Engineering participation: The processes and outcomes of irrigation management transfer in the Terai of Nepal

Puspa Raj Khanal

Promotor:

Prof. L.F. Vincent, Professor of Irrigation and Water Engineering, Wageningen University

Samenstelling promotiecommissie:

Prof.dr.ir. C. Leeuwis, Wageningen University

Dr. G. Shivakoti, Asian Institute of Technology, Thailand

Ir. P. van Hofwegen, World Water Council, Marseilles, France

Dr. H. Murray-Rust, International Water Management Institute, Hyderabad, India

Dr. U. Pradhan, The Ford Foundation, Jakarta, Indonesia

Propositions

Current problems in irrigation are often linked to civil engineering field, for being ignorant to social realities, but I wonder whether the problem is civil engineering or engineering not being civil? *(This Thesis)*

Participation is not only a tool for interaction, but also a field of transaction and struggle–with arenas of conflicting interests and domains for negotiations. It is recognition of this transaction and conflict that can overcome accusations that participation is just another manifesto of post positivism. *(This Thesis)*

The Polarized either/or approach to blueprint versus process is not the way ahead. Rather it may be a question of which form of blueprint or process, in which circumstances, and even of what means may be used to integrate blueprint and process approaches. *(Hulme, 1995)*

Technology development process is not only about application of methodologies, but is also about developing effective networks and collations. *(Biggs and Smith, 1998).*

Federated structure is more suitable for designing local organization, as politics of irrigation organization will be reshaped in federal linkages *(Freeman et al., 1989).*

Do not embarrass with failures, they too are part of learning guiding to future successes. *(A common saying in Nepalese society)*

Why does one need 4 years of engineering education just to make water flow in down slope, which a common villager can do? Engineers must make it flow upward. *(An old women farmer to the researcher when a new canal failed to irrigate her fields lying higher than canal level)*

Propositions attached to the thesis
Engineering participation:
The processes and outcomes of irrigation management transfer in the Terai of Nepal
Puspa Raj Khanal
Wageningen University, 28 April 2003

Engineering participation:
The processes and outcomes of irrigation management transfer in the Terai of Nepal

Puspa Raj Khanal

Proefschrift
ter verkrijging van de graad van doctor
op gezag van de rector magnificus
van Wageningen Universiteit,
prof.dr.ir. L. Speelman
in het openbaar te verdedigen
op maandag 28 april 2003
des namiddags te 14:00 uur in de Aula

Engineering participation: The processes and outcomes of irrigation management transfer in the Terai of Nepal. Wageningen Univeristy. Promotor: Prof. L.F. Vincent. - Wageningen : Puspa Raj Khanal, 2003. - p348

ISBN 90-5808-816-2

This thesis will also be published by Orient Longman, Hyderabad, India in the *Wageningen University Water Resources Series* with ISBN 81-250- 2493-X

Contents

Figures

Tables

Boxes

Preface

This study is my search towards engineering participation in water management. The interest grew out of my own involvement in facilitating irrigation management transfer program in Nepal, the key actions and struggles of which forms the backdrop of this thesis.

I have tried to present different context and domains of participation and challenges facing them, readers can make their own choice for its reading. For those interested in organizational evolution and local management, Chapter 4, 8, and 9 can provide related information. Whereas those interested in participatory approaches and project dynamics, Chapter 4, 5, and 6 and 7 provide more information.

This study would not have been possible without continued support, guidance and encouragement from my supervisor, Prof. Linden Vincent. I would like to express my sincere gratitude to her intellectual guidance and valuable insights during the entire study period. She encouraged me to let it finish in time and provided every guidance, and finally make it reality.

This study was arranged by the soil and water engineering group of Wageningen University in a Ford Foundation supported program. I would like to express my sincere thanks to the group for providing me this opportunity. I would also like to express my sincere appreciation to Dr. peter Mollinga for organizing workshops during the field-work and arranging publication of the book. In Wageningen, the administrative support from the department is greatly acknowledged.

I was also inspired by colleagues at the Water Management Study Group at Institute of Agriculture and Animal science (IAAS) Rampur for this study. I am personally indebted to A. K. Shukla and other members of the group, for their support and encouragement. I will be always grateful with farmers and WUA of Panchakanya and Khageri system with whom I learned the challenges behind every day water management and who also provided support during my field-work. Thanks are also due to WUAs of all the three systems who provided me necessary data and logistic support during the field-work.

Occasional discussions with Dr. Prachanda Pradhan were very helpful during the field-work. Dr. Umesh Nath Parajuli provided every possible support during the whole study period. Late DDG Satyal and Shyam Prassad Raj Bhandari in the DOI also provided necessary encouragement and support. I am very much grateful to all of them for their valuable guidance and support.

Finally, I am indebted to my parents for their encouragement and sacrifice they have made to make me educated. I would also like to extend my sincere appreciation to my mother in law who always took care of two children Shreeya and Siddhartha while Seema was away with me. And to the children, who sacrificed a lot, never asking questions about my where being - I have no words for them. Last never the least, thanks to my wife Seema for her patience and sacrifice and encouragement thorough out the study.

Abbreviations

ADB	Asian Development Bank
ADBN	Agriculture Development Bank
AMIS	Agency Managed Irrigation System
AO	Association Organizer
APP	Agricultural Perspective Plan
BC	Branch Committee
CADP	Command Area Development Project
CIP	Chittwan Irrigation Project
DDC	District Development Committee
DOI	Department of Irrigation
DG	Director General
DDG	Deputy Director General
FO	Farmer Organizer
FAO	Food and Agriculture Organization
FMIS	Farmer Managed Irrigation System
GA	General Assembly
HMGN	His Majesty's Government of Nepal
IFAD	International Foundation for Agricultural Development
ILC	Irrigation Line of Credit Pilot Project
ILO	International Labour Organization
ISSP	Irrigation Sector Support Project
IMTP	Irrigation Management Transfer Project
IMD	Irrigation Management Division
ISF	Irrigation Service Fees
KIS	Khageri Irrigation System
MC	Main Committee
MOWR	Ministry of Water Resources
MOF	Ministry of Finance
NPC	National Planning Commission
NWGIS	Nepal West Gandak Irrigation system

NLIO	Narayani Lift Irrigation Office
NRs	Nepali Rupees
O&M	Operation and Maintenance
PIS	Panchakanya Irrigation System
UNDP	United Nations Development Program
VDC	Village Development Committee
WB	World Bank
WUA	Water Users Association

1

Introduction

1.1 Research Context and Objectives

Irrigation Management Transfer[1] is a world-wide phenomenon, and it is under this banner and many other titles that more than 25 countries world-wide are now engaged in management transfer programs (Kloezen and Samad, 1995). Vermillion and Sagardoy (1999) defines irrigation management transfer as the relocation of responsibility and authority for irrigation management from government agencies to non-governmental organizations, such as water user associations. Such programs aim to achieve better service provision through users' involvement in system management. In addition, reduction in public expenditure and empowerment to farmer groups are also often goals of these programs.

In Nepal, the process of transfer of irrigation management in Agency-Managed Systems[2] to new local organizations began in the 1990s. The design of implementation processes for this management transfer and its outcomes has received little analysis so far, while its understanding is crucial for future irrigation management reform in the country. The reasons for pursuing reform in the irrigation sector in Nepal have been three-fold. First, there has been increased dependency on the government for system development and management, whereas the performance of the systems has remained relatively poor. Second is the dependency of water resources sector development on donor support, who now favour less government and more private-sector involvement in development activities. Thirdly, it is also inspired by the successful tradition of farmers' managed irrigation systems (FMIS) in the country. The process was formulated around decentralized and user-centred approaches emphasizing participation and local organizational development.

The present study concerns the intervention program in the Terai Region of Nepal to transfer irrigation management functions to the users. The Irrigation Management Transfer (IMT) program in Nepal involves both institutional reform and technical rehabilitation to facilitate decentralization of irrigation management. However the primary concern is that of a modernization approach to induce institutional innovation. The study critically studies the dynamics of the participatory processes behind this management reform and organizational change, and what and how changes were achieved. It draws on the experience of the author, who himself was part of these processes and explores how and why organization change has evolved in current practice.

The research contributes to four inter-related themes in irrigation management reform: (1). the development and empowerment of WUAs as new form of governance (2) the support process to facilitate the management change and wider organizational transformation, (3) the role of technology in both these participatory processes and new management, and (4) the transformation of policy in projects and local practice.

The first concern of this study is to understand the processes and outcomes of these reforms in local water management in Nepal. Most studies about irrigation management reform so far have focused on the impact of reform (see for example Kloezen *et al.* 1997; Vermillion, 1997) or they are based on the policy conditions and organization structures of WUAs (Geiger, 1995; Johnson *et al.* 1995; e- conference on IMT, 2001). Studies in Nepal have also focused mainly on the impact assessment of the intervention (Adhikari, S. 2002; Adhikari, B 2000; Shukla *et al* 2000). Such studies tell about the management arrangements present as a result of the management change, but often fail to explain why and how these arrangements materialize in practice. Detailed accounts of the dynamics of the process of management transfer and change are rare in irrigation literature.

The second concern of the research is about the support process to facilitate this management change. IMT in Nepal, as in most countries is program focused with clearly defined stages. Though the need for program/projects to implement the reform has been questioned (Turral, 1995), in practice it has been implemented in program mode with clearly defined stages employing supposedly participatory techniques. In this context, the details of participatory design approaches and tools and methodologies used to facilitate institutional reform have not been systematically documented. We also know little about the actual participatory technology development process when operating in an action research and development context.

