the check dams, changed volumes of water available and thus, changes in the cropping system and the crop productivity.

MANAGING WATER FOR IRRIGATION AS A COMMON PROPERTY RESOURCE: A PROPOSAL FOR THE ETHNOGRAPHIC STUDY OF IRRIGATORS IN ANTHROPOLOGY

LAYA PRASAD UPRETY[1]

THE RESEARCH PROBLEM

Culture is the central concept in anthropology. Culture as broadly defined, is the way of life of people. Culture emphasizes the holistic view–the integrated totality of the way of life, including people's behavior and their ideas. Culture is the entity with continuity through time. Anthropology treats the whole of human activity and organizes it under the central concept of culture (Rosman and Rubel, 1981). Anthropology also emphasizes the influence of social forces on human behavior (Herskovits, 1955). The proposed study treats irrigation management as 'culture' with three major aspects, viz. material (i.e. the irrigation structure), institutional (i.e. ideal behavior and role expectations and as a generic concept for a variety of rules that help pattern of social behavior) and organizational (i.e. human group pattern of social behavior and interaction aspects).

Nepalese farmers have recognized the paramount importance of water resources for centuries and have been constructing irrigation systems at their own initiatives to sustain agricultural yields. Irrigation development in the country remained in the hands of people for many years. This tradition gave birth to the Farmer Managed Irrigation Systems (FMIS) scattered all over the country. Historically, irrigation development has fallen under the domain of either a religious trust, individual initiatives, or community effort. The legal tradition and local administrative structures over a period of time have permitted FMIS to operate without interference from an irrigation agency or administrative units. However, they have been assisted by the government from time to time when natural calamities required resources beyond the capacity of the farmers (Pradhan, 1989: 1 and Pradhan, and Bandaragoda, 1998:35).

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A substantial portion of the country's irrigated area is under numerous FMIS scattered across the country. About 950, 000 hectares of arable land in the country have some form of irrigation, of which 675,000 hectares are under FMISs and 275,000 hectares are developed and managed by government agencies. FMISs account for over 70 percent of irrigation development in the country and contribute over 40 percent of the national cereal crop production (Poudel et. al., 1997: 129) The FMISs have been considered as indigenous irrigation management systems in the proposed study.

There must be many irrigation systems throughout the world that were built by the independent groups of farmers. Since many of the groups were formed at the initiative of farmers themselves, the institutional resources of these groups had relatively much more time to gestate and mature before the full-scale operation of their irrigation systems. As such, indigenous associations often develop organizational skills and techniques which are more effective and appropriate than the administrative procedures of practices in systems that were not indigenously-developed or designed. However, there is very little detailed information of how such indigenous irrigation groups function and operate. Such knowledge can definitely contribute towards a clear understanding of how farmer's organizations participate in the critical function of water control and allocation and of system construction and maintenance. This knowledge, in turn, forms the basis of guidelines on how governments can best assist such groups (Siy, 1982: 1-2). This equally holds true in the context of Nepal because one of the objectives of government Irrigation Policy (IP) is to continue the Nepali farmer's tradition and managing irrigation systems as autonomous entities in the private sector by making it more stable and extensive.

In order to understand the functioning of irrigation, anthropological studies on common property resource management have also to be carried out focusing on the social relationships of the irrigators because the notion of interdependence (embededdness) has not been given central importance in Nepal. The effective management of common property by a 'collective' is not the theoretical problem that it is asserted to be, simply because the theory assumes that economic behavior is played out as if it were a game disembeded from social relations in general. The reason why people conform to practices which are against their short-term economic interest is that they have other interests besides narrowly defined economic ones, including the desire to maintain social relationships. Anthropologists can contribute to a greater understanding of common property by going back,

to some extent, for a key concept of their discipline -- the notion of embededdness (like Malinowski explained cooperation of people in primitive societies in terms of reciprocity which occurs in the context of religious, kinship and other obligations) (Fisher, 1994: 74). Though Fisher emphasizes the need to focus on the notion of embededdness while carrying out the researches on forests as common property, it is equally important in the water sector because of the dearth of such irrigation—related studies in Nepal.

The proposed research aims at answering the following principal questions: What is the historical dimension of managing water as a common property? What are the existing social structures of the irrigation users? What is the nature of interdependence/embededdness among the irrigation users? How have kinship ties, caste/ethnic relations (subsuming patron - client relations) and class relations contributed to the conformity of institutional rules and regulations for managing water as a "commons" for irrigation? How have the social subjectivities (such as norms, values, ideas, altruism, leadership, etc.) impacted upon irrigation management? What are the organizational structures of the irrigation users? What are the water use activities for irrigation management? What are the control structure activities for irrigation management? What are the organizational activities for irrigation management?

OBJECTIVES OF THE STUDY

General Objective

The general objective of the proposed study is to furnish a systematic account of the process, social subjectivities and cultural dimension on the management of water for irrigation as a common property resource in the Terai region by focusing on the indigenously - managed irrigation system.

Specific Objectives

- To analyze the past and existing social structures of the irrigators based on kinship ties, caste/ethnic relations and class relations with a view to drawing their implications on managing water for irrigation as a "commons",
- To analyze the roles of social subjectivities such as social values, ideas and leadership in managing water for irrigation as a "commons", and

- To analyze and explicate the institutional arrangements for irrigation management as culture vis-à-vis water use activities, control structure activities and organizational activities.

REVIEW OF LITERATURE FOR THEORETICAL MODELS

It is proposed to undertake the review of the literature with a view to developing the theoretical models to guide the whole academic research. At this preliminary stage, three theoretical models are identified namely, substantivist theory in economic anthropology, post-Newtonian social science perspective and theory of common property.

Substantivist Theory in Economic Anthropology

Economic anthropology has now been recognized as the sub-discipline of social and cultural anthropology. N.S.B. Gras, an economy historian, had coined the term "economic anthropology" in 1927. He had originally conceived it as the synthesis of the anthropological and economic studies which emphasized the ways in which primitive people obtained a living (Scott, 1997:795). Polyani followers still argue that economic theory is applicable only to the market-oriented, price-governed economic systems of modern industrial capitalism. The mainstream of work in economic anthropology today is characterized by a growing spirit of cross-fertilization and collaboration between economists and anthropologists (ibid.-796).

Two separate tendencies are seen while looking at the relationship between anthropology and economics. On the one hand, there are scholars who argue that economic anthropology is best understood within the framework of political economy (i.e, economic hisoricism and institutionalism or Marxian economics), with its scope encompassing the description and analysis of all economic systems of record (i.e, extinct and extant preindustrial and industrial system). On the other hand, there are those who are impressed with the success of neoclassical economics in formulating principles to explain and predict processes of resource utilization in general. They conceive economic anthropology as the study of social relations concomitant of the process of resource utilization (i.e, economizing), and providing the description and analysis of the specific ways in which this process is patterned in various socio-cultural settings (ibid-800).

The first view is essentially historical, arelativistic and substantive in orientation, relies heavily on a taxonomic/typological method and is concerned primarily with the structure and functioning of contrasting institutional and organizational types. The second view is essentially a historical (synchronic), analytic and formal in orientation, relies heavily on a method of applying general abstract (logico-deductive reasoning) principles. It is concerned primarily with the systematic analysis of the conditions and dynamics of social performance in contrasting cultural settings (ibid-800). While there is still substantial controversy and disagreement among economic anthropologists over a variety of issues. There are certain unifying themes in the contemporary literature. There is the use of comparative strategy that consists of both a synchronic and a diachronic search for relationships between (1) economic organization/ performance in two or more social situations in the same society or in two or more different societies; (2) economic organization/performance and non-economic organization /performance (e.g, political, religious, kinship) in one society or in two or more societies; and economic organization/ performance in a given sample of societies and non -economic organization/performance in the same sample society(ibid-801).

The typical problem in economic anthropology deals with multiple relationships between economic and non-economic organization/ performance in one small-scale society (e.g., Trobriand islands). In their comparativism, the economic anthropologists have not deviated significantly from the cultural and social anthropological strategies formulated earlier in this century by Malinowski and Radcliffe-Brown. In accordance with Malinowski's position, they agree that all cultural (including economic) phenomena must be considered in their relationship to other aspects of culture under study; and they agree with Radcliffe-Brown that all social phenomena must be considered in their relationship to the corresponding phenomena in other societies (ibid-802).

One of the unifying themes in contemporary anthropological inquiry is "functional contextualization". An anthropologist discovers and analyzes the interrelationships of the economic and other fields of activity in the socio-cultural systems under study. This reflects an adherence to the functionalist strategy that has been applied in economic anthropological studies since the contribution of Malinowski, Mauss and Thurnwald emphasized the holistic and interdependent nature of human social life (ibid-802).

One of the root causes of sectarian conflict in economic discourse in general and in economic anthropology in particular is a genuine difference in the epistemology of its contributors. Two dominant and opposing orientations may be isolated: materialism and idealism.

There is an agreement among economic anthropologists that the anthropological perspective precludes describing and analyzing a particular economy without simultaneously demonstrating its ties with non-economic element in a given social system .The most persevering and vocal proponents of the conceptualization of the economy as wholly internal to or "embedded" in society are Polyani and his followers—the substantivist group. In their approach, the economy is viewed as a process of provisioning society or the socio-cultural system. No social relation, institution, or a set of institutions is considered to be economic; it can only serve economic purpose (Polyani, 1957).

Production is the process by which the members of a society appropriate and transform natural resources to satisfy their needs and wants. Distribution determines the extent to which the individuals participate in this production. Exchange enables them to acquire the particular products into which they wish to convert the quantity allocated to them through distribution. Consumption goods are individually appropriated as objects of use and enjoyment. There are three prominent figures in the development of economic anthropology. They include: Malinowski, Thurnwald and Firth. Production activities are included within the scope of their work, yet each has made his major contribution to the development of economic anthropological thought in the realm of exchange and distribution.

Transactional modes, not production modes, emerge as the dominant concern of the substantivist writers. They do not analyze or theorize about the forces and relation of production or about the creation of commodities, but invariably restrict themselves to the circulation and destination of the commodities already produced. (Scoot, 1997:816). Belshaw (1965:4) states that all enduring social relations involve transaction which have an exchange aspect. To study exchange, then, is to study social behavior and an economic strategy becomes -- in this transactionalist approach--- a general strategy for the study of all social relations.

Distribution implies a reward system in which produce is channeled out among individuals or groups by reason of their control over the factors of their production or for the labor they extended in the productive process.

Exchange refers to the various processes by which goods and services move between individuals or groups, for example, between producers and consumers, buyers and sellers and donors and recipients (Scoot, 1997).