A third concern is to understand more about the role of technology both in shaping management and as a focus in the intervention process. Typically, technical improvement is a major part of the support in IMT programs. In this regard, the issue whether the improvement has to be done before or after the transfer has got considerable attention. However, the more important issue of how to promote service-oriented water control appropriate to local users and new local organizations facilitate management change has been less debated.

So far policy and legal support, where it exists, has been focused on forming laws authorizing the formation of WUAs. These mostly focused on the duties and responsibilities of WUAs and irrigation agencies, system operation and maintenance and transfer arrangements (less addressed in Nepal). However, the long-term sustainability of local organizations depends on their ability to cope with the changing physical and social environment. Policies are usually translated on the ground as programmes of support and local action proceed, but these can also show need needs which policy must translate. The further policy support needed for these WUAs to survive and mature (referred to as second-generation problem, Svendsen, 1997) has been given less attention.

The aim of this study is not to suggest specific conditions to facilitate management change and assure achievement. Rather it is to improve understanding of change processes that translate policies on the ground, and the self-actualizing and evolution of WUAs - and how actions around technology and its transformation relate to this. It also hopes to contribute to better understanding of participatory processes, in how they can be practiced beyond just an instrumentalist perspective. The core concepts used in these fields of concern are reviewed in the following sections.

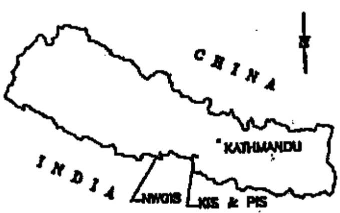
The present study was carried out in three systems: Khageri Irrigation System (KIS), Panchakanya Irrigation System (PIS) and the Nepal West Gandak Irrigation System (NWGIS), which differ in size, have different social and physical environments and different histories of water management organization. All are gravity irrigation systems supplied by river diversions. Eleven projects were selected to begin the management reform in the country and these three systems were in the first phase of policy implementation. There were different reasons for their selection at the first phase. Khageri and Panchakanya were selected because farmers there were innovative and educated. They also have simple water control structures and a relatively water-scarce situation, which is considered to be favourable for inducing collective action. West Gandak was selected because of its potential to provide year-round irrigation to farmers.

The IMT programs in all the three systems were initiated in the mid-nineties. The size and location of the systems are shown in Table 1.1.

TABLE 1.1 Area and location of irrigation systems

System	*CA*	*District*
PIS	600 ha	Chittwan
KIS	3900 ha	Chittwan
NWGIS	8700 ha	Nawalparasi.

FIGURE 1.1 Location of the three irrigation Systems



As I was a key actor in implementing the IMTP in two of the three irrigation systems selected for this study - Khageri and Panchakanya - I find it essential to describe my research journey.

1.2 Beginning a Research Journey

In December 1994, the department[3] asked me to head the Narayani Lift Irrigation Office (NLIO), whose remit included the Panchakanya and Khageri irrigation systems. In early 1992, the government initiated the Participatory Joint Management Program (PJM) in the Khageri Irrigation system. Two years later, Panchakanya was also included in this program: ultimately the government was going to transfer the management of the Khageri and Panchakanya systems, beginning with this joint management activity. I worked in the IMTP for almost four years from December 1994 to October 1998.

I was recommended by the outgoing NLIO chief for his replacement, due to my previous experience in implementing the Irrigation Line of Credit (ILC)[4] projects, which were based on a participatory approach. I had just returned from the Asian Institute of Technology, Thailand, with a Masters' Degree in Water Resources Development, after earlier graduating as a civil engineer in 1987, and had not been placed in any charge before then. I immediately moved to join the NLIO, unknowingly beginning my research journey.

Paradoxically my professional career began not with design innovation of large structures, but with involvement in the formation and capacity development of WUAs, and designing systems through joint planning and supervision. I had neither training in this newly emerging 'social engineering' approach nor any knowledge in mobilizing users in this process. It was thus not only a new experience for me, but also one I never expected – uncharted terrain (Honadle & Cooper, 1989). The term 'Peoples' Participation' was highlighted at that time. It was considered a mantra to heal the ailing irrigation sector. The field of civil engineering was blamed for most of the problems, criticized for adopting top-down and blueprint approaches, while engineers were criticized for being biased towards construction and ignorant of social realities. As I became further involved in the project, I started wondering whether the problem was civil engineering, or that the type of engineering was not being very civil?

Being involved in complexity

I was trained as a hard-core engineer and equipped with knowledge of hydraulics and civil construction, where innovations are brought through knowledge of science. My professional orientation thus began with a positivist perspective[5]. However, after being involved in the participatory rehabilitation of FMIS, I came to realize the complexity and dynamic processes of real-life irrigation intervention. There were multiple actors and multiple realities. I could further realize that the positivism perspective ignores the 'civil' aspect of my engineering profession. I gradually shifted towards a constructivist perspective. Our work in the IMTP was characterized by conflicts and struggles between various actors and stakeholders. There was always a need to find ways to mediate and negotiate the conflicting interests between different group of farmers, as well as between farmers and other institutions. We ended with both intended and unintended outcomes.

I also juggled different roles in this process of change as a facilitator, a project manager and an engineer. For the department, donors and consultants, I was a Project Manager responsible for implementing the IMT Project. My role here was to complete the project in time and perform administrative and financial activities in accordance with their requirement. For farmers, I was the first port of call to negotiate and bargain their demands. In this respect, I was both a mediator and a negotiator between the government and the farmers, and between different farmer groups. This was the most painful part of the work, because, a win-win situation was not always possible, and failure to find a win-win situation meant being blamed by the losing side.

As an engineer, I was to engage in design innovation of the structures and help my technical staff to carry out the construction, and also to help farmers understand the different aspects of system technology. This was the comfortable side of my job - I enjoyed designing with the users, especially when being able to translate their ideas and preferences into practical reality. However, my primary role was to facilitate the management change from the government to the farmers. This was not limited to a single aspect of my work, but included every dimension from the design innovation of structures to negotiation for turnover, and negotiation for future support and helping WUA to develop their future vision. As a facilitator, I had to engage at various levels. First, I myself was the facilitator directly engaging with the WUA and the government agencies including my own department. At another level, I was supporting my staff implementing the activities in the field. I was working both as an 'ordinary' facilitator and as a 'meta'-facilitator' Groot (2002).

These different domains kept me running from one place to another, even to the Supreme Court of Nepal. Participation, I realized, was not only a tool of interaction, but also a field of transaction and struggle - with arenas of conflicting interests and domains for negotiation. It is recognition of this transaction and conflict that can overcome accusations that participatory methodologies are just another manifestation of positivism.

Taking this view, I am not a pessimist on participatory development, and neither do I view it as tyranny (Cook and Kothari, 2001). In the latter part of the book, I will rather argue that it is promising but inevitably complex and messy and we should be prepared for both intended and unintended outcomes. Participatory approaches do have several practical limitations in irrigation but there is no need to rush to abandon the approach itself, as there is no alternative approach that pays better attention to users.

Meeting with Prof. Vincent: the journey continues.

Meanwhile, in April 1998, Prof. Vincent was on a supervisory visit to two of her Ph.D. students who were at their final stages of field-work. I met her briefly and shared my views on the current reform process in Nepal, the ongoing IMT program and what we had learned after the implementation. I wrote a research proposal. Besides seeking explanations of my past actions, I was further interested to learn more about the management change over time. My proposal was accepted later on as part of the program on 'Matching Technology and Institutions (MTI) in Land and Water management[6]. For this later part of the journey, I included another case of IMT where I was not involved as implementer.

Is it appropriate to do research on a system where the researcher himself was a principal actor in the implementation? I took this as both an opportunity and challenge. It was an opportunity in the sense that I had the access to data, memory and documentation of many of the events that were important in shaping the management turnover process. I was familiar with the local environment and enjoyed close relationships with my previous staff. I had friendly relations with many farmers and WUA members, with whom any differences existing were more on policy matters than personal ones. For a study of an implementation process, I believe an implementer can provide more information than an outsider if he wishes to do this.

I was committed to show the difficulties and challenges that others and I faced in facilitating irrigation management change. I was also convinced that it is not a story to tell about who did what, or judge the success or failure of an individual or of an organization. With this research, I am searching for explanations on why and how particular outcomes have arrived through theoretical concepts. As Yin (1989) notes, case studies can produce explanations if they proceed from an adequate theoretical framework. My confidence to document the research journey grew as I discovered several authors describing their research journey through reflection on their own work on intervention (Auerbach, 1999; Malkin, 1999; Uphoff 1992; Haggmann, 1999) and more recently Groot (2002).

This book shares as honestly as possible some of the challenges, obstacles, frustration, pitfalls and the lessons learned in the process of irrigation management reform in Nepal. Although every situation has unique elements, I believe that many of the difficulties encountered and rewarding moments experienced are in common. These perspectives and lessons learned and discussed here will help design intervention aiming to promote participatory management in irrigation. I make no apologies in presenting personal elements of my research journey: I think it important to document my situation, experiences and values as they also shaped the research study. They help show the struggles inside a participatory approach by key actors among farmers, engineers and program staff, which few studies document. There is a known challenge in reporting and analyzing situations in which one is an actor, but this does not invalidate the analysis if it is done with critical awareness and openness.

1.3 Re-structuring Local Organization

An organization can be conceptualized as a social grouping of users involving a definite set of authority relations who meet regularly, may not have intimate ties with each other and normally come together for a specific practical purpose (Giddens, 1989). In irrigation they can be formal or informal organizations (the WUAs) depending on legal recognition. The resulting WUAs can be single or multi-tiered depending upon the type and structural complexity of the systems, and can be developed in unitary or federated models (Freeman *et al.*, 1989). In the unitary model, the structure is a pyramid-type, and the higher level is formed out of representatives of lower units, whereas in the federated model, the higher level committees are formed for different canal units with different selection/election processes. However, in both structures, the WUA consists of different tiers, for example a main committee (MC), branch committee (BC) or tertiary committee, depending upon the canal layout.

Freeman (1989) argues that the unitary structure is unresponsive to local farmer requirements, and that federated structures are more suitable for the efficient functioning of an organization. He sees the disadvantages of the unitary model - that the decision-making tends to divert from local needs as the power is concentrated at centre level, the main committee is over- loaded and thus decisions are slow. Also, that power and formal authority tend to be concentrated with relatively few leaders and brokers. As membership of governing bodies and councils at each higher level is drawn from the membership at each lower level, power and influence rapidly concentrates among a few. On the contrary, in the federal model each organizational level is clearly responsible for a particular segment of canal, and needs can be quickly addressed. Power and influence will tend to be distributed among different canal sections, and the politics of irrigation organization will be reshaped in federal linkages. Solidarity may also be promoted as groups recognize interdependencies in gaining water supply from year to year.

The functional versus political model of a WUA

Work on WUA design and development has generally followed two approaches to institutional design. Researchers like Ostrom (1992) emphasizes governance[7] as a dimension of management involving the generation of rules for management practice. Another group is more focused in identifying conditions under which the WUA can perform irrigation management tasks (see for example, Vermillion, 1995, Vermillion and Sagardoy, 1999, Groenfeldt, 1999, 1996; Meinzen-Dick *et al.* 2002). They are more focused on organizational type, size of organization, compatibility of structures and clear water rights. Both of these approaches are more concerned over finding appropriate conditions and generating rules to govern and manage irrigation water. However, they fail to understand governance as possible under divergence forms of regulation and control[8]. Participation, done well, helps build the process through which governance develops and to find ways where there is consensus.

Both of these discussions are based on the 'functional model' of the WUA, which describes conditions for the management to work. It is guided by the assumptions that the WUAs are non-partisan, non-political and homogeneous bodies, and perform the irrigation management tasks as designed. These discussions do not show the conditions under which accepted rules and organizations come into being. To understand the dynamics within a WUA and their functioning, their political character has to be recognized.

The WUAs are also political bodies, through which the farmers aim to increase their political power to bargain and negotiate with the government and other agencies. Farmers use their social and political status to be representatives in the WUA and at the same time use these positions within the WUA to further increase their political and economic power. Though the members are selected through democratic election, attention can be diverted towards more vocal groups because of the pattern of socio-political dependence and lack of literacy among the farmers. Different stakeholders have competing and conflicting interests, different opinions and access to different knowledge and information (Vos, 2002) which also shapes the outcome of the WUA structure. However it is not surprising that the discussions so far have given less attention to political aspects of the WUA. This is because the reform process is mainly guided by concerns over the financial sustainability of irrigation.

To function well, organizations require resources as well as legitimacy, and these are often linked in political action. Organizations will continue to contest rights and seek resources externally for their own survival and preferred means of operation, which then further adds to the legitimacy and power. The WUAs thus exhibit as much a political character as a functional one, and the two cannot be separated. The difference is that where the WUAs are functioning well, their political dimensions are less visible, whereas when WUAs fail to function, their political characteristics are visible and often blamed for any program failure. In Nepal, there is also a dilemma that the government's version of the WUA is only the functional model: they view its political characteristics as a problem. The farmers' immediate attention is often the political front, and they can move away from the painstaking jobs of resource collection and system operation and maintenance (O&M).

Enabling management factors

The functioning of the WUA depends on three factors: skills, resources and accountability. Skills needed are both of a managerial (organizational) as well as technical nature. Managerial skills include the daily administration, financial administration and mechanisms to collect resources and conflict resolution. Technical skills are the skills required to operate and maintain the system. They are thus related to the technology and physical environment of the system. Technology design and development should thus be based on the skill of the local organization to operate and maintain the system and operational procedures and decision making process in local social environment. A WUA can buy in the necessary skills or develop these themselves. In this respect, we see two different WUA models: 'management models' and 'participatory models'. The WUAs which function in management mode, as in Mexico (Kloezen, 2002) and the USA, buy in most of the administrative and the technical skills; where irrigation management are carried out through hired professional staff. However, where WUAs are directly involved in management as in most of the Asian countries including Nepal, these skills have to be developed within the WUA body.

However, there are two challenges in developing skills within the WUA. The first is that WUA members are not permanent, they change due to elections: it may be possible that an entire new body is formed without any of the skills developed by their predecessors. Also, skills cannot be developed with one instant of training and capacity development, but have to be built through experience and learning over time. Often the implementing agencies (both donor and irrigation agency) lack commitment to facilitate such change with a longer time framework. Efforts to get quick results without estimating the technical and organizational requirements of local organization can result in the collapse of the program in turn, resulting in demoralization of the local groups (Brett, 1996).

A WUA, like any organization, requires resources to perform its activities, which are linked with both skill and accountability. Unless service is delivered according to the farmers' needs, and also payment mechanisms are structured to ensure payment, farmers are not encouraged to pay for irrigation. As mentioned earlier, this depends on the skills the WUA present in maintaining the irrigation service and setting up acceptable procedures. Failure to maintain accountability would also result in the farmers' distrust of the WUA and result in poor resource mobilization.

Accountability[9] has different dimensions and is the key factors that strength or weakens the leadership within the WUA. The WUA loses its credibility at local level upon being failed to maintaining accountability. In irrigation, it is between the WUA and the users, and between the Irrigation Agency and the WUA. It is a two-way mechanism, not only that the WUA management should be accountable to the user farmers, but the users are also accountable to the Board. Likewise, both the government agency and the WUA are accountable to each other. Failure to maintain accountability from one side also results in failure on the other. The struggle to do this in a project context, and wider water management context, are shown in this thesis.

1.4 Irrigation Technology, its Design and Management

Technology commands a central role in transforming irrigation practices, mediating between society and the physical environment. Technology in its widest sense can be considered as the capacity to transform goods into desired things (Vincent 1997 b). It thus involves material objects, knowledge and skills to transform objects into goods. In this study, I consider technology as an artefact or material object (Hoogendam, 1994; Mollinga, 1998; Latimore, 1986) and that can be studied as a hard system dependent on a soft system (the hard and soft systems are discussed in next sections). This allows for the practical study of design construction and operation of the irrigation technology.

The social (soft) dimension of irrigation technology is best understood through recognition of the social shaping of technology, that it has social requirements of use, is socially construction and has social effects[10] (Mollinga, 1998). This also provides new light for designing structures at the interface between the state and the users in jointly managed systems.

Technology design and development is a social process where different actors involved interact continuously to shape technology outcomes. The important actors in this process are the agency engineers, WUA members, common farmers and politicians in some cases. In the process of design and construction these actors talk, negotiate and struggle with each other about the actual end result. Design and construction are thus formed in arenas in which there is social interaction between different social actors about the characteristic of the technology (Boelens, 2002). The arenas and the interaction are space- and time-dependent, conversation and negotiation may take different forms: conversations in the field, official meetings, but also obstruction of machines or refusal to participate in construction (Hoogendam, 1994). This requires that design process should be decentralized, and utilize users' needs, knowledge and skills. These concepts also form the theoretical approach to interactive design and participatory technology development (PTD) explained later.

The service and technical characteristics of technology

The issue of water delivery service through design management interactions have been well discussed in recent years and there has been concern to ensure that structures are designed to be appropriate to local knowledge and skill and local objective of water management (Lankford and Gowing, 1997. Lankford, 1998; Horst, 1998). To better understand the design of artefacts and their service delivery, I further operationlize technology in terms of its characteristics: the technical characteristic and the service characteristic[11]. The first describes the internal structure of the artefacts and the second implies the functioning or the service of the artefacts. However, certain types of service delivery emerge from certain types of technical configuration, and the two are related. For example in irrigation, the service delivery patterns of proportioning weirs and those of adjustable gates are different, and they have different technical configurations. Both serve the purpose of water delivery, but the service patterns are different. The technical and service characteristics in irrigation structures can also be described in terms of their structural and hydraulic behaviour. The structural dimension describes the materials, their shape, dimensions, and the geometry of the structures whereas the hydraulic dimension determines the flow parameters, like flow discharge.

The need for technical change to support institutional reform is decided by the compatibility of the existing technology to meet farmers' preferred service pattern. Technical change can be looked into two different ways: radical or incremental (Savioti, 1988).

Radical changes involves creation of entire new sets of technology abolishing the existing one, and are needed if there is no scope of meeting the service requirement of the users with modification of the existing technical configuration. Incremental change involves the change in technical characteristics of the existing technology, and is preferred if new service requirement can be put in place with modification in the existing technology. However, when technology change brings new options and conditions, these should be reviewed by users for acceptability of water delivery and operational requirement of new systems and there should also be space for new operational routines to be evolved and agreed. Halsema (2002) has emphasized how the need to define these new routines is often neglected.