M. Sahlins points out that redistribution is a system of reciprocities associated with collective action within the social unit, as distinct from the reciprocity system, which is associated with individual action between parties. The redistribution system implies social unity and centricity; the reciprocity system implies social duality and symmetry. Sahlins (1965b:145-49) has sought to impose order on this ethnographic diversity of transactional mode through a " scheme of reciprocities

Economic transaction between an individual distributor and many receivers within a single community-insofar as they occur regularly and involve the circulation of a significant proportion of total goods produced –characterizes band and tribal societies…The ethnographic record clearly shows that intra-community distributive activities have kinship and political aspects (Shalins, 1960a, 1960b). Food distributions are made along kinship lines. The concomitant process in the putative generosity of the giver is the display of his power and may be associated with his occupancy of the chiefly status (Scoot, 1996:836). Ceremonial gift exchange consists of an initial transfer of goods which in the short run appears as a one-sided give-away, but in the long run leads to the deferred counter-transfer. Ceremonial gift exchange often involve ritual items not intended or suitable for consumption and gives rise to the symbolic return (Scoot, 1997:836).

In fact, the notion of embeddedness/interdependence/reciprocity among the irrigators has compelled them to conform to the organizational and institutional rules and regulations vis-à-vis the irrigation management. This is indicative of the fact that the economic aspect of the society cannot be seen in isolation of the non-economic aspects.

Post-Newtonian Social Science Perspective

Norman Uphoff, a noted American social scientist, has recently developed post- Newtonian social science perspective on the basis of longitudinal field experience in the Gal Oya irrigation system in Sri Lanka in 1980s and 1990s. Prior to shedding the light on the perspective, it would be contextual to provide the scenario of the social setting where the newly observed social realities contributed to shaping the new contemporary social science perspective. In 1980, the government of Sri Lanka did

request the Agrarian Research and Training Institute in Colombo and Rural Development Committee in Cornell University to introduce water users' associations in Gal Oya. The system was diametrically replete with a host of structural and managerial problems. Put in other words, it was the most difficult and poorly managed irrigation system. The system has the command area of 125000 acres (1 ha. = 2.475 acres) and structurally the most complex. Water distribution was the main problem. The management by the government was also highly unreliable and the irrigation officials had the antagonistic attitude towards the farmers. Conflict among the farmers over the scarce water supply triggered the breakage of structures, problem of channel maintenance and irregular distribution. Farmers were unruly and highly uncooperative. Water distribution had an ethnic dimension; the conflict between the Sinhala-speaking farmers in the head location and the Tamil-speaking farmers in the tail location. Thus, there were a myriad of problems. Uphoff, with the support of 32 college graduates who were trained to live in the communities to act as catalysts, worked as a social consultant to form the farmers' associations and mobilize them for the sustained irrigation management. Gradually, the outside assistance contributed to altering the chronicity of the afore-mentioned problems. Later, when the outside assistance was withdrawn, the new farmers' organizations continued to be active and effective. These organizations contributed to altering the socio-economic ambience of the irrigation command area and an impetus to national program for participatory irrigation management was proffered. The prolonged fieldwork with longitudinal dimension of Norman Uphoff and his unparalleled academic skill triggered a new publication entitled "Learning from Gal Oya: Possibilities for Participatory Development and Post-Newtonian Social Science" in 1996. This treatise has been the milestone of post-Newtonian social science perspective that can be potentially used for analyzing both the subjective and objective aspects of the social realities. Though the book is also focused on how participatory development can be fostered and institutionalized, only post-Newtonian social science perspective has been reviewed here.

Norman Uphoff (1996) holds the view of the durability of the institutional and behavioral innovations – a function of the method of participatory development. Though many of his earlier experiences about the participatory development were validated by the interventions in Gal Oya irrigation system, the found a few other broader implications too. Uphoff (1996) writes that" it (the intervention process) challenged my understanding of individual and collective motivations and capabilities. Farmers did not calculate their advantage simply in self-serving terms, nor

they did place greatest weight on material benefits…Hence, rethinking is required on the ontological and epistemological assumptions on which most social sciences are grounded; a worldview that privileges the individual over the collective, the material over the ideational and the mechanistic over the organic…Current social science perspective is pervasively influenced by the concepts of classical physics, (associated with Sir Isaac Newton). Such concepts have been immensely productive for several centuries across the wide range of phenomena. But in this century, we have discovered that these are not only concepts and privileges for understanding the material realm…There is a valid post- Newtonian view of the world that is shaped more by concern with energization than with equilibrium, and oriented towards evolution than entropy. It frames relationships in terms of open systems than just closed systems… Promoting participatory development will be more successful and effective with a more contemporary understanding of the nature of social as well as material realities. Post- Newtonian social science understands reality as embracing both objective and subjective factors in less linear and less deterministic way…Values and personal factors find a legitimacy in post-Newtonian considerations which is denied them in any scheme modeled after classical physics where objective and subjective factors are considered entirely separate (Uphoff, 191:viii-xii).

While seeking the explanations of the empirical data, Uphoff (1996) concluded that ideas – the way we think about our goals and constraints, about our strategies and about themselves- are ultimately crucial determinants. For 20 years, he was prepared to exclude values from analysis and to emphasize materialistic and individualistic considerations when explaining behavior, as most social scientists do. Familiar with philosophical debate between materialist and idealist concepts of the world, he equated the latter as purely normative incompatible with the empiricism and pragmatism that all teachers and researchers endorsed. But ideas and normative influences kept arising as explanations for tangible effects evident in Gal Oya. These factors did not displace or replace materialistic phenomena, yet they demanded considerations as valid sources of explanations.

He also emphasizes social energy, strategy of cooperation and altruism for the sustainable irrigation development. The social energy, being a soft variable, is the people's self-directed and creative effort. The strategy of co-operation has more advantages over the longer period of time than the opportunistic exploitation of others. Altruism attaches some positive values to others' well-being concurrently with one's own. This work

extends the conceptual analysis for those who call into question the validity of narrow self-interest, materialistic models of behavior and explores alternative systems of interaction based on valuing mutual welfare. People can be selfish in private, but it is hard to be selfish in public. But this does not mean that objective factors are excluded.

Uphoff (1996) notes the importance of cognitive science. He adds that ideas could evoke principles of choice and action that transcend narrow individualism…They could enlist cooperation where mores have existed before and even modify behavior by evoking ideals and norms that are otherwise dormant. Though material factors are not excluded, there appears to be a dialectical relation between the realms of matter and energy, with people brokering between the two. Ideas might be more potent force in social relations than material things, because things by themselves, unrepresented by ideas, lack value. Positivism can be inappropriate for rapidly changing developmental situations like in Gal Oya. The social energy, altruism, and cooperation opened up opportunities for promoting development of irrigation system in participatory ways.

When Uphoff (1996) started to see some automatic influence of idea on the behavior of the farmers during the process of catalyzation for the sustained development of irrigation system, he needed to reconsider his structuralist orientation (stance of regarding roles, incentives and sanctions as more important than ideas). For instance, farmers made a commitment to keep their organization apolitical and began to work accordingly. Friendship established by the catalysts with the farmers also played a key role for establishing trust and a sense of mutual obligation.

Uphoff (1996) holds the view that social science can be enriched or expanded by adding post- Newtonian dimension which asserts that reality is more like a river than a rock. Reflecting upon his experience in Gal Oya, he identified four analytical orientations that are common in the contemporary social science and result in fallacious thinking and action. These four fallacies are reductionism, greatly simplifying complex phenomena or relationships; individualism, treating social or collective phenomena as if they were the only reflections of personal interests; materialism, denying the reality and importance of non-materialism factors and mechanism, regarding things as if they were machines. He is of the opinion that these four fallacies are inadequate, not broad enough to carry the large intellectual work assigned to them. The methods and assumptions of positivist social science do not do justice to values, ideas, and motive forces like human social solidarity (Uphoff, 1996:273-302).

Theory of Common Property

An effort has also been made to review the existing literature on the theory of the management of water for irrigation as a 'commons'. In so doing, general theory of common property is also reviewed and presented that has relevance to water as a ‘commons’.

Property is a social concept and property rights do not refer to relations between men and things, but rather, to the sanctioned behavioral relations among men that arise from the existence of things and pertain to their use. The prevailing system of property rights in the community can be described, then, as the set of economic and social relations defining the position of each individual with respect to the utilization of scarce resources. Communal form of property ownership means that the community denies to the state or any individual the right to interfere with any person's exercise of communally-owned rights (Martin, 1985, Cirivcy-Wantrup and Bishop, 1975 and Furubotn and Pejovich, 1973). Common property resources, broadly speaking, are the resources accessible to the whole community of a village and to which no individual has exclusive property right (Jodha, 1974). Common property means that the group has a collective responsibility for resources, which tends to guarantee care and conservation; the austerity ethnic means that consumption pressures tend to be low, removing one major stimulus to resource abuse (Bennett, 1996:66). Common property resources are defined as property shared by a specified group of people with specified rights, as opposed to open access resources (open to anybody without restriction) (Fisher, 1991:3).

The concept of common property-a catchword associated with 1980s and 1990s development theory - centers on the concentration of ownership or control of the resource base within a group of resource users who are expected to manage the resource as a collective undertaking. In other words, the resources under collective control are barred from access by other individuals and groups; that is, it is a way of excluding some potential users and thereby controlling impact on the resource... The success or failure of common property institutions is strongly related to the extent of communal ownership as well as the kinds of property falling under communal control. That is, the more pervasive the common property system, the stricter the sanctions and control mechanisms for governing behavior and productive activity .... (Bennett, 1996: 167-68 and 187).

Water as a resource moves; it is a transient substance. This means that whenever people wish to utilize water in one place, they must capture and store the water when and where it is available. Since water that flows past is not captured and may be used by others in the downstream, water use for agriculture or human consumption automatically imposes problem of sharing and, generally, of water as a form of property. Sharing of a fluid resource requires co-operative relationships. However, in most cases, the specific forms of sharing will depend on co-operation displayed by the water users in Thailand may be inter-village and kinship-based while the cooperative mechanisms of ranchers in the American West involve ordered competition for water through an individual water-rights system administered by courts... Co-operation and competitions become alternative ways of exploiting the hydraulic "commons". The nature of water as a transient resource argues for co-operative sharing because if each user maximizes his use, the finite supply diminishes and other users are deprived. If this point is reached, either co-operative measures to distribute the goods or a third party empowered to penalize those who violate the rules of sharing will emerge (Bennett, 1996: 233-34-36).

Garrett Hardin's concept of "The Tragedy of the Commons" emphatically asserts that the individuals are primarily concerned with the maximization of their share of a resource that eventually results in ruin. Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons. Freedom in a common brings ruin to all (Hardin, 1968). However, Hardin forgets the importance of institutional arrangements in providing a framework within which economic behavior occurs. Individuals have also the capacity of social learning. In other words, individuals are able to discuss issues and develop rules and collaborative strategies (Fisher, 1994 and Bomley, 1986).