Participatory design of irrigation technology

Papanek (1985) describes design in its widest sense, as the imposition of meaningful order. Thus one can ask who orders and meaning shape the structures and processes of artefacts and institutions introduced in irrigation. Technology design to support institutional reform for water management involves negotiation about the design objectives, the design methods and the process of implementation at every step in the process. The use of tools like Participatory Technology Development (PTD) has been advocated to support local water management, and have been used in Nepal and this study.

PTD is a process of design shaped by the interaction between local users and external change agents and other relevant actors involved in water management. This interaction is meant to increase understanding of the main characteristics and dynamics of that particular systems in its agro- ecological context, to define priorities, analyze problems and experiment locally with a variety of technical options. It systematically presents participatory tools and approaches in technology development from initial contacts up to the evaluation of activities and phase out of external support. Ashby and Spurling (1994) have given four characteristics of participatory design: client-driven, decentralized technology development, decentralized management and accountability. The limitation in the application of the tools like PTD has been due to narrow focus and understanding of participatory development process in the current development discourse.

Boelens (1998) mentions that because of the conflicts, negotiation and farmers' mediation process associated to real-life irrigation design, the outcomes can be quite different from the ones planned. Different actor groups can define their own strategies, call in the necessary capacities and resources and enter into the diverse political arenas at local, regional and national levels, in order to struggle for their interest, negotiate and exert pressure. In these formal and informal platforms-according to their point of departure, strategic alliances and the power that different groups are able to bring in these negotiation- farmers groups are in a position to inject their ideas into the irrigation design. The design results as an outcome of these ongoing negotiations (ibid).

Irrigation management

Irrigation involves the movement of water by people to crops through the use of technology. To make water available in the farmers' field, three factors are thus involved: water, people and technology. Technology is at the centre and mediates the two in transforming irrigation practices. Irrigation management then can be considered as the mechanism; that is; the actions, processes and institutions involved in getting water to farmers' field.

Earlier works to define irrigation management include Coward (1980) and Uphoff (1985, 1986). These standard frameworks of management tasks have been criticized, especially in their failure to understand how particular management activities appear in the field (Van de Zaag 1992; Manzunga 1999; Wahaj 2001; Halsema 2002). Manzungu pleads for better understanding and recognition of contingency management, with roles, rules and actions emerging from every-day necessities. Halsema demands that thinking about management takes stronger recognition of technology needs but also of the social environment: not just of what is possible but also how people choose to develop and use local organization. He also stipulates that it shall recognize not just functions but also process of decisions making, monitoring and direction.

Irrigation management as a form of water control.

Mollinga (1998, 2001) defines three dimensions of irrigation management in the form of water control: technical, organizational and socio-political. The technical dimension relates the regulation of physical forces to control the flow of water, and technical control provides means to capture, convey and distribute water through the physical artefacts. The organizational dimension of the water control relates to the regulations of human behaviour in daily irrigation practices, such as a WUAs and different rules and regulations to make the WUA work. The socio-economic and political dimensions refer to the wider societal conditions shaping the possibility for particular management practices to take place. It thus varies from the everyday struggle to get water at the local level to the changes in the relation and accountability between the state and users to make the management work. It also recognizes that water is politics, that water delivery often both involves political actions, and that WUAs are political actors. This sociotechnical approach is used in this study. To understand how irrigation systems are designed, operated and used by people to provide water for production.

The three dimensions of water control are intimately related with each other, and policies that seek to achieve changes in the irrigation management therefore have to address all three dimensions. This is clearly reflected in the current irrigation management reform program in Nepal, where efforts to establish new management have involved technical intervention, organizational development and their legal and political support. This thesis examines how these different issues were addressed in Nepal, and also how the changing control in one dimension changes the other control mechanisms.

The system environment and water distribution

The sociotechnical nature of irrigation systems, where the technology of the systems shapes and is shaped by bio-physical system and society, shows the complexity of irrigation process situated between the domains of physical and social environment. Both the social and physical environment are dynamic, and bring new situations and challenges in the management continuum, so management, should be thus viewed as a process rather than a task. The interplay between the technology, physical environment and society requires understanding of the systems involved, as Checkland (1981) notes that untangling complex interrelationship requires an understanding of entire system involved.

Designing for participation in irrigation water management has to address irrigation such that it translates the constraints and opportunities of the physical environment and provides a way to capture and transfer water to farmers' fields and at the same time address societal concerns in practical design. The physical environment is more tangible, and scientific approaches to irrigation design exist, which employ agronomic and hydraulic principles. However, despite available scientific knowledge for innovation[12], irrigation systems still face challenges due to these variable characteristics of physical environment. For example irrigation systems confront three different levels of physical (also managerial) domains: the watershed (catchment) level, the conveyance and distribution level and the water application level (Keller, 1990). The river regimes on an irrigation system often have intra- and inter-annual variation in water quantity and quality as rainfall varies. The extent of silt load depends on vegetation cover and land use practices in the catchment. The same area that faces water scarcity in one season may suffer from inundation and flooding in next season. Within the system itself, the conveyance canals and water distribution structures confront several cross-system streams and are vulnerable to them. They should not only be able to deliver the required irrigation service to the users but also be safe enough from the threat of physical environment like flooding and inundation, and be consistent with seepage patterns and problems. These situations give rise to particular challenge in irrigation management, which can be beyond the capability of the local managing units.

The social environment is also critical to irrigation, and is equally dynamic. Studies have shown that irrigation is as much socio political processes as technical and how the processes to get water is shaped by values, interests, knowledge and capability of users, local rules and practices, socio-political condition (Mollinga, 1998; Wade 1982; Zaag 1992). This study focuses on the agrarian conditions and social forces shaping the water delivery process: it is especially concerned on the strategy and actions of people and the socio-political dependence in society and how they shape the institutional arrangement and management regimes leading to both intended and unintended results in water management.

To help understand these social and environmental dynamics the study adopts and agro-ecology perspective. To Altieri (1990) agro-ecology is an approach that allows a focus on the principles on which to base agro-ecosystem design, leaving the specific technological form to be determined by the agro-ecological milieu. It thus allows a focus on how farmers discriminate, adapt, and select technologies of use to them, while also validating older local practices. This helps understanding of the interventions to take water for irrigation and distribute it (but also problems from the water sources), and also of the agriculture and agrarian conditions that shape the agroecology of the systems. Manzungu (1999) has also described how water distribution is shaped by: the water source, irrigation technology, socio-political relations and commodisatizion effects.

1.5 Participation, Development Intervention and Policy Reform

The paradigms for rural development pursed and practised in developing countries have transformed greatly since the 1950s. Failure to achieve intended results through transfer of technology policies caused shift towards a more user-centred approach to development, and 'people first' development model based on popular participation gained popularity in the 1980s and 1990s (Brukley, 1993; Chambers, 1997; Cernea, 1991). Structural adjustment and neo-liberal polices of the 1990s further shifted attention from participation to local governance. The focus of water resources management has also shifted accordingly, from technology transfer towards decentralized and user-centred approaches emphasizing participation and local organizational development as explained by Clyma (1989), Uphoff (1986), and Korten (1984). This has changed the development problematic in two ways: Firstly, the focus has shifted to the promotion of local water management through user organizations; secondly, design approaches have also shifted towards participatory design processes to support organizational evolution. More recently, attention has been shifted towards promotion of local governance and transfer of irrigation management to user groups commonly referred to as Water Users Associations (WUAs), has been central in the irrigation reform process (Vermillion, 1999; Meinzen-Dick *et al*, 2002, Johnson *et al.*, 2002).

Participation in irrigation engineering has thus become central concern, and also of this study, with focus on both the development of the WUA and the participatory development processes to support them, with a central focus on the role of technology in these processes.

Conceptualizing participation and innovation and the relations between them

Participation has become is a very broad concept, and has been debated not simply as action but as objective. It has be viewed in many ways; as a way of mobilizing people to solve their own problems or as process for releasing people from being subject of change to agents of modernization (Korten, 1983). People can come together or be forced to come together. Several authors have developed typologies of forms of participation[13]. Musch (2001) notes that though this ladder type of typology is appealing and simple, it is too simplistic to handle the issue of multiple farmer groups.

Innovation here is considered as a new way of doing things or doing new things, and can only be considered innovation if it actually works in practice (Leeuwis 2002). Innovation is thus not only composed of novel technical devices or procedures but also of new or adapted human practices, including the conditions for such practices to happen (ibid).

This study rather looks as the origins of participatory efforts and the methods used. Participation does not operate in vacuum, it is linked with certain development objectives. Another limitation in the debate so far is that participation is seen as transaction between the farmers and the engineers (or facilitators). It is argued here that there are different development contexts linked to participatory frameworks for intervention, and there are different domains of action in participation (Vincent and Khanal 2002, Vincent 1997). The different development context of participation do have different concepts of innovation and different sets of participatory methodologies linked with them.

Development context 1: Economic development and modernization

In this context, participation is an approach (by agencies) to induce increases in performance or impact, through providing conditions or incentives that enable farmers to take on new responsibilities and opportunities. Participation here has moved beyond project execution to policy reform and self-governance, and even been considered the way to operationalize decentralization as the motor for democratic transformation (Cornwall, 2001) Innovation then concerns new activities that improve linkages between resource use and production – new techniques, artefacts or institutional relations. In irrigation, its primary focus is on institutional reform to both local organization and the irrigation bureaucracy, but also heavily focused to system modernization to provide better working conditions for farmers. It lays emphasis on participatory design processes to support evolving organization, and calls for accountability between the irrigation agency and the WUA and between the WUA and the farmers. Thus, participatory approaches that allow local negotiation and evolutionary change rather than blue-print models work best. However, it is vulnerable to blueprint ideas about WUA development and new technologies, and over-expectation of what users can do. Bureaucratic reform is a time-consuming process, and is often outside the framework of funding agencies. This context of participation is the backdrop to the IMTP and its policy tools and intervention approaches, and to my work.

Development context 2: Joint planning and problem solving

Here, participation is a process through which stakeholders influence, share control and work together to achieve desired change. Innovation is shown through the changed behaviour of the people involved, and the sharing of knowledge and skills. This context focuses on the generation, transfer and exchange of knowledge as a means to beneficial change. It recognizes that technology is not neutral and technological change should reflect local needs and knowledge. Also that people have a right to self-determination over their development. In the field of technology development in this context, Participatory Technology Development (PTD) has got considerable attention as an approach. However, the technical biases of many engineers, and their sense of status that makes them unwilling to accept farmers as partners and lengthy bureaucratic process often yields failure to make design process participatory. This context drove the choices of participatory methodology within the project framework, and the personal actions of many field-level actors described in this thesis.

Development context 3: Social inclusion, improved equity and reduced vulnerability

Participation here is organized efforts to increase control over resources and regulative institutions in given situations on the part of groups and movements of those hitherto excluded (a definition from an ILO program). Innovation is the delivery of different benefits to different people. This context recognizes the tensions and complex politics of negotiating change in many different arenas, but needs highly motivated and conscientized actors to empower change. It is committed to capacity development of the users groups and concentration on the certain marginalized groups. However, the danger may come from its conscientizaion and political action which may lead to collapse of existing management arrangements without new forms to replace it. Very different levels of action in this context occurred in the three systems studied: political struggle brought improved equity within Khageri and Panchakanya, but has hardly improved any conditions in West Gandak.

Domains of participation

These contexts help explain differences in concerns and actions of key actors in the IMTP process at field level. In addition however, the interfaces with different stakeholders must be understood, in terms of their sphere of influence and local representation, their interests in participation, and their practice in relation to water supply and water users. In a large irrigation system, participation is not only with farmers directly. More commonly negotiation will also be done through water user organisations (whose representation often changes), as well as with system operators, and the contractors who often implement new construction. These different domains present different opportunities and challenges to participatory approaches. Successes in some areas – like working with farmers to agree new designs and irrigation schedules - may be tempered by problems in other areas – like failing to get good quality construction under contracts. As a designer and implementer, I had to work across these domains and interfaces – to get farmers' ideas put into practical reality and researchers have to see those domains and interfaces.

The different development contexts of participation together with the different domains of interactions constitute a 'Participation Complex' in which a facilitator works and actions are shaped. In a real-world situation, a program execution can involve all the different development contexts together, requiring understanding of the clashes these can bring between people with different aims and objectives in participation. These outcomes help explain policy as 'process' where people reshape water management with around new policy instrument and their own objectives, to give intended as well as unintended effects.

While writers like Boelens (2002) have listed a wider range of contexts of participation, these three context are used here as they are clearly visible in the transformation sought in IMT in Nepal, and in the project dynamics discussed in this thesis.

Participation, policies and project environments

As noted in context 1, policies can be introduced to formalise both the forms of local governance envisaged and programmes of support to achieve policy aims on the ground. This study sees policy as a process (Grindle and Thompson, 1992) where policy directives and guidelines are adapted in use locally by a wider range of agencies and individuals, and where local dynamics can also feedback to reshape policies. This study also shows how the participatory processes used to effect new policies for WUA development both shaped and reshaped policy tools and outcomes.

Projects and programs translating policies into action involve a complex environment involving various actors. Interventions seeking management change requires the bringing together of agencies and individuals together in the program process. Their participation in the process can be partial and conditional. Intervention must thus be understood to take place in a complex highly populated landscape of human activity (Wield, 1999).

Managing such a change process involves building of coalitions (Biggs and Smith, 1998), or networks (Mahanty, 2002) among the actors, learning lessons and feeding them back into practice.

This political and interactive nature of the development intervention, has led a call to shift from conventional blue print models of project implementation to participatory process-based approaches to projects/interventions (Korten, 1980; Hulme, 1995; Rondinelli, 1983; Brinkenhoff, 1996). Though process approaches have been also looked upon in different ways[14], they emphasize experimentation, learning, adoption, participation, flexibility, building local capacities and organic expansion (Bond and Hulme, 1999). They have a common feature of joint planning, decision-making and social learning. This was the proposed framework for the IMT project. However, despite efforts, in reality, the rigid project process set by the donors, shorter time frame, and hierarchical bureaucratic structure still limited the outcomes of the learning process. In irrigation intervention, initiating intervention without initial learning about both human and physical/technical dimensions has often led the blueprint application of the methods, though participating staff are motivated and committed.

Another weakness in current participatory interventions is in handling conflictive situations. It is guided by the notion that consensus is possible out of learning and negotiations among actors. However, people are not only rational choice makers but act purposefully guided by their interest and values. Long (1992, 2001) shows that people possess 'agency', or knowlegeability and capacity and their actions are shaped by strategic interactions in a network of social relationships. He views intervention as an arena of struggle and action, a multiple reality constructed by the ongoing social and political struggles taking place among the actors. This study also takes this view.

Planning models aim to solve these problems by bringing different actors together in a common forum. However, as noted by Leeuwis (2000), it will not be easy to make actors set aside their conflicting personal interests during the process. Besides, different actors are located at different institutional layers and have different power positions, making it difficult to obtain favourable outcomes. Considering these weaknesses of participatory trajectories, Leeuwis (2000) argues for a negotiation theory in designing the participatory intervention. He pleads for integrative negotiation (see also Meegeren and Leeuwis, 1999), where stakeholders develop (new and often wider) problem definitions and perceptions on the basis of a creative collective learning process, resulting in the identification of so called win-win solutions. This study shows that negotiation might guide the intervention. However, equally important is to adopt collaborative learning that demands reform in bureaucracy and donor agencies, such that learning is extended beyond local level.

Locating the actors: Projects and their environment

Interventions take place in a sea of linked activities that involve multiple agencies - where the objective of an individual organization do not necessarily add up to and coincide with those of the project or the target group and where issues are often complex, ill structured, interdependent and multi-sectoral (Wield 1999). It is therefore essential to move beyond actors and locate them and their sphere of influence in the intervention process

Smith *et al.* (1980) differentiates between three different environments of a project:: the controlled environment, the influenceable environment and the appreciated environment. The controlled environment is those elements which are inside the boundary of the implementing agencies for example the field staff, the budget etc. Actors in this environment are those involved in everyday implementation and management. The influenceable environment involves those activities and institutions that can be influenced by the projects and organization, but cannot be controlled by it. The appreciated environment involves those, whom the projects or the organization can neither control nor influence, but whose actions can still highly affect the outcomes of the project or organizational management activities.

However, the term 'controlled environment' does not satisfy field level reality. It is true that actors in the field level are visible, and that certain actions can be controlled and put in to practice through consensus or negotiation at this level. However, actions and struggles are more dominant at field level, as here actors engage in daily management activities and have high stakes in control of the process. There can be thus no such a thing as a 'controlled' environment. A term like 'internal environment', is considered more appropriate. Actors in this environment are those involved in every-day implementation and are thus part of everyday politics and struggle. This division of actors at different levels has the advantage that it locates the actors and their sphere of influence; it helps us to realize that actions and struggle take place beyond the local level, and influence the design of the program process and the policy outcomes accordingly. Project environments are dynamic too. As projects, interventions or other forms of management activities move on, they bring new situations with them. New conditions can also come through policy and legal changes.

1.6 The Central Research Question

Based on the research review and above theoretical discussions, the central research question of this thesis is set as follows:

What participatory processes have been used in irrigation management transfer (IMT) in Nepal, how did they evolve, how has technology been addressed in these processes, and how have these processes and transformations been shaped by their system and project environment?

IMT here represents not only the event of management shift to the WUA from the government to the WUA and the support process for this, but also includes the changes in management under the WUA. The system environment refers to the system's social and natural environment.

1.7 Methodological Questions and Approaches.

The hermeneutic challenge

A critical concern came with my past role as an actor in the management transfer process. I had to interpret my past actions and past texts and procedures, and tried to do this honestly and straightforwardly. My past position brought me advantages and disadvantages. I had advantages because when working in IMTP, I was not assuming that I would write a thesis on this. So I did not have to juggle with the dual role of a Ph.D. researcher and that of a facilitator; the actions were not guided by the research objectives. [15]Also, I was an insider, and there was no threat to me from others. However, like Groot (2002) I worried about uncovering the weaknesses of our professional work, and making them known. I write about a Department where I work and people who are my colleagues, some senior in positions. However, I was never victimized for the questions I tried to answer.

Shaping the knowledge base

The thesis employs both qualitative and quantitative data, but qualitative data dominates the presentation. Data were generated from both direct involvement and secondary sources through different techniques. Data especially about the current management changes that appear in chapter 8 and 9 were collected between August 1999 to August 2001. The elements of data collection are described in the paragraphs below.

Restructuring the process of action

The principal data source for this is my own actions and my memories of it: the elements of joint actions for Khageri and Panchakanya are from this. I also revisited the past actions with the farmers and the WUAs, and my previous staff involved in the implementation. Data for West Gandak were generated from review of project documents, from interviews with the key informants, including WUA members, engineers involved in the implementation in West Gandak, and consultants and project officials working for IMTP in the central Irrigation Department office in Kathmandu. Documents reviewed included the detailed design reports, the minute books of the WUA, action plans and documents of agreement between the WUA and the Government.