Water is one of a class of natural resources that are termed "fugitive". "Fugitive" resources are mobile and must be captured before they can be allocated to individuals or groups. Since such capture and allocation poses the problem of exclusion, institutional regulation of these resources tends to develop early. Common property institutions are the most important means of regulation of "fugitive" resources. A 'commons' is a resource that is exploited by a group, a group that has certain membership criteria. There are group rights and duties with respect to the resource. The group will try to exclude non-members from using the resource, and it will regulate the members' use of it. On the basis of this description of common property, a farmer organization can be thought of as an owner and manager of

common property. The water is managed by the groups with individual farmers being the ultimate consumers. There are definite criteria for membership in the group. Property rights in irrigation centers on a comparison of the "riparian" and "prior appropriation doctrines" of water rights. The "riparian doctrine" states that every proprietor of lands on the banks of a river has naturally an equal right to the use of water that flows in the stream adjacent to his lands. This doctrine defines a collective ownership of water by owners of the adjacent land. This treats water as a free one. The "riparian doctrine" has been retained mainly in the region where water is relatively plentiful and where irrigation is not essential for agriculture and thus, not a primary use of water. Under the "doctrine of prior appropriation", water rights belong to those individuals or groups who first put the water for beneficial use. It allows individuals to acquire water on land without regard to its location relative to the stream from which it is feasible. Anyone who first began to work has the "prior right". A FMIS exhibits the characteristic of common property, and the irrigation organization and the institutional arrangements (the rules and procedures) by which it operates can be seen as endogenous responses to the problems of the management of common property. The term "common property" refers to a distribution of property rights in resources in which a number of owners are co-equal in their right to use the resource (Martin, 1985, Cirivcy-Wantrup and Bishop, 1975 and Furubotan and Pejvoich, 1972). Questions related to water rights and who owns the water has to be addressed properly prior to the design, development and implementation of comprehensive water resource management programs. Absolute ownership of the water by the state or private individuals must be sorted out (Water International, 1998).

Prachanda Pradhan, in his research work, entitled 'Patterns of Irrigation Organization in Nepal; A Comparative Study of 21 Farmer Managed Irrigation Systems' (1989) has elaborately discussed water as 'community property'. Once the resource becomes the 'community property', the group must organize to preserve it and distribute benefits to the members of the community. This requires a viable community-based organization as has emerged in most FMIS in Nepal. The effectiveness of irrigators' organization can be placed on a continuum ranging from anarchic to well-organized, depending on the degree of collective interest in irrigation water. Non-compliance with rules for water acquisition, allocation and distribution and resource mobilization results in anarchic application of irrigation water, where individual interest prevails over collective interest. In a well- organized system, irrigation-related tasks are performed collectively by the beneficiaries or group agreements are carried out by the

individuals. Simply put, management and decisions related to irrigation are based on the premise that water is 'community property' (Pradhan, 1989: 18-19).

Thus, the limited review of existing literature presented above has shown that three theoretical models can be used to study the management of water as a common property with the adoption of ethnographic approach. The substantivist theory in economic anthropology helps to look at the nature of interdependence/embededdness among the irrigators with the objective of drawing the implications for managing water as a 'commons' (i.e. how the social relation impacts upon the conformity to the organizational and institutional rules and regulations). The post-Newtonian social science perspective helps to look at social subjectivities having the potential role in managing the water as a 'commons'. But this does not mean that social objectivities would be ignored. In other words, most of the studies have proffered the analysis on the economic behavior vis-à-vis the resource utilization by treating it as a game disembeded from social relations --- a serious lacuna. Similarly, the objective and subjective social factors are considered entirely separate. The normative influences are disregarded in the area of the sustainable management of water resources. The proposed study hopes to bridge the research gaps with empirical evidences. The theory of common property guides the research to look at the role of organizational and institutional mechanisms/rules/regulations for managing water as a 'commons'.

RATIONALE OF THE STUDY

Anthropologists have made substantial contributions towards a better understanding of traditional and indigenous resource management practices in Nepal. Anthropologists with their sensitivity to indigenous knowledge, indigenous social structure and adaptive mechanisms used by the local people to adapt to their environment can play a significant role. There have been arguments in favor of building upon or capitalizing on the existing indigenous resource management systems and indigenous knowledge systems while implementing rural development programs. Stated somewhat differently, development can only be sustained if existing indigenous initiatives are recognized, mobilized, and made a part of the externally sponsored development programs (Chhetri, 1994:24-29).

Gerald Gill (1993) also points out two compelling reasons for studying indigenous management systems in a country like Nepal. First and foremost, such study represents a genuine effort to achieve people's

participation in the development process. How better to ensure participation than to ask the people themselves their views: what they do, why they do it, and what improvements they would like to see? For the educated elite, one of the most important 'spin-offs' of research into indigenous systems is a growing awareness of the rationality of supposedly uneducated rural people and the fact that, far from conforming to the popular image that they are despoilers of the natural resources. They are often among the most careful guardians of these national assets. The other reason that the study of indigenous management systems is important for policy analysis is that these systems are, by and large, extremely cost effective. There is an increasing awareness of the values of traditional ways and means of production. Many studies have demonstrated that indigenous practices of resource use are often entirely sustainable. Economists, the leading proponents of cost-effectiveness, have themselves belatedly come to realize that, when all factors are taken into consideration, most of the production decisions made by the poor farmers in developing countries are found to be economically rational. It was Sol Tax, an anthropologist, who originally recognized this on the basis of many years of participant observation in Guatemala. Economists elaborated Tax's ideas into the famous "poor but efficient" hypothesis, which has since received widespread recognition. (Gill, 1993: 7-6). Thus, the proposed study assumes paramount importance by understanding indigenous knowledge and practices or irrigation management which will eventually help the policy makers and development practitioners to develop sustainable irrigation program. It will also have its academic value for the posterity of anthropological researchers who will carry out researches in the domain of common property resource, especially in water for irrigation management. Finally, the present empirical research guided by the post- Newtonian social science perspective will be exemplary for the future research in the similar area.

LIMITATIONS OF THE STUDY

The study will not claim to have accomplished all its original objectives in their entirety because the study will be constrained by time and resource. The generalizations yielded from the study of the Terai may not be equally valid in the hills and mountains where the socio-cultural setting is also different. Given the fact that the study will be undertaken in one indigenously-managed irrigation system of the Terai region, there will be no comparative analysis between and among other systems of the Terai.

RESEARCH METHODOLOGY

Rationale of the Selection of Study Site

The command area of *Chattis Mauja* Irrigation System located in the plains of Rupandehi district (which has been an exemplary system in the domain of managing water as a "commons") has been selected as a research site for the proposed study. It has a command area of 3,500 hectares. It was originally constructed by the *Terai* autochthonous *Tharu* people about 137 years old. Initially, the system served a total of 36 *Maujas* (villages) and hence, was called *Chhattis Mauja* Irrigation System. But the irrigation command area was later expanded to 54 *Maujas* ---- a function of the population growth triggered by the Hill to *Terai* migration. The available literature shows that hitherto no in-depth anthropological study of the system has been carried out. The command area has now been a mosaic of cultural and caste/ethnic diversity, particularly after the 1960s, when the influx of hill migrants got its momentum. Despite the heterogeneity in the social structure of the beneficiary farmers of the command area, the irrigation system has been effectively functioning and has become an often-cited reference of the participatory and sustainable irrigation system in Nepal. Hence, the system has been selected for in-depth anthropological study.

Research Design

The research design to be used in this proposed study is descriptive. It has the following characteristics: (i) the variables and procedures will be described as accurately and completely as possible so that they can be replicated by other researchers; (ii) it will be non-experimental for it deals with the relationships between non-manipulated variables in a natural setting and since the events or conditions have already occurred or exist, the researcher will select the relevant variables for an analysis of their relationships; (iii) it will employ methods of randomization in selecting the study sample sites; and (iv) it will use logical methods of inductive - deductive reasoning to arrive at generalizations (Best and Kahn, 1992).

Units of Analysis

The overarching/central units of analysis are the users' organization and institution. The secondary unit is the water users' group/community.

Design, Size and Selection of Sample

The sample would be selected at two levels as follows:

- Since the command area of the irrigation system has 54 *Maujas*, it would be impossible to study all of them -- a function of lack of necessary time and the adequate resources. Therefore, the whole command area would be divided into head, middle and tail section and two *Maujas* would be randomly selected from each section which would be a total of six *Maujas* (11.1% of the 54 *Maujas*).
- Since the proposed study does not tend to carry out household level survey, the informants would, therefore, comprise all the functionaries of the executive committee of the system (at the macro-level) and regional communities of the sample pocket locations (at the meso-level) and village-level irrigation committees and leader farmers of the users' groups within villages of the sample locations (at the micro-level). They would furnish data on the process aspect and the overall system management. Besides these functionaries, the researcher, after building the initial rapport with the study community, will purposively select 10 other key informants and 15 participants for well-being ranking in each *Mauja* which would come to be a total of 60 key informants and 90 participants for well-being ranking.

Data Collection Methods

The data collection method will be entirely based on the basic principle of triangulation. The methods to be used for data gathering are summarily presented below.

Ethnographic Method

Ethnographic method is conventionally an important one for data collection in cultural anthropological study. Ethnographic method in this study generates qualitative data on social structure and irrigation management and may also generate a few quantitative data. Using the method of field observation (a foundation of anthropological research), the researcher will observe, listen to and converse with informants in as free and natural an atmosphere as possible. The assumption is that the most important behavior of individual farmers in groups is a dynamic process of complex interactions for irrigation management and consists of more than a set of facts, statistics or even discrete incidents. The strength of this kind

of method lies in the observation of natural behavior of irrigation user in real life settings. The researcher will participate in the meetings of the users' committee and seasonal, periodic and annual rehabilitation/ maintenance activities. Another assumption is that human behavior (i.e. water use behavior) is influenced by the setting in which it occurs. The researcher will understand that setting and the nature of social structure; its traditions, values and norms of behavior. It is important for the researcher to observe and interpret the collected facts using etic approach but emic perspective will also be taken into consideration (Bernard, 1988 and Best and Kahn, 1992). While conversing with the irrigation functionaries and other key informants, a checklist will be developed and used.

Participatory Rural Appraisal Techniques

An array of Participatory Rural Appraisal (PRA) techniques will also be used to generate necessary information from the field. These include well-being ranking, historical time-line, focus group discussion, social map and key informant interview. A brief discussion of these techniques is presented below.

Well-being Ranking

Since the study also aims at looking the social structure by analyzing the class relations of water users, a popularly practiced PRA will be used with the assumption that community members have a good sense of who among them is more or less well-off. There are inequalities and differences in wealth in every community. These differences influence or determine people's behaviors, coping strategies, and views. Well-being ranking allows the researcher to investigate the perceptions and inequalities in a community, discover local indicators/criteria for wealth ranking and establish the relative position of households in a community (Thesis and Grady, 1991). Once the relative position of water user households is determined, then qualitative information on class relations will be sought for by using the checklist. The well-being ranking data will be used only as a basis for the analysis of class relations at the water users' group level.