Studying local management action and evolution

This was done by direct observation in the field and also through review of secondary literature. I observed the field level activities and irrigation water management practices of the WUA. To understand the WUA themselves, and decisions regarding their water management problems, I attended their meetings at all association levels. I also carried out some flow measurements to know how the improvement work has been able to control canal seepage, and provide better water availability to the farmers. In West Gandak I measured the extent of silt deposition in the canal.

I also reviewed secondary literature to study the management actions of the WUA: the constitution and by-laws of the WUA, and the minute books of the WUA, to understand the rules and regulations of water distribution, and their financial status and fee collection mechanism. Project progress reports also provided information on evolution of the new management, and had been prepared by donors, consultants and the DOI at various stages of implementation of the IMTP.

Understanding the effect of change

An asset survey[16] of the canal system networks was another source of field data, made to understand the effect of the change on infrastructure management and farmer satisfaction. This survey was done jointly[17] with a research team from HR-Wallingford and myself in Khageri and West Gandak, to find its current condition, and how system improvement had facilitated management change.

Given my ongoing research and own plans to do an asset survey, the chief of research in the Irrigation Department (COR) included me in the team. In West Gandak, I had already selected MC-5, Mangharia and Germi Minor for this study, based on their geographical location as head, middle, and tailend minors. Another reason was that all had committees (although not functional) and farmers were familiar with the IMT program. In Khageri, branch canals B_1, B_5 and B_1 were selected, also based on their geographical location (head, middle, tail location). They were also the first group of branch canals handed over to the WUA. By 2000, it was some four years since technical improvement works were carried out.

In Panchakanya, I undertook the asset survey myself, and a research assistant undertook the interviews with farmers. Otherwise, two other teams carried out this research. The COR and myself did the asset survey. An NGO was involved in interviewing farmers on their perception of the management change through structured interviews in both of these systems. This was an advantage as I wanted to avoid interviewing myself, especially asking farmers about the performance of the systems, given my prior involvement in Khageri and Panchakanya, and that most key WUA and farmer members in West Gandak knew I belonged to the Irrigation Department.

1.8 The Structure of the Book

This chapter has given the research objectives, and the analytical framework and methodology for the study. **Chapter 2** reviews the evolution of irrigation management and reform in Nepal and the key policy instruments used, which it shows is linked with the historical evolution of irrigation development, and to donor policy changes world-wide. .

Chapter 3 introduces the irrigation systems studied: the Panchakanya, Khageri and West Gandak systems. It gives an historical account of their development and agroecological characteristics, and discusses their challenges of water delivery and key management problems. It concludes with a review of the opportunities and constraints for these schemes to take up irrigation management reform.

Chapters **4 to 9** present the process of IMT in Nepal and thus forms the core of the thesis. Chapters 4 to 7 describe the joint actions involved to promote new management. Chapters 8 and 9 describe the evolution and change of the WUAs and the management.

Chapter 4 presents the beginning of the reform process. It describes the process of group formation, and negotiation for change and struggle therein. It shows how organizations come into being with different structures as a result of different societal dynamics despite being based on identical design approaches.

Chapter 5 reviews the joint planning process, which is considered as the first and most important element of the participatory project process. It discusses the process of preparation of the technical inventory of the systems, setting a vision for the future and development of the plan of action for the future system development. It shows that mere use of tools (canal walk-through in this case) is not sufficient to incorporate users' needs and preferences in the planning process. It is a question of who participates in the process, participatory processes used, and the context in which the interaction takes place.

Chapter 6 examines the participatory design and construction process looking at the changes in infrastructure and irrigation scheduling materializing through negotiation. It argues, in the context of management reform, that participatory design construction should not be taken on its own, but rather be taken as a way to help new management decide on and establish service oriented water control they can ensure. It also draws attention to some of its limitations of PTD and calls for a multi-actor negotiated learning process for future implementation design.

Chapter 7 presents the dynamics of management handover to the WUA and shows how project environment and wider social environment shape the outcome of the organizational debut of the WUA. It also shows that shift in control of management from the government to the WUA also requires reform in other sectors of the political and administrative institutions of the government, besides reform in the irrigation sector.

Chapter 8 describes the changing governance structure for local water management. It shows how organizations become strong when supported in their administration and structural evolution. It argues that a WUA should also be viewed as a political body, against the common assumption that it should be a non- political, non -partisan functional body. Only in this way can it achieve both accountability to its members, but also create controls complementary to technical and organizational.

Chapter 9 describes the evolutionary changes in management activities and show how they are shaped by the system environment of the irrigation system. It argues that project support to facilitate management reform should translate the constraints of system environment in practical design to provide better working condition to the farmers.

Chapter 10 presents the conclusion of the study which summarizes the key learning from the research relating to organizational evolution, the participatory support process and the role of technology in transforming irrigation practices. It also explores the agendas for future study on participation and local governance.

Notes

---

[1]State disengagement, management devolution, privatization, turnover, handover, or more recently the term 'Participatory Irrigation Management'

(PIM) are also synonymously used for IMT. However, PIM is an umbrella concept in which various forms of joint management arrangement can be devised between the users and government: the local organization may complement or replace the irrigation agency. When the local organization replaces the irrigation agency, it can be viewed as IMT. For a more detailed distinction, see Vermillion and Sagardoy (1999); Meinzen-Dick (1996).

[2] Irrigation systems in Nepal are classified as Agency managed, Farmers Managed, Groundwater systems and private systems.

[3] 'Department' hereafter refers to the Irrigation Department of Nepal.

[4] From 1988, the government started rehabilitation of FMIS on a large scale, with World Bank funding for the pilot scale under the ILC project. Parallel with participatory design and construction activities, the ILC intervention also involved formation and capacity development of WUAs. See Pant (2000) for details about the ILC and FMIS intervention in Nepal.

[5] Positivism considers science as the source of knowledge. It treats human beings as objects. Development process are accordingly linear and mechanical, whereas constructivism considers reality to be socially constructed and no single party can control the process. See also Groot (2002).

[6] The program is funded by the Ford Foundation for studies on relations between technology and institutions in Nepal and India

[7] Governance is seen here as diverse forms of regulation and control used in management conceptualised by a governing institution: a WUA, is only one form of such regulation. Ostrom differentiates between three different layers of rules: the operational rules, collective-choice rules and constitutional-choice rules, which cumulatively shape an irrigation system.

[8] Aggrawal (2001) and (Kloezen, 2002) discuss further the limitations of these approaches.

[9] Accountability is defined here as an obligation to give a reckoning or explanation for one's action, in relation to expectations or agreements about that action.

[10] For example, fixed structures provide low management intensity and a high level of transparency; the local organization may prefer transparent control system at the cost of flexibility. Gradually adjustable structures are complex to handle and need regular maintenance, but provide more flexibility. Organizations capable of providing high management intensity and strong social control may prefer this type of technology. In summary, we can say that the management structure is shaped by the irrigation technology (see also Horst, 1998).

[11] This is adopted from Savioti (1988), where similar divisions are made to understand technical change in the industrial world.

[12] For example, since 1885 efforts have been made to design canal to avoid silt and scouring, and regime theory has been widely used in the

canal design in Indo-Gangetic plain. However, systems continue to suffer from siltation problems, as wells as water-logging, inundation or flooding.

[13] For example in a range that varies from manipulation to self-mobilizing, and from listening to sharing to empowerment of a group, or from non-participation to degrees of citizen power (Arnstein, 1969, cited in Fisher, 2001; Pretty, 1994; Van Vuren 1998). It can be pseudo-participation (White, 1994; Abler 1993, cited in Shukla and Sharma, 1997), where the decision-making power rests with managers and planners and the local elite. It can be free or forced participation or customary participation. It can be direct participation where all are participating, or indirect participation where specific groups participate on behalf of large groups (Dusseldorp 1993)

[14] For example Korten (1980) argues to shift away from the project framework and emphasize on local institution building, whereas Brinkerhoff (1996)and Rondinelli (1983) plead for flexible and adoptive management under a project framework.

[15] Chambers notes that outside agents for facilitating change are often considered a threat to insiders.

[16] An asset survey in irrigation documents the amount and condition of physical infrastructure and equipment available for the operation and maintenance of an irrigation system.

[17] At the midpoint of my fieldwork (May 2000) HR-Wallingford (a UK consultancy company) and the Irrigation Department planned to carry out research on the operation and maintenance status of the transferred and non-transferred irrigation systems in Nepal (also in India), to find out the operation and maintenance requirement of these systems, and gain a clearer picture on maintenance status in branch canals recently rehabilitated. The two-transferred systems selected were Khageri and West Gandak where I was also doing fieldwork. I was also planning to carry out an asset survey to monitor farmers' satisfaction with the system.

2

Irrigation Development, Irrigation Policies and Irrigation Management Reform in Nepal

The current irrigation management reform process in Nepal has not emerged all at once. It has emerged out of changes in development policy worldwide as well as the historical context of irrigation development in the country. The chapter begins with a historical review of modern irrigation development in the country and explains how the state gradually became involved in irrigation development, which used to be a farmers' affair. It will be shown that the state's expanded role in irrigation management was due to changes in local governance structures brought on by political and administrative changes, as well as the initiation of large-scale irrigation construction activities. The chapter then explains why the state's increased role in irrigation was problematic, and how attention then shifted towards participatory management, necessitating policy reform in the irrigation water sector. It then describes the current irrigation management transfer program and its implementation framework. The chapter concludes with a summary of the key strengths and weakness of the reform process, which also come to shape the scope and nature of changes in the project and the WUAs.