Historical Timeline

This participatory technique will be used to generate data on the temporal dimension of the irrigation system under study.

Focus Group Discussion

This technique will be used to generate information on the specific issues such as the role of subjective factors in managing water on a sustainable basis. Effort will be made to arrive at a consensus on the specific issues.

Social Map

Social maps of the irrigation system and users' community will be drawn in a participatory way.

Key Informant Interview

The knowledgeable elderly people of the users' community/organization will be interviewed to generate information on the process aspect of irrigation, social subjectivities and cultural dimension of water management for irrigation as a "commons".

Mode of Data Analysis and Interpretation

Data analysis is a continuous process of reviewing the information as it is collected, classifying it, formulating additional questions, verifying information and drawing conclusions. Analysis is the process of making sense of the collected information (Thesis and Grady, 1991). Since the study will be diametrically based on the qualitative data generated through the anthropological instruments, they will be analyzed by searching for patterns in data and for ideas that help explain the existence of those patterns (Bernard, 1988). In so doing, the qualitative data will be analyzed by first perusing all the original texts of the field notes and then identifying and listing all conceptual categories/patterns in data. Then, second order categories of data/patterns of data will be prepared in an analogous pattern by verifying the context of original descriptions. The relationship between the categories or patterns of data will also be worked out by coalescing or separating them as appropriate. Finally, third order categories will be made by developing generalizations. A few quantitative data to be generated from the field work will be summarized by using frequency distributions, percentages and means. Then, interpretations of the findings will be made by looking at the relationship of the variables under consideration.

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INTERVENTION IN MONTANE FARMER MANAGED IRRIGATION SYSTEMS OF THAILAND AND VIETNAM: HOW PARTICIPATORY AND DYNAMIC ARE THE PROCESS?

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INTRODUCTION

Thailand and Vietnam are two major rice exporter countries in the South-East Asian region. In the past, the governments of these countries have put significant investment on irrigation development, particularly in the construction of large-scale irrigation infrastructures to increase agriculture production, particularly the irrigated rice crop. In Vietnam, the government has initiated massive work only after reunification in 1975, whereas it has been initiated quite long time ago (1902) in Thailand. However, farmers in these countries especially in the high land and mountain areas (so called Montane areas) have developed and managed traditional and indigenous irrigation systems for centuries. This paper examines the government policies on social and institutional aspects of Montane irrigation schemes' operation and maintenance are affecting water resource development and management of late in Thailand and Vietnam. Recently, both governments have been reviewing their institutional policies towards more decentralization through involvement of local people in irrigation systems operation and maintenance. This paper also presents the various modes of interventions which promote local organizations and thereby improve the performance of Farmers Managed Irrigation Systems (FMIS) in the mountain and high hill regions of these countries.

INFORMATION ON THAILAND AND VIETNAM MONTANE AGRICULTURE

The total land area on Thailand is about 513,000 sq. km. with the total population of 60.3 million. Thailand is divided into six major regions; the central plain, southeast cost, northeast plateau, central highlands, north and

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west continental highlands, and peninsular Thailand. The physiological conditions vary significantly among regions. Northeast Plateau comprises of several small watersheds and two large rivers, namely, Chi and Mung which drain into Mekong river. The Mekong river is a major river system of South-East Asia passing through six countries originating in China and passing through Thailand, Myanmar, Lao, Cambodia and Vietnam. Central highland is situated in between northeast plateau and central plain with various landforms. Pasak river valley is the largest one that divides the region longitudinally. Water comes in this region from north, east and west sides. North and west continental highlands can be divided into the two main sub regions i.e. western mountain range and northern hills and valleys.

Current water demand in the country according to FAO estimate is 39 billion m^3 per year, where 90% of the demand is only for irrigation, 4% for domestic consumption and the rest for industrial uses. The water demand has been increasing by 3% annually over the last decade. Central region has the highest water use in the country as this region consists of large irrigated paddy land. Eastern region on the other hand has the lowest position in water availability and use.

Agriculture is an important sector contributing both for subsistence and for commercial purposes of many developing countries. Both Thailand and Vietnam have the same trend. Out of the total 51.31 million hectare area of the Thailand, nearly 45% is devoted to agriculture (Koninck and Dery, 1997). More than 80 percent of the population are engaged in agriculture. Rice, maize, cassava, sugarcane and rubber are the major commodities for exports. These farm commodities have been produced under low-input, low technology and low-cost practices therefore growth in agricultural output is mainly resulted from expansion of the productive area in Thailand (Uppatum, 1992).

Vietnam, on the other hand, is officially classified into seven zones. These include Red River Delta, Northern Mountain and Midlands (which are further classified into the Northeast and Northwest regions), North Central Coast, South Central Coast, Central Highland, Southeast and Mekong River Deltas. The Northern Mountain and Midlands Provinces comprise the sixteen provinces. Together they occupy an area of approximately 10.2 million ha (Statistical Publishing House, 2000). The montane region of Vietnam in the north-eastern area is located upstream of two major river systems; the Bang-Kycung and the Red-Thaibinh Rivers. The Bang-Kycung River has a catchment area of 39,680 $km.^2$, originating in Vietnam

and flowing into China, where the catchment area occupies about 68% of total basin area. The Red-Thaibinh River, originating in China, has a total catchment area of 169,000 km.^{2}, out of which 87,400 km.^{2}, including 17,000 km.^{2} in the delta, are in Vietnam (World Bank, 1996).

Dense river systems and mountain ranges make the terrain of the region extremely diversified. It contains flat lands, inter-mountain basins and river valleys, hills and high steep mountains. Except for a small portion of plain land available for paddy fields in those basins and river valleys, most of the terrain of the Northern Mountain and Midlands are undulated with steep slopes.

The population density of mountain areas in Vietnam on available farmland is as high as in the delta provinces. In 1999, the total area for food crops was approximately 1.2 million ha in the Northern Mountain and Midlands and 1.27 million ha in the Red River Delta. The cropping-intensity index of 1.2-1.3 in the mountain is much lower than the 2.3-2.5 index for the delta. In most of the flat inter-mountain basins and river valleys, where paddy fields are located, farmers can grow only one rice crop per year due to inadequate irrigation water. Yields are less than in the delta because of deficient soil and natural conditions, and low adoption rates of improved varieties and technologies. In addition to poor productivity, the absence of a reliable marketing system keeps product prices low and unstable (Deanna et. al., 1997). In many cases, people have to convert cash-crop plantations to grow cassava to feed their families. The mountain and highland region is, the country's poorest region in terms of land productivity, food production and income.

HISTORY OF WATER DEVELOPMENT (*JALAPRATHAN*) AND MANAGEMENT IN THAILAND

The historical perspectives of water development in Thailand differed from region to region. The country was not unified and regions were under several colonial regimes. Only in 1939, the north and northeast regions were released from colonial power. Hence, the name of the country changed from Siam to Thailand. The FMIS, also referred to as traditional or people's irrigation systems, were mostly found in northern part of the country. The northern part o the country was established as early as seven hundred years ago (1296), during the period of king Mengrai (RID, 1970). The king had instituted some detail and rigid legal code for proper use and management of the irrigation systems. In the early days, more than two thousand FMIS existed in the northern parts of Thailand alone (Suraroek

et. al., 1980). These systems were classified into two categories based on systems capacity; small system of the mountain type with a coverage area of less than 1000 rai (160 ha.) and the large systems with coverage area between 1000 to 10,000 rai mainly found in plain area.

Given the condition of farming systems in steep slope in northern region, gravitational flow of water was quite rapid and water shortage even in monsoon season was common. Farmers therefore started to build weir and watercourses with the help of available local resources such as bamboo, wood materials and stones. King Mengrai was the first to build a tank or small reservoir as a source of water resource for irrigation purpose during dry season. In the central plain region on the other hand, there were very limited number of water development activities done in the past, although several Kings of the region made effort to construct irrigation systems. However, they were washed away due to torrential monsoon annually. Thus there were less effort made to construct and manage irrigation systems in the plain region of Thailand than in the North.

FMIS BEFORE THE ESTABLISHMENT OF RID IN THAILAND BEFORE 1900

Irrigation organization was considered an essential institution for ensuring sustainable water development for agriculture and for providing legitimate social control and conflict resolution in contemporary northern Thailand until the beginning of 20th century. The irrigation institutions before the state intervention in northern Thailand were fully autonomous unit of farmers group. They came together and performed activities to achieve common goal i.e. water development for irrigation. The FMISs were typically developed, operated and maintained communally by groups of water users (farmers). The systems were mostly of small scale, optimum to maintain (100-1000 rai). The organizational objectives were; (a) to provide water for good harvest of main rice crop, (b) to prolong water available period so that second rice or other crops could be grown during dry season, and (c) to expand cultivated areas.

In the organizational process of the committee, first the district head arranged meeting with different sub-district heads and discussed the possible and feasible way for supplying water to different sub-district and villages. The sub-district head then discussed with village head and finally worked out strategies for implementation. In order to operate and maintain the system, farmers were organized and formed water user committees, based on canal network. In most cases, a FMIS committee was divided

into two levels for efficient management of water resource i.e. at system level and at canal level. The former organization was the main body for operation and maintenance of the entire systems, while the later consisted of small group of members mainly responsible for the management of individual canal (secondary canal – *muang soi*). There were several canal level organizations that performed under co-ordination with a system level organization comprising 10-20 villages depending upon the distance of the river. The district head was the chief of the system level organization and the sub-district heads become deputy chiefs at village level. Village heads worked as assistants to the sub-district head. At all levels, there were some other positions such as messenger and water man.

At operation level, the village headman had full authority to allocate and deliver water to different canals, organize members for repair and maintenance, sanction punishment and reward. There were several village headmen under the main system committee to assist the system committee head for proper functioning of the irrigation systems. However, the exact organizational process in that period is still the question of further investigation. It needs to understand what type of irrigation systems and what types of organizational process were appropriate for increased agriculture production and in improving people's standard of living. However, it was mentioned that FMIS were functioning in an economically efficient and more equitable fashion by serving rural areas over the current system of state managed irrigation systems (Surarerks and Chulasai, 1982).

The functioning of FMIS was primarily based on socially and culturally embodied custom and norms. The irrigation systems were constructed communally with the help of available local materials such as bamboo, logs and stones. As the need for irrigation water increased, the community along with community head identified the source of irrigation water and constructed weir on river. Water flows were held back by artificial weirs. Since the weir as well as entire irrigation system was considered as common property, the households had therefore common rights and responsibility for repair and maintenance. Therefore, they were governed by customary rules and regulations. Each household was obliged to contribute labor, construction materials, and tools based on their landholding and economic status. Based on traditional belief, the households had to contribute some funds for annual ritual rites performance to the weir spirit for the protection of entire irrigation systems.

In general, all households gathered, cleaned and repaired the weir and canals just before the start of monsoon season. They developed their own rules and regulation for the labor and tools contribution which every household followed not as imposed legislation rather as social obligation. At the first time of water delivery into canal, farmers performed ritual rite and pray for good harvest and for preventing their weir from destruction.

ORGANIZATION AND OPERATION PROCESS OF FMIS: FROM CUSTOMARY PRACTICE TO LEGAL ADOPTION IN NORTHERN THAILAND

Given the historical background of different FMIS in Thailand, several FMIS prevailed in different time and space variation. The operation and maintenance rules and regulation, therefore, are different at operational level. However, many of traditional systems at early stage were operated based on customary regulation. There were some common understanding among the users on their contribution to operate and maintain irrigation systems.

- **Proportionate Relationship between Labor Contribution and Landholding Size**

For maintenance of the irrigation systems, labor contribution was guided by the principle of more land, more labor contribution. This was later incorporated into the "People's Irrigation Code (1939), clause 30 which states for example "*calling up of labor for irrigation work in the people's system will vary according to the amount of land over which an individual has rights or owns. In general, one person day of labor contribution for ten rai of irrigated land will contribute for maintenance*".

- **Proportionate Relationship between Tools Contribution and Landholding Size**

Since the people's managed irrigation systems were fully constructed and repaired by local materials, farmers were obliged to bring necessary tools and material during maintenance time. The amount and types of tools and materials were brought either by the decision of weir headman or, in most cases, already agreed upon rules of proportionate of landholding size.

- **Contribution for Ritual Ceremony (Weir Spirit)**

As a traditional society is bounded by several belief systems, their mutual understanding and community solidarity has often been reflected in some performance of rituals. Each household has to contribute for ritual offerings either cash or kind whatever would be convenient.

Role of FMIS Committee Members

Weir Chief (*Kae Muang* or *Hua Na Muang*) was the main position established at system level even after intervention of RID. He was also named as "leader". He held the highest authority and made final decision in all affairs. Their major responsibilities were as follows. They were incorporated, later on, in the Peoples Irrigation Code, 1939.

- Inspect and regulate activities according to weir code amended by the district chief and by the government.
- Allocate water to members according to limit set by the codes.
- Periodic survey of the condition of weirs and canals.
- Setting up time, day and tools for the repair and maintenance of the systems.
- Conflict resolution among water users.
- Decide the level of dues and fines to be paid by defaulters.
- Set the time and venue of meeting.
- Establish the authority of vice-chief, assistants and water managers.
- Co-ordinate works with pertinent government officials.

The deputy chief of weir committee assisted in overseeing water usage by member of the system, allocating water through zone man, help in repair and maintenance by checking labor and equipment during repair work, and also assisted zone man in conflict resolution.

The assistant on the other hand kept and maintained account books for various expenses of the systems, assisted water headmen to allocate water and served as representative of the chief in asking water from other systems.

The main responsibility of Messenger was to deliver messages from chief or deputy chief of Weir Community to water users and report back to the chief. The messages were in relation to scheduling of meeting, water delivery, repair and maintenance and amount and type of equipment to be brought by each household.

The water man was supposed to deliver water in the rice field during transplanting as well as seed bed preparation period. All the uses were supposed to abide by the distribution schedules of water man which were approved in the committee meeting.

Water users were comprised the households which would use irrigation facility and contribute labor, tools and cash for sustainable operation and maintenance of the systems. There were several groups of water users based on number of field canal.

Thus, FMIS in northern Thailand possessed the following salient characteristics:

- The traditional irrigation systems provided an efficient basis, in terms of technology and social organization for wet season rice cultivation.
- This efficiency was achieved through substantial contribution of labor and a complex social organization.
- The entire weir community acted as an autonomous unit, technologically and organizationally, without state support. Consequently, the communities had easy access to and control over means of production as well as enforcement of norms such as acquisition, regulation and allocation of water and dispute settlement.
- The autonomy and unity was often expressed symbolically in the weir spirit cult (Cohen and Person, 1998).

RECENT INITIATION IN PARTICIPATORY INTERVENTION OF GOVERNMENT: THE FUTURE OF FMIS IN NORTHERN THAILAND

The first attempt of participatory intervention of government started in 1962. The government emphasized Common Irrigators' Organization framework to integrate local people (beneficiaries) into the irrigation systems. Then, it was followed by the model of "head irrigators", which was borrowed from indigenous irrigation systems of Northern Thailand. In 1967, RID introduced the concept of the Water User' Association (WUA) in Northeast Thailand and in 1968 in Central Thailand. During the time, it was expected that farmers were to take control over operation and maintenance activities at farm level.

The association was initially established as multipurpose organizations to deliver production inputs and mobilize manpower and funds for irrigation operations and maintenance. The key person in the WUA was the common irrigator, who was responsible to supervise and control water distribution among farmers, maintenance of irrigation canal, and to act as intermediary between farmers and RID. In some irrigation systems, *chaek* (area served by one inlet) organization has been established with single propose i.e. operation and maintenance of irrigation systems. Since then, several farmer's organizations have been organized like Peoples Irrigation Association and Land Co-operative Association. They have the common objectives of providing mutual help in common resource management.

The FMIS have been facilitated and supported only after the recognition of people's participation and governance by the government on irrigation systems operation and maintenance. As a result, the Office of Co-operation and Accelerated Water Resources Development have been involving local people at all stages like in planning, implementation and operation and maintenance of irrigation projects. They also include issuing rules, regulation and guidelines to carry out activities in long-run. Similarly, government owns the large and medium scale irrigation systems. However, management responsibilities are divided between both government and farmers at two different levels. The farmers are responsible to manage on-farm irrigation canals, while government organizations would manage the main systems such as reservoir and head works maintenance, discharge and allocation of water into different irrigation systems.

The issue of property right, particularly land title, holds significant role in the past. It has impact on and present political and economic stability of the country. Previously, all land was regarded as government property and Thai law recognizes three classes of land; (a) title deed, (b) exploitation testimonial, and (c) reserve license. People first had to apply for reserve license to have claim over public land. After getting and making satisfactory use of the land, they had to apply again for exploitation testimonial, which was more permanent in right, at the district office. Finally, they had to apply for title deed in provincial office which gave them full, permanent ownership. However, it took long time, sometime generations, to get full title on land due to bureaucratic procedure. Household, therefore, holds different titling over land and upgrading the title is still a major issue. Despite such titling systems, there persisted socially accepted principles of land inheritance from one generation to another. In most cases matrilineal inheritance of land prevailed i.e. from

parents to daughters, in many kinship communities. Sons inherited only movable properties such as money, livestock etc. (Ganjanapan, 1994). The system of inheritance gradually changed. At present, land is shared equally among both male and female children in the family. There are still several unwritten traditional principles of land inheritance in the country.

With the increase in population and increase in level of production and income, the property right issue has become more apparent as a cause of social conflict and dispute among villagers, and between villagers and outsider. Infrastructure development such as road, railway, irrigation structures, new market place etc. has accelerated farming systems towards more intensive commercial production. The usufruct right let farmers to cultivate more intensively with heavy use of water, fertilizer and pesticide. At the same time dispute over land boundary and water resource use become much apparent and frequent with the coming of an irrigation projects (Ingersoll, 1969). Increased productivity and limited land resources created another social dispute among household family members on the issue of land inheritance. The issue is: whether the land is to be held under traditional principle or under the formal legal system?

Given the situation of increased dispute over land title as well as mismanagement of land resource, the Thai government established Land Titling Project in 1986. The project objective is to enhance the security of agricultural landholding and to promote more rational use of farmland to increase productivity. The program has both negative and positive impact as it influences all aspects of rural life (Ganjanapan, 1994).

The existence and effectiveness of traditional institution for irrigation and land management has been in effective stage due to changing economic and government policies. Although the code of conduct for participatory intervention in FMIS has clearly spelled out the conditions of water fee collection, labor contribution, tools contribution including code of punishment. Due to availability of other economic opportunities, there is hardly any initiative for the farmers to continue maintaining their systems. Also the dependency syndrome promoted by RID over last 80 years, the traditional mobilization of resources and assigning specific responsibilities to the specific group of expert people have been practically now non-existent. This has further been exacerbated by stringent property right criteria to be fulfilled as required by the government. This does not match with the changing land ownership pattern in the region and the world. The industrialization and urbanization process has further complicated property right issue, especially relating to land and water resources.

A Case Study from Northern Thailand

A brief summary of a case study result, as an example, from a research work conducted by Viriyasakultorn (1994) is presented to illustrate the farmers' response over state intervention on traditionally managed irrigation system in Mae Ai district of Northern Thailand. A total of 103 sampled households were interviewed from 10 villages where 82% responses were collected from household head and the rest from relatives of the head.

There were significant changes noted on the activities related to irrigation operation and maintenance. One of the changes is the reduction in labor requirement in the activities such as building of weir, repair and cleaning of weir after RID intervention. Similarly, in agricultural activities, cleaning and repairing of ditches were reduced from 98% to 60%. These activities made positive impact on the water management (see **Table 1, 2** and **3**). However, there was also reduction on the cultural and spiritual activities, including in participation of the community members in water management committees and in conflict resolution. Therefore, the social capital of mobilization was replaced by the physical improvement. There are still large member of ignorant village communities about government law. The construction of the new weir was not accompanied by an effort to organize the water users which conforms to the laws. In the brighter aspect on the composition and functioning of water user functionaries, the traditional *de facto* rights are maintained and hence there is less conflict.

Table 1: Participation of Farmers in Irrigation Activities before and – after Intervention

Irrigation Activities	Participation (Percentage)	
	Before	After
Building of weir	86.4	10.7
Allocation of water	74.4	74.0
Diverting water into paddy field	**97.0**	95.0
Reconstruction or repair & cleaning of weir	93.2	73.8
Membership of water management committee	4.8	1.9
Participation in the resolution of conflict about water use	8.7	2.9
Meeting to elect weir leader	93.2	73.8
Requesting water from another weir	1.9	1.9

Table 2: Participation of Farmers in Paddy Cultivation Activities before and – after Intervention

Activities	Participation (in Percentage)	
	Before	After
Clearing and repairing the ditch	98.0	62.2
Offering to the spirit of weir	37.9	2.9
Preparing seed bed of rice	99.0	97.0
Allocation of water	74.4	74.0
Plowing for transplanting paddy	98.0	97.0
Sowing	87.4	83.0

Table 3: Involvement in the Systems Management

Variables	Response (before) in Percentage		Response (after) in Percentage	
	Yes	No	Yes	No
Position hold in committee				
- Household head	66	4	61	10
- Relatives	17	11	16	10
Participation by Sex				
- Male	67	4	61	11
- Female	16	11	16	9

LAND AND IRRIGATION WATER USE AND MANAGEMENT IN VIETNAM

Contrast to Thailand under the feudalistic system, all the land in Vietnam, in principle, belonged to the King. In reality; the regime controlled only part of the land. The rest of the public lands were communal properties under the control of individual villages. It was only in the 17th century that private land was first institutionalized. In the early 19th century, land privatization was encouraged by the need of the newly-established Nguyen dynasty to reinforce its authority (Phan et. al., 1993).