2.1 Modern Irrigation Development in Nepal: an Historical Overview

Modern irrigation development in Nepal is said to have started in 1922, when an irrigation system, later named Chandra Canal, was designed and built by British engineers in India. I call it 'modern' to differentiate from the indigenously developed irrigation systems popularly known as Farmer Managed Irrigation Systems (FMIS), which have been in existence in the country since time immemorial. The Chandra Canal was initiated after a severe drought in Kathmandu, upon the request from the then Rana rulers to the British rulers in India (Poudel 2002, personal communication). However, it is also said that the construction of the Chandra canal was not aimed at the public welfare to overcome the problem of drought, but at increasing the land revenue or irrigating the *Maujbas* (land grants) belonging to the Rana family. The British had already started construction of large irrigation systems in Indian areas bordering Nepal, like the Tirhut Canal in 1911 and the Sarda Canal System in 1920[1]. The Tirhut canal was constructed at the Indo-Nepal border in Nawalparasi district (where the present Gandak Barrage lies), whereas the Sarda Canal was constructed from the Mahakali River[2] (called the Sarda River in India), the border between India and Nepal in the west. So the construction of Chandra canal by the British is also said to be the start of large-scale irrigation works to fight any future drought and famine.

Government involvement in large-scale irrigation development remained limited. In the next 30 years, only two more systems were added (Pradhan, 1996): Jagdishpur in the western Terai in 1942 (1000 ha), renamed Banganga Irrigation system after being expanded in 1978, and Judha Canal in 1946 (2000 ha) later called Manusmara Irrigation System after being expanded in 1976. Even though developed by the government, their management responsibility lay with the farmers, who were to raise the costs of O&M

Irrigation development remained in the farmers' domain until the start of the Democracy period in 1951[3] and except the few ones mentioned above, all of the country's irrigated areas were developed and managed by farmers. Many of these FMIS emerged out of the *Birta* and *Jagir* type of land tenure systems[4] practiced in those days. *Birta* and *Jagir* were land grants awarded to individuals. The owners, called *Jemdar* (or *Jamindar*), had judicial and administrative powers over land use and were in a position to mobilize a labour force to construct the canal systems (Regmi, 1978). The objective behind the land grant and subsequent irrigation development was to increase State revenue, the major source of income in those days. The *Jamindar* (also called *Dittha* or *Jimmawala* in different places, see Pant, 2000) were to collect the land tax, and submit it to the concerned land revenue office.

Irrigation systems were also developed out of the 'Guthi' system. These are endowments of lands and other properties to support religious and charitable activities. Irrigation systems were developed by the Guthi to increase the productivity of the land. Some systems called 'Raj Kulo[5]' were initiated by the state. Though the patterns of resource mobilization in the development of these FMIS were different, they had common features of self-governance and strong community participation.[6] These FMIS were regulated through the 'Muluki Ain', the law of the realm, which guards the customary practices relating to irrigation and the traditional customs of different ethnic communities. It also specifies property rights and resource mobilization in irrigation systems development and management (Regmi, 1978; Pradhan, 1990).

Irrigation development and management in Nepal was thus largely based in local land management before the 1950s. Although this was linked with a type of local political control, it was not always participatory. The state had a provision to provide interest free loans to the farmers if the damage of an irrigation system, or the construction of new ones, were found to be beyond their capacity. The *Jamindar* of the particular area was responsible for mobilizing the loans as well as paying them back. The Government used to formulate regulations from time to time regarding the type of support it could provide farmers for the management and development of the irrigation systems[7].

2.2 Agency Involvement in Irrigation Development

The state's direct involvement in irrigation gradually increased after 1951. After the introduction of the democratic movement there were radical changes in government administrative systems as well as in development approaches. Several Ministries and Departments were created to manage development programs. As the country's economy was mostly agriculture-based, the irrigation sector was also given the highest priority in the government. An Irrigation Office was established in 1952 (Sharma, 1983) to look after the irrigation sector, replacing the previous Agricultural Council. The office was established with technical assistance from India and was upgraded to a directorate in 1958. It was further upgraded to a Department, to look after both irrigation and water supply. The water supply wing was later detached and the name was changed to Department of Irrigation (DOI): this has since remained the principal agency for planning and development of irrigation in the country.

The DOI was first engaged in construction of small-scale irrigation schemes, due to financial as well as human resource limitations. These activities were supported by the Indian Government and by FAO in providing technical assistance (Sharma, 1983). Commencing in the Second Plan period (1962-1965), a 'minor irrigation program' was started which aimed to develop small-scale irrigation systems with voluntary contributions from user farmers. The program continued until the third planning period (1965-1972). The objective of the minor irrigation program was to develop the systems with maximum user participation, and hand-over the system to the user farmers for O&M. However, there were no clear directives from the government: some of them were managed by farmers but others relied on continued government support for O&M activities. The government's role in irrigation gradually increased from the 1960s. This was due to two factors: change in local governance structure and priority for large-scale system development.

Changing local governance and irrigation management

One reason for increasing government involvement in irrigation sector was the change in local government structure in the country[8]. The previous *Birta* and *Jagir* systems of land tenure that had overseen earlier management in most irrigation systems were abolished in 1964. This was done immediately after the political change of 1962, after which the partyless 'Panchayat' system was established by the King, overthrowing the multiparty political system. The abolition of the *Birta* system was targeted at land reform to bring agrarian transformation in the country, and the politico-administrative changes were instrumental to the disintegration of the traditional irrigation institutions (Pant, 2000). Lands were then given to individuals after a cadastral survey was carried out all over the country. The land tax was now to be collected by the Land Revenue Office directly from the individual owner.

Under the new political system the local level government institution was the Village Panchayat (VP). The irrigation systems were now more dependent on the VP and also sought government support for their rehabilitation and expansion. However, the VPs had their own financial and technical limitations and sought support from irrigation offices. The VPs in fact became mediators between the DOI and farmers, as shown by Pant (2000). The Village Panchayat is now called the Village Development Committee (VDC) since the re-establishment of the multiparty democracy in 1990, and is one of the critical local actors shaping outcomes of the later IMT. As direct agency involvement in irrigation gradually increased, the irrigation bureaucracy expanded. By 1988, the DOI had offices at all regional and district levels[9]. In addition, there were also separate project offices to look after construction of large irrigation systems, which in most cases were separately administered through a development board[10].

Priority to large-scale scheme development

The increased role of the government agencies has been also due to the construction of large and medium-scale irrigation schemes from the mid-1960s. This was after the bilateral agreement with India on the use of Koshi River water in April 1954 and on Gandak River water in December 1959 both for irrigation and power. This agreement initiated the construction of large-scale irrigation systems namely the Sunsari Morang, also called the Chatara Canal (66000 ha), the Narayani Irrigation system (29,700 ha) and the Nepal West Gandak Irrigation system (8700 ha). The Sunsari Morang resulted from the Koshi Agreement and its construction began in 1964. The remaining two systems were linked to the Gandak River Agreement and their construction started in 1969 and 1973[11]. According to the agreement, the major canals and associated structures of these schemes were constructed by the Indian Government and handed over to Nepal. Nepal later on carried out farm-level development in these systems with multilateral funding mainly from the World Bank (WB) and the Asian Development Bank (ADB).

From the 1970s, construction of large and medium irrigation schemes further accelerated due to funding from bilateral and multilateral donor agencies, both in loans and grants. Major lending agencies like the WB, ADB, United Nations Development Program (UNDP) and International Foundation for Agricultural Development (IFAD) became involved in irrigation development activities.

With the DOI focusing its attention on the construction of large and medium-scale systems, other government institutions gradually took over responsibility of development of small schemes. The Farm Irrigation Water Utilization Division (FIWUD) of the Department of Agriculture (DOA) started irrigation development for schemes of less than 50 ha in the hills, and 500 ha in the Terai. Under this program, users were involved in making requests for technical assistance and in construction contributions. The Ministry of Local Planning and Development also started small-scale system development. The Agricultural Development Bank, Nepal (ADBN) established in 1968, also got involved in small-scale system development. Non-Governmental Organizations (NGO's) like CARE and the United Mission to Nepal (UMN) also focused on small-scale scheme development activities. However, the DOI remained the principal institution for irrigation development, and construction of large irrigation systems was given primary attention in government plans and programs.

Poor performance of public sector irrigation systems

Upon completion of the construction activities, the management responsibility for these systems was also kept by the DOI. Unit offices were established to look after the operation and maintenance (O&M) activities in the completed systems and users were expected to pay Water Tax to the Government. The rate of water tax was increased more than six-fold in March 1979 from NRs. 9.75 (about $0.8 at that time) per ha to NRs. 60 per ha (about $5) (Sijapati *et al.* 1999). The water tax was to be deposited in the government treasury, and the O&M cost of the completed systems was to be provided by the government. Contrarily, the performance of water fee collection by DOI remained poor, especially in gravity schemes (Barker and Lohani, 1987). The funds provided by the government were not enough for the O&M of the systems. Table 2.1 shows the water tax collection and allotted operation and maintenance budget for the period of 1986 to 1990.