Under French colonial regime, the high taxes and crop failures due to natural disasters rendered many people landless and starving peasants. A Land Reform Program was implemented following the Nationalist Revolution in August 1945. Land held by rich landlords was confiscated and reallocated to the peasants.

Soon after the defeat of the French colonial forces, the socialist model of economic management was introduced. Central planning system dominated the entire country after reunification. In agriculture, this was the period of capital socialization as well as land and farming collectivization. Cooperative farming started in 1959/1960. In the beginning, "lower-level"

producer cooperatives were formed. This was followed by a transition to "higher-level" cooperatives, which went on until the late 1960s. A second phase lasted till the late 1970s. Both category of cooperative were amalgamated, leaving only 5% of land being owned privately by the farmers. The early cooperatives were often organized according to hamlets and villages. The same basis was used for the production brigades at the commune-level cooperatives of the 1970s. The village was no longer an autonomous unit as in the past (Tuan, 2001).

Each village became a rice production unit with a team leader who was a staff member of the cooperative management board. In addition, specialized teams for seed production, land preparation and water management were also established. The villagers worked, as cooperative members, under the cooperative's instructions. The remuneration was based not upon labor productivity, but upon the recorded number of hours worked.

An irrigation and drainage team was formed for water allocation and maintenance of the cooperative's irrigation network which is usually tertiary canals serving all or part of the village or hamlet. Each rice production team nominated 1 or 2 people to be members of the irrigation and drainage team. As the cooperative's production was centralized and strongly controlled by the government, water was allocated according to the government's wishes.

The management of an entire irrigation and drainage system was also effective. The irrigation management of head work – main canal – intake to secondary canals was done by an Irrigation and Drainage Management Company (IDMC). An Inter-commune Canal Irrigation Management Committee, which is made up of representatives from cooperatives and IDMC's staff, was established to oversee the fringe areas, which cover secondary canal-turnouts to tertiary canals. The tasks of Inter-Commune Canal Management Committees were to control the turnout operation and keep the water delivery among the cooperatives on schedule.

Centralized planning and administration were effective during the war period. However, it had casted a serious negative impact on farm incentives and constrained the nation's development in the post-war period. Agricultural production became unstable and declined in the late 1970s. Since the beginning of the 1980s, as measures to free the country from economic stagnation, economic restructuring with market orientation policies were launched (Tuan, 2001).

In the agricultural sector, land had been redistributed to farm households for private production. The forced procurement system was replaced with a unified "contract price" system in 1984. The modified system has been successfully applied since 1988. Under the new policy, the farmers owned the land for a long period of time. They were obliged only to pay taxes for the land. The cooperatives are gradually turning into a service organization due to loosing its right in land and production management along with reduced roles and tasks. In the newly introduced private production, the farm household became the basic economic unit. Agricultural production revived with investments from the motivated and eager farmers. In contrast, the management of many common resources, such as water, worsened (Doan, 1998).

LAND USE AND IRRIGATION WATER CONTROL IN THE NORTHERN MOUNTAIN AND MIDLANDS OF VIETNAM

The land-use patterns of the Northern Mountain and Midlands are paddy fields and ponds; home gardens; plantations for tea, coffee, fruit trees or upland cassava; grassland, plantation forest and natural forest. Forests are found in the mountains. Fruit trees, tea and cassava are planted on hill slopes. Bamboo, secondary forest and coarse grasses are found on barren hills. Vegetables, fruit and wood trees are grown in home gardens. Paddy fields are found in the inter-mountain basins and river valleys. Rice is the most important food crop, but it is insufficient because of shortage of level land where paddy rice can be grown, poor soil conditions and natural hazards. Cassava is planted to supplement people's food supplies (Tuan, 2001).

Despite this effort, food production per capita is quite low. In 1998, the gross per capita output of food in paddy equivalent was only 270 kg, compared to the expected level of 3,560 kg to meet nutritional requirements. Apart from relying on imports from other parts of the country, the farmers have to shorten the fallow periods, cut the forests and clear the land to grow enough food to meet their basic needs.

As a result, deforestation is increasing. In 1990s, approximately 20% of the country was covered with forests (compared to 48% in 1945). In 1988, forest fires destroyed 2,133 ha of forests in the Northern Mountain and Midlands (Statistical Publishing House, 2000), leaving barren hills to occupy more than 60% of the total land area. The steep slopes, heavy rainfall, deforestation and shifting cultivation practices have led to heavy

soil erosion, which is estimated to be 1-1.5 cm, or 150-250 ton/ha, of soil loss from the cultivated area every year.

There are lack of water-control systems because the steep terrain makes it very difficult and costly to construct such infrastructures. The cost could be two to three times higher in the Northern Mountain and Midlands than in the downstream areas. Nevertheless, the government and farmers have invested considerable labor and financial resources into irrigation and flood controls because they need to ensure food security and to combat the negative impacts of deforestation including the much needed safety-net of the low land (Tuan, 2001).

Unlike downstream areas where sluice gates and low-head pumps are needed, the main hydraulic structures in the Northern Mountain and Midlands are reservoirs, tanks, ponds, weirs and high-head pumps. These water-control structures are constructed and managed by local farmers. However, where the catchments cover several communes, bigger dams with larger reservoirs built by state and provincial authorities are needed. For these, the management is shared between both the state and farmers. In general, the government has 60% control over the management of the infrastructures. Thus, the cooperative farming process in the Northern Mountain and Midlands was slower than in the delta. After being allocated long-term use of the land, the farmers can cultivate whatever crops they think are most suitable. Such new freedom, however, gave rise to some problems of common resource management, such as land loss and irrigation.

Many irrigation schemes constructed in the upper watersheds supply water to low lying areas. After the land redistribution, the villages in the upper watersheds lost their land to the construction of dams and reservoirs but gained no benefit from the water supply. In retaliation, some farmers destroyed dams and drained the water from reservoirs to reclaim their land for cultivation. Moreover, the cooperative and water-management teams, in their diminished roles, were unable or unwilling to conduct proper water management. At the farm level, water management was disorganized, and the efficiency of the irrigation and drainage systems declined. Often, reservoirs, ponds, tanks and weirs can only provide water to 50-60% of the target area, while the irrigation schemes can serve only 20-30% of the agricultural land in the Northern Mountain and Midlands (Tuan, 2001)

The farmers' primary concern is to minimize the negative effects of sediment and run-off on paddy lands in the downstream areas while

maintaining the fertility and productivity of the uplands. The scale at which water supply has to be sustained and soil erosion controlled is beyond the individual farmer's capacity. Therefore, a new form of common resource management such as irrigation systems at the watershed level is emerging, and villages have begun to play important roles in managing the common resources in the Montane areas of Vietnam.

A Case Study from Northern Vietnam

We present a summary of a comparative analysis of irrigation performance in Red River highland. They are a system managed and operated by government and another managed and operated by farmers themselves (Dat, 2001). Findings of the study show that performance of irrigation and agricultural production of FMIS were significantly higher than that of managed and controlled by government. Thus the study concludes that irrigation facility did not so much affect the performance but it was the alternative management structure. For example irrigation service fees in government managed irrigation systems are based on the irrigated area and levels of irrigation service. These regulations have been carried out for each agricultural cooperative along the main canal. However, it was modified by farmers within a cooperative in FMIS according to the household needs and members' level of involvement in O&M activities from the secondary canal level to the farmer field level. The study findings further point out that as benefit from irrigation increases so do the participation of farmers and their perceptions of irrigation schemes effectiveness. Thus, clarifying rules, rights and duties of the irrigation management organizations both at the village users community level and at higher authority levels help improve the irrigation performance.

CONCLUSIONS AND IMPLICATIONS

While the process of public intervention in FMIS in Northern Thailand started nearly a century ago, the traditional customary practices and indigenous management regimes were incorporated in the intervention process. This helped the FMIS to maintain the community character of mutual and communal resource mobilization for operation and maintenance of the irrigation systems. Due to major emphasis of government investment decision in the productive flood plains and river basins to increase export crop production, little attention was paid on the improvement of small-scale FMIS in Northern Thailand. But with the focused targeted poor area and people development plan implemented a participatory mode of intervention in FMIS which started during early

80's. But with the consolidated land titling project of 1986 and new economic opportunities, there are both positive and negative visible impacts on the organization and management of FMIS in Northern Thailand. While the price of land has increased due to secured land titling, there are several alternative uses of land and water identified in the production of cash crops. The change requires high capital which fetches high price. Similarly, there are changes in resource mobilization criteria from labor based mobilization to cash based mobilization. This leads to less availability of man-days for repair and maintenance of system as compared to earlier. There is reduction in the cultural activities. There are less arena now for social gathering where conflict resolution takes place in different forms. There are more formal cases than earlier. Due to availability economic opportunities other than farming, many people are moving of farming out and new people have come in with diverse interest and less concerned about community resource such as water and its use in irrigating the field. Due to multiple and conflicting uses of water, irrigation activity becomes less profitable and individual economic benefits are gained at the cost of FMIS (Shivakoti, 2000).

The constraints and problems of people living in the uplands in Vietnam, on the other hand, have led them to turn to dynamic adjustment in land-use practices which have resulted both negative and positive aspects such as deforestation, water shortages, flooding, soil erosion and insufficient food supply. Proper and efficient land and water resource planning and management involving and integrating local people and existing practices can stop and reverse the negative trend. But, however, after the reallocation of land in the 1980s, the households have again become the focal point in rural resource management. Food production has increased, but water supply and erosion controls are not yet addressed at a community level. However, the land and irrigation systems which have been managed properly at the watershed level there are instances of villages being given the key role in managing the land and water resources in Montane areas of Vietnam. The higher performance of FMIS compared to government managed irrigation systems are the direct outcome of better governance and management of the systems under farmer control. These context specific dynamic management integration giving higher autonomy to the users has certainly benefited the ultimate users, community and the environment.

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INDIGENOUS KNOWLEDGE AND PRACTICES IN SHRINGIGHAAT SIMUNIYA SAATGAON IRRIGATION SYSTEM

SHISHIR PRASAD ARYAL[1]

INTRODUCTION

Nepal, a Himalayan Kingdom, is an agricultural country where more than 80 % people depend on agriculture for their living. Cultivation of different kinds of crops and providing water to them are two important jobs of irrigation management. Water is acquired from the source and delivered to the crop lands. There are mainly three types of irrigation systems in Nepal, Farmer Managed Irrigation Systems (FMIS), Agency Managed Irrigation Systems (AMIS) and Jointly Managed Irrigation Systems. The history of FMIS is very long. These systems irrigate about 70% of total irrigated land.

In FMIS, all the irrigation management activities are carried out by the farmers by their formal and informal organizations. The rules and regulations of the system become the norms and values of the society. Different practices in the system become the tradition and culture of the area. Farmers show good leading capacity and follow fundamental democratic norms in all organizational activities in most of the systems to acquire water from the source. They construct diversion weirs of locally available material using the indigenous knowledge and skills. Equitable distribution of water is observed in many systems. So the illiterate farmers seem to be good technicians, administrators, leaders and planners of Nepal.

INDIGENOUS KNOWLEDGE AND PRACTICES IN SHRINGIGHAAT SIMUNIYA SAATGAON IRRIGATION SYSTEM

No one can clearly say about the beginning of Shringighaat Simuniya Saatgaon Irrigation System (SSSIS). An elder member of the main committee of the Water Users' Association (WUA). Mr. Tribeni Tharu (from indigenous community) knows the system since his childhood. Mr. Shiva Chandra Acharya, a knowledgeable person in the Village Development Committee (VDC), is sure that the system was started in the

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beginning or before the Rana regime as his grandfather migrated here in 1940 BS, while the system was in operation. Mr. Kul Chandra Aryal, a founder teacher of a local high school says "the indigenous Tharu people were the innovator of the system and this system is being operated using their indigenous knowledge and practices." Due to the non-availability of written documents, the early history of the system is obscure but it is clear that it is in operation from generations using local knowledge, tradition, practices and organization and resources.

Tharus are the indigenous tribes of the Terai regions of Nepal. They are famous for their hard work, honesty, and expertise in agricultural works. Agriculture is their only profession to earn their living. They are well skilled in preparing agricultural and household implements using wood and mud so they choose to live in the fringes of the jungle. Motipur VDC is in the lap of forest marking its border to the north and west. The VDC is surrounded by the river so was a remote area before dissecting it by Mahendra Highway. It has been now an easily accessible village from other parts of the country. After being accessible by road, many people migrated to this VDC so the VDC has now a multiethnic and multicultural society with different economically active people. Location map of SSSIS in Motipur VDC is shown in **Figure 1**.

The change in the composition of the society has influenced in the irrigation system activities. The number of people in the command area has increased but land has been fragmented into smaller plots for agriculture and also used for other purposes likes houses, roads, schools, shops, mills, public market systems and so on. So the real command area has decreased. More importantly the Tharu population is decreasing. They are out migrating from the area, causing the knowledge gap owned by the Tharus. Now the migrants from surrounding districts mainly the Brahimins, Chhetris, Magars, Kami, Damai, and the Tharus are the stakeholders of the system. The SSSIS serves water for irrigation in the VDC for major agricultural production i.e. rice in the rainy reason and wheat, mustard, flax, lentil, pigeon pea and others in the winter. The users' participation in the irrigation system activities can be understood within the context of local cultural norms and values and their indigenous knowledge, practice, techniques and perception in the local environment for the sustainable water management system.

Figure 1: SSSIS in Motipur VDC

WATER USE ACTIVITIES

Different activities carried out to use water in the indigenous irrigation management system are known as water use activities. Water acquisition, allocation, distribution and drainage are the operational indicators in water use activities on the basis of which the SSSIS has been described.

Water Acquisition

Water acquisition means to acquire water from the source. The Banganga River is the source of this system. This is a perennial source of water and originates from Siwalik range in Arghakhanchi district. Flowing down to Bhabar area of Kapilvastu district, the river meets 11 different dams to distribute water into different FMIS included Shringighaat Kulapaani Samitee. Out of these 11 systems, the SSSIS is one which irrigates different areas of Motipur VDC acquiring 15.3% (2 Aana 2 Paisa of water out of 16 Aana/Paisa[2]) of water from the source (**Table 1a**). Among the terraces of dams at Shringighaat the fourth from north is of this system. *Baijalpur, Tinaiya, Pipara, Madhuban, Rajpur, Bathanpura, Gajehada, Jitpur Dungahawa* and *Jhanda* are other sister FMIS which irrigate about 2523.3 hectares of land of Kapilvastu district.

The main canal of SSSIS runs west south from the source and after 1500 meter distance downward, it gives a branch to Mormi area at Simuniya. Just beneath Simuniya, the main canal has been damaged so badly at Bhachana that it has formed a stream to the west to separate Mormi from the main canal. The main canal upto Bhachana seems small stream and has no artificial border. At Bhachana, farmers have tried to control the canal to divert water toward the main land using their indigenous knowledge, practice, design, resources and locally available materials. They have planted Byay (*Ipomaea fistulosa*), a fast growing shrub throughout the lining of the canal. The canal then divides and sub divides to irrigate *Bandeuli, Dhodekol, Chappargaon, Motipur* and *Bangain* areas.

During rainy season water is enough to all. Each branch canal gets its share according to the land area. But in the winter, amount of water decreases so the farmers acquire their share in turn (*Uljha*) by dividing the time on the basis of the land area as the same as the division of water in rainy season.

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[2] Aana and Paisa are the units of land (1 ha = 19.5 Ropani, 1 Ropani = 16 Aana, and 1 Aana = 4 Paisa)

Some times, even in the rainy season, if the water is not enough in the source there can be *Uljha* within the main canal or branches. There is usually *Uljha* in the sharing of water from the Banganga river itself.

Water Allocation

Water allocation means to entitle water as a share of what is available to the beneficiaries. In SSSIS, water is allocated on the basis of irrigated land areas. To allocate water, farmers have their own indigenous practice on which they divide the available water in the main canal into 16 Aana and a branch gets its share according to its land area (**Table 1b**) which is rooted in the peoples' mind as their cultural values and norms for crop cultivation associated with the irrigation management system over generations.

During rainy season, allocation of water has no problem. During winter, there is a high demand of water as the quantity becomes low. The allocation on the basis of land area seems to be unscientific. So the farmers make an *Uljha* of days dividing the time (day & night) on the basis of their land area. Sometimes a village may not need the water in winter but gets its turns. In the same time, another village in need of more water can not get enough as its turn is over. So the farmers need to revise this pattern as they can divide water on the basis of land area, types of cultivated vegetation & types of soil, and weather.

Water Distribution

Water distribution means the physical delivery of water to a crop land following the water allocation decision. Water distribution process is the most important in the system. Farmers become pleased to see water in their fields. Water is distributed on the basis of the land area in the branch canals for different Maujas. Within a branch (Mauja), farmers get water by their turn for which the branch canals have been divided into several sub-canals to irrigate each and every plot of land. The farmer leader (*Badghar*) and his assistant are responsible to distribute water to the proportion of land. The farmers trust *Badghar*. "The *Badghar* means to be impartial and he is of all" is their belief. The *Badghar* is ranked in higher social status equal to local government and respected by all.

Table 1: Water Allocation Pattern

a) At Source River

S.N.	Irrigation Systems	Allocation of Water	Percentage Share
1.	Baijalpur	2 paisa	3.1 %
2.	Tinaiya	2 paisa	3.1 %
3.	Pipara	1 Aana 2 paisa	9.4 %
4.	Saatgaon	2 Aana 2 paisa	15.3%
5.	Madhuban	1 Aana 2 paisa	9.4 %
6.	Rajpur	3 paisa	4.6 %
7.	Bathanpura	3 paisa	4.7 %
8.	Gajehada	3 Aana 2 paisa	21.9%
9.	Jitpur	2 paisa	3.1 %
10.	Dungahawa	2 Aana	12.5 %
11.	Jhanda	2 Aana	12.5 %
	Total	16 Aana	100%

b) In SSSIS

S.N.	Branch Canal Systems	Allocation of Water	Percentage Share
1.	Dhodekol	2 Aana	12.5%
2.	Chappargaon	2 Aana	12.5%
3.	Bandeuli	1.5 Aana	9.4%
4.	Motipur	4.5 Aana	28.1%
5.	Bangain	3 Aana	18.7%
6.	Mormi	3 Aana	18.8%
	Total	16 Aana	100%

Source: Field Visit

Water Drainage

Flowing away of excess water from the system is generally known as the water drainage activity which starts from the main intake at Shringighaat. During rainy season, the water is discharged to downstream in the river through the gap in the weir. The system has outlet to drain the excess water during rainy season.

PHYSICAL SYSTEM ACTIVITIES

Maintenance

Maintenance means the repairing and cleaning of the system to make water acquisition and distribution smoothly and efficiently. In SSSIS maintenance work starts before growing saplings of paddy in the first week of June. Cleaning canals by cutting unnecessary weeds, shrubs and digging out stones, sand, gravel etc (Dhule Kulai) is completed first in every branch canal. The time period is fixed by the main branch

committee. The branch canal committees by rotation select one committee as a chief to lead other systems in all activities of system. During maintenance within the branch system or whole system, labor and material resources are mobilized on the basis of the area of land that a farmer owns. All the maintenance works within a branch canal are completed by the farmers of that canal using their own resources. In the past, wooden aqueducts were used to convey water which have been replaced by concrete structures.

After completing *Dhule Kulai* up to the water proportioning device of a branch canal, the main branch committee decides to repair the damage in the common main canal. If the task is large, there is a *Jharawa* Kulai including all the farmers based on their landholding. When regular maintenance as to be done, a *Kishan Kulai* having proportional number of *Kulara* (workmen) in canal is preferred. During diversion weir repair, the *Jharawa Kulai* is preferred as it requires more resources. Division of labor depends on the amount of water allocated for the branch system. The *Badghar* of main branch committee has measuring stick to allocate the amount of work to be done by different branches. To complete the given task is a challenge and pride to all systems. The work is monitored by the *Badghar* of the main committee. If any branch fails to complete the given assignment, that branch is fined. The incomplete work would be completed with the help of the manpower from the other branches.

Operation

Operation system in the SSSIS is special and remarkable. The *Badghar* of main branch canal (*Gaon Mukhya*) is the head of the system and he regulates, monitors, directs and decides the water operation activities in the system. Farmers of the *Gaon Mukhya* by their turns have to patrol the entire canals upto water proportioning device for branches. They monitor the systems and find damages of the lining, leakage of water, imbalance in water allocation, stealing of water, damages of main intake and other irregularities.

After the inspection of the system, the farmers report to the *Badghar* of *Mukhya Gaon* before 8 am from where the Chaukidar (watch man) of all other branches take information daily and inform their farmers to take a required action as decided by the main *Badghar*.

If the *Mukhya Badghar* finds any disputes among the branches or any irregularities from the branches, he calls a meeting of main committee.

The main committee decides for all irregularities and takes an action against irregularities. All the operational work in water acquisition, allocation, distribution are deeply associated with the tradition of this systems managed by the farmers.

Construction

Construction means to build physical structures for smooth delivery of water from the water source in the river upto the crop land. It includes construction of all required structures in the system. Main weir, intake canal, conduits, water distribution devices are the major structures in the system constructed during last 200 years. They have their own special technique to construct the brushwood temporary weir for the diversion structure in the source.

The brushwood temporary weir is built using locally available materials like stones, brushwood, tree branches, shrubs and grasses as shown in **Figure 2a**. The farmers are so knowledgeable and have expertise that they can build the weir to divert the water of flooded river. The weir is not built across the river. A part is left uncrossed by the weir as shown in **Figure 2b** so that the weir is less likely to damage by the normal flow. The base of the weir is made wider so that it can normalize the hydraulic pressure at the bottom. This scientific knowledge in the farmers has been developed with trail and error method for centuries.

Construction of canal from head to tail reveals a scientific knowledge among farmers that they have divided canals into many veins to irrigate all the corners. Water division devices of wooden planks or the cemented floor are the result of their intimate knowledge to allocate water equitably without any prejudice to all branches.

Figure 2a: A Temporary Brushwood Weir

Figure 2b: Orientation of Temporary Brushwood Weir across the River Adopted from Shukla and Khanal

Design

Design means the framework of the physical structure of the systems in which water flows from the source to irrigate the croplands. Designing the FMIS can be a result of long experience and practice of farmers on trial and error methods. In the SSSIS intake and main canals have been changed in different time because the wider river sometime changes its course or the farmers find more efficient route to operate the system. The regular repair and construction of brushwood temporary weir needs a lot of forest products so have caused deforestation. Boulders, stones, sand, gravel, and mixed sand are mined for urban construction work. This has created problems to construct the weir and maintenance of the system.

Most importantly, the temporary brushwood weir site for the main intake of this system is located at the narrow section of the source river. This section lies in the *Badghar* area below the Siwalik Range. After this site, the river enters into the alluvial plains and widens to occupy a larger area.

The farmers in this system seem to be experts by their knowledge design. The proportioning devices (Sancho) which is to allocate water to different branches is developed so scientifically that water is divided almost equal to the proportion of their land.

ORGANIZATIONAL ACTIVITIES

The norms, values, practices and behavior of members to regulate an organization can be included in organizational activities. Norman Uphoff's conceptual framework about mobilization, communication and conflict management are the key factors of organizational activities. Farmers of SSSIS have their organization. All the branch canal committees have the same rank in the system. By rotation they make one leader committee among themselves for a year. After the introduction of Water Resource Act 1992, the informal organization was formalized by registering it in government agency. The registered committee is now working in parallel with main committee of the system. The main branch canal committee is working with the direction and co-ordination of this committee functions in the system. The Constitution of this registered system has different provisions in irrigation system activities. This irrigation system gives more importance to the indigenous practice, traditions, norms and values of the system as it states all the traditional activities in the systems are considered as the rules of the system.

Decision Making

Decision making is the vehicle for carrying managerial work load and discharging managerial responsibilities. So it is a goal oriented activity. The main function of formal or informal organization is to make decisions. In SSSIS, decisions are made on democratic pattern which starts choosing *Badghar* (leader), Assistant *Badghar* and *Chaukidar* (Watchman) of the branch canals. Role of all farmers becomes equally important to decide about *Badghar*. General decisions made by the farmers committees are to fine farmers for their absence (*Khara*), to charge farmer for annual water supply (*PanKat*), to fix the time of *Dhule Kulai*, to collect money for special maintenance and improvement of the canal system.

Resource Mobilization

Resource mobilization includes the use of locally available material and manpower to make maximum benefit to the system. A large forest of *Sal, Khayer, Sisau, Simal, Banjhi*, etc. is the main source of construction material for the weir. Out of 12207 people of 2155 families, there are about 300 farmers in the *Jharawa Kulai* in the main intake. Farmer organization has used this large manpower to construct, operate and maintain the system for acquisition, allocation, distribution and drainage of the water. The nearby forest and the river itself are sources of biotic and abiotic resources like plants, stones, gravel and sand necessary for constructing weirs.

In the recent years, gabion boxes netted with stones are also used to control and divert the water. The changed social and environmental condition of the system is facing some problems to mobilize the resources of both kinds, i.e. men and materials. Generally young generation is not interested in the *Kulai* (Canal work) as it needs hard physical work. The biomass of the forest is also decreasing because of its regular destruction for maintenance and construction of similar 11 diverting weirs. Besides over grazing, forest fire, cutting trees for firewood, timber, fodder and other activities have caused a fast deforestation in this area which causes a severe shortage of plant product to construct the weir.

Because of changed socio-economic condition, many people have changed their profession or changed their system in agriculture. So the number of *Kulara* is decreasing, this has also created a problem in the system.

Finally the canal and the river have been wide and become shallow. Therefore, the system has become more damage prone area. The quantity of human and material resources are decreasing. The two-tiered SSSIS organization is shown in **Table 2**.

Table 2: Shringighaat Simuniya Satgaon Irrigation System (Water Users' Organization)

a.	**The Main Registered Committee**	
1.	Chairperson	Mr. Dilli Raj Gnawali
2.	Vice-chairperson	Mr. Gita Ram Bhandari
3.	Secretary	Mr. Ambar Bahadur Basnet
4.	Treasurer	Mr Bishnu Prashad Basnet
5.	Member	Mr. Nitya Nanda Belbase
		Mr. Ram Bahadur Tharu
		Mr. Dukhe Tharu
		Mrs. Guna Panthi
		Mr. Ghana Shyam Bhandari.
6.	Advisors	
		Mr. Netra Giri
		Mrs. Shiva Chandra Acharya
		Mr. Ravi Raj Achary
		Mr. Tribeni Tharu
		Mr. Chulai Tharu
		Mr. Lokhari
		Mr. Babu Ram Tharu
		Mr. Dharma Raj Bhattrai

b.	**Branch Committees**		
1.	Motipur Branch		
	(i)	Badghar	Mr.Chhabilal Bhattrai
	(ii)	Assistant Badghar	Mr.Chulai Tharu
	(iii)	Chaukidar	Mr.Dhan Bahadur Damai
2.	Mormi Branch		
	(i)	Badghar	Mr. Tuk lal Bhatrai
	(ii)	Assistant Badghar	Mr. Bhim lal Neupane
	(iii)	Group Badghar	Mr. Nil Kantha Pandey
			Mr. Yam lal Ghimire
			Mr. Mukti Ram Bhattrai
			Mr. Nokhai Tharu
			Mr. Shambhu Tharu
	(iv)	Chaukidar	Mr. Chautare Tharu
3.	Dhodekol Branch		
	(i)	Badghar	Mr. Tribeni Tharu
	(ii)	Assistant Badghar	Mr. Pardeshi Tharu
	(iii)	Chaukidar	Mr. Solari Tharu
4.	Bandeuli Branch		
	(i)	Bagdhar	Mr. Ghana Shyam Bhandari
	(ii)	Chaukidar	Mr. Indra Bahadur

5.	Bangain Branch		
	(i)	Bagdhar	Mr. Rum Bahadur Thapa
	(ii)	Assistant Badghar	Mr. Ram Prasad Tharu
	(iii)	Chaukidar	Mr. Dan Bahadur Badi
6.	Chappargaon		
	(i)	Badghar	Mr. Bishnu Prasad Paudel
	(ii)	Assistant Badghar	Mr. Top Lal Gaire
	(iii)	Chaukidar	Mr. Krishna Paudel

Source: Field Visit, February 2002

Communication

Communication helps manage all irrigation system activities by disseminating all decisions made by the leaders, the situation to be decided and conditions compelled malfunctioning of the system or others. Communication system is more appropriately seen in SSSIS.

The *Chaukidar* of the branch canal inspects the overall condition within his territory and informs to the *Badghar*. If *Badghar* thinks to take any action, he directly decides or calls for a meeting of farmers. For general maintenance work on canals, the *Chaukidar* notifies all farmers speaking loudly (*Haak Halnu*). When the *Chaukidar* announces something loudly all the farmers become attentive to listen and to communicate with their neighbors too.

To inspect the main system from the brushwood weir at the source to the water proportioning devices is the duty of the *Badghar* of main branch canal. So he sends his farmers daily in a group of 2 or 3. The farmers give report to the *Badghar* from whom the watchmen from all branch canals take and supply information to the concerned branches. In the process if any one fails in his duty, he is fined.

If the *Badghar* of main branch committee thinks to have a meeting with *Badghars* of other branch committees, he writes letters to the branch committees. Usually, communication takes place from committee to committee and farmer to farmer.

Conflict Management

Arising conflicts are common in SSSIS but they are not out of control. All kinds of conflicts are solved by discussions. Generally there are three kinds of conflicts.

- Within a branch canal;
- Among the branch canals; and
- Among different systems in the source.

Conflicts within the branch canal are related with the amount and turn of water supply which is solved by the *Badghar*.

Stealing water, imbalance of water allocation, breaking of proportionate device, works with unwanted qualities are some examples of conflicts among the branch canals. The *Badghar* of main canal and the main committee resolve all conflicts on the basis of mutual understanding and consent. Sometimes the main committee can fine one who steals water and cannot complete the given work in common canal.

Stealing water by breaking the main weirs of other systems is another matter of conflict among the irrigation systems in the source river. This conflict is resolved by the Khole Samitee or the Shringighaat Kulapaani Samitee.

In SSSIS, there is a general understanding not to generate any conflict.

CONCLUSION

The study has following findings:

1. The SSSIS is an example of FMIS. This system was started by the local Tharus using their indigenous knowledge and practices in designing, construction, operation and maintenance activities for water acquisition, allocation, distribution and drainage.
2. The farmers have developed the qualities of organizing, leading, decision making, conflict resolution and overall management of the system.
3. The constitution of the main committee of the Water Users' Group has no provision to function the branch committees

4. All the branch committees have their own system of operating their committees and branch canals.
5. Water users of this system or the farmers in general do not know that there is a registered main committee of their own.
6. The canal has been widened and become shallow thereby washing away a large area of cultivated fertile land because of entry of uncontrolled volume of water into the systems that have no control mechanism.
7. Widespread flooding is affecting large area of the VDC as it has primitive irrigation system and is surrounded by rivers from all sides.
8. Shortage of natural resources like brushwood, stones and manpower (as they have engaged in other profession) has created problems in construction and maintenance of weirs.
9. The temporary brushwood weir and lining of canals are frequently damaged during monsoon. So, the farmers are always under pressure. This hampers their agricultural practices.

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