There is no data regarding how much area was under the direct control of the DOI to estimate the collection efficiency of the water tax. However, command areas of the completed projects at that period show that about 150,000 ha were under the direct control of the DOI. Assuming this figure, the collection efficiency in this period never exceeded 40% (Table 3.1). Likewise the budget allocation for O&M was far lower than required cost of NRs. 200 per ha at that time. Lack of financial resources resulted in poor maintenance, caused rapid deterioration of the structures and required rehabilitation within a very short period of time.

TABLE 2.1 Water tax collection and O&M allocation 1986-1990

Year	*ISF collection in Million NRs.*		*O&M allocation in Million NRs.*
1986/1987	1.2	13.3%	6.9
1987/1988	3.6	40.0%	7.9
1988/1989	3.5	38.8%	8.7
1989/1990	1.9	21.1%	10.4
1990/1991	1.0	11.1%	4.6

Source: Economic Survey of Nepal, 1998, (cited in Sijapati, 1999)

Despite considerable investments in infrastructure development and a well-trained cadre of technicians for design, development, operation and management, the public sector irrigation schemes in Nepal have been constantly performing below expectations. A series of reports published by the Agricultural Projects Service Centre (APROSC) during the late 1970s were fundamental in drawing attention to this poor performance (APROSC, 1978a, 1978b, 1978c). However, no effective solutions were proposed to solve this poor performance of large-scale irrigation systems, and more investment for command area development and other rehabilitation programs continued.

2.3 Searching for Solutions: Management Reform with Farmer Participation

The world-wide interest in user participation in development in the 1980s also changed the course of irrigation sector development in Nepal. The attention now shifted towards management improvement in completed systems, rather than new construction. Irrigation interventions were then directed at promoting local management, and participatory design processes were adopted to support the evolving organizations. The USAID started the Irrigation Management Project (IMP) in 1986, which worked as the foundation for future irrigation management reform in the country. The major aim of the IMP was to improve irrigation management practices in both agency- managed and farmer-managed irrigation systems. It aimed to develop and sustain irrigation management activities by improving the capacity of both DOI professionals and water users through training and research activities (Shukla and Sharma, 1997). The IMP activities were facilitated by a joint team of Consultant firms - Louis Berger International Inc. (American), East Consult (Nepali), and Cornell University (American)[12]. The objective of the IMP was reformulated in 1989: to support the DOI in implementation of the participatory management program. The scope of the work was reduced, and a new consulting firm the Computer Aided Design Inc (CADI) was hired by the USAID to support the IMP activity.

The IMP later supported the joint management program that began in 1992, including both Khageri and West Gandak systems. The IMP ended in 1994, but the USAID continued to support the new project, the Irrigation Management Transfer Project (IMTP) hiring the same consulting firm, CADI. The IMP also carried out pilot programs in the two agency managed irrigation systems, Sirsiya Dudhaura[13] in the Terai and Handetar in the Hills The objective behind these two pilot experiments was to utilise the experience and lessons learned to implement similar programs in other parts of the country. The IMP formed the base for further implementation of participatory programs in irrigation. The IMP was the major player in formulating the new policies, acts and regulations that began in the 1990s, as will be discussed in next section

Another important event that helped initiate reform in irrigation sector was the Basic Needs Policy (1987) of the Government. The irrigation sector was one of the most prioritized sectors in this policy, as food security was its prime concern. The government introduced a Working Policy on Irrigation Development (1989) focusing on user participation. This document provided new directives to Nepal's irrigation sector, mandating participation of user farmers at all levels of irrigation development, from project identification, design and construction to operation and management. This policy specified a cost-sharing arrangement between the farmer and the government in development of both gravity and pumped schemes. This policy also set out an action plan for joint management and management turnover of the AMIS.

The Basic Needs policy also led the widespread expansion of the irrigation bureaucracy in the country, establishing the district level offices in 1988. Previously, there were only divisional offices at required places. The need to expand the irrigation bureaucracy was recognized because there were no other government agencies to look after the irrigation development at district level.

The Working Policy was immediately followed by the Irrigation Regulation (1989). The regulation for the first time prepared the legal basis for WUA formation and registration. The strategy of increasing farmer participation mainly stemmed from recognition that government resources alone were inadequate to meet the country's irrigation development objectives and sustain the management of government irrigation systems after their completion (Pradhan, 1996).

With these ongoing changes, both the priority and approach to irrigation development in Nepal took a new direction. Priority now shifted to management improvement of large-scale public irrigation systems and the rehabilitation and extension of existing FMIS, rather than on the construction of new large systems. Intervention in FMIS received a major thrust. The majority of the FMIS had been considered outside the Government's domain, although they irrigate more area than the government-built systems. Even at present, some 70% of the total irrigated area of 1.12 million ha is managed by FMIS[14]. It was believed that much of the country's food production could be generated from the rehabilitation and extension of these FMIS as studies had shown that many of them were performing below their potential, especially due to technical problems (ADB, 1988).

Intervention programs implemented since then include the Irrigation Line of Credit (ILC) pilot project (1989); the Irrigation Sector Project (ISP in 1990) and the special public work program of ILO. Out of these the ILC and ISP were funded by the WB and the ADB, with long-term commitment for irrigation development. The two projects are now at their second stage and called Irrigation Sector Support Project (ISSP) and the Nepal Irrigation Sector Project (NISP). Both these major funding agencies abandoned the individual project approach to development, and adopted the program mode such that learning from one site could be used for another. These programs mainly involved the physical rehabilitation and expansion of FMIS as well as capacity development of user farmers. It was based on a demand-driven approach, and users were required to pay part of the construction cost, based on scale and type of development varying from 5% to 25%. User involvement during design and construction was also made mandatory, including the prioritization and approval of the construction works. Users were also allowed to execute the construction work by themselves if the cost was below NRs. 1 million.

Despite this, large-scale AMIS remained untouched by the reforms. The Command Area Development Project (CADP) initiated in 1982 planned to involve users in project implementation. The CADP was started in three irrigation systems including the West Gandak, but it could not succeed as users were organized at a very late stage of project implementation (see chapter 3). However, these groups vanished in most cases as soon as the project ended. These groups were created at the end of the project period when construction activities were over and did not feel responsible for later operation and maintenance. These groups also did not receive continued support from the DOI to improve their canal management capacities. Byrnes (1992) observes a similar situation in Pakistan. In India, the CADA[15] experience is similar (Narain, personal communication).

2.4 The New Policies and their Legal Context

In 1990, the Panchayat system was overthrown and the Basic Needs policy also ended. By 1992, the newly elected government was in charge, with a multiparty democracy and a constitutional Monarchy established. The government initiated neo-liberal policies, curtailing the role of the state and promoting private-sector involvement, which still continues. In the agricultural sector, first the subsidy on fertilizer was removed and the private sector allowed to import and market fertilizers. By 1997, the government also started to withdraw subsidies from shallow tubewell development. These changes were a response to the policies of major donor agencies like the ADB and the WB, who were pressing for more market-oriented economies with less government involvement. In the irrigation sector, the O&M of the AMIS was known to be poor, and users participation in management was seen as a viable option (Irrigation Master Plan, 1990; CMS 1992). Several policy reforms and legal changes were thus made in 1992 affecting water sector development. These policy reforms were shaped to promote participatory management in the irrigation sector.

The Irrigation Policy formulated in 1992 was a continuation of the previous Working Policy with a major focus in the participatory approaches in irrigation development and management. The policy classified irrigation systems into four categories: Farmer-Managed Irrigation Systems (FMIS) developed and managed by farmers; Agency-Managed Irrigation Systems (AMIS), which are to be transferred to the WUA or jointly managed; Groundwater Systems including both shallow and deep tubewells; and Privately Owned Systems. Under the policy, the responsibility for supporting the first three types of systems was kept with the DOI whereas the responsibility for the private systems was left with ADBN. All systems with less than 10 ha area (changed to 25 ha after an amendment was made in 1997) were considered private systems.

The policy also set out the conditions for joint management, or full transfer, of the AMIS, depending on the size of the project. Accordingly, AMIS of up to 500 ha in the hills, and 2000 ha of irrigated are in the Terai, are to be gradually turned over to the Water Users Associations. However, the policy does not bar handing over even bigger systems if feasible, based on WUA capacity and structural complexity of the irrigation systems. In general, projects larger than 500 ha in the hills and 2000 ha in the Terai which cannot be turned over to the WUA, are to be jointly managed by the concerned irrigation office and WUA.

The policy also encouraged the WUA to be self-reliant and granted them the status of a full autonomous body. It states "His Majesty's Government shall not realize irrigation service charges on the turned-over surface and groundwater irrigation systems. The concerned water users may realize service charge for the maintenance, rehabilitation, improvement and operation to be carried out themselves. The WUA itself may, as required, determine the rate of such charges. In cases where joint system management has been introduced an exemption shall be given to the water user to the extent of 50% of the irrigation service charge as prescribed by His Majesty's Government".

The DOI was also restructured after this policy reform, and a separate unit - the Irrigation Management Division (IMD) - was created especially to look after the O&M of the large systems, as well as to facilitate the IMT programs.

Soon after the promulgation of the Irrigation Policy in 1992, a new Water Resources Act[16] was enacted in 1992 replacing the previous Canal and Electricity Act (1967). The Act sets out provision for building the WUA, and handing over systems developed by the government to such WUAs. It states that "His Majesty's Government may, on terms and conditions as are necessary, turn over to the users association any water resources project developed pursuant to Subsection 1 or 2 of Section 10 after its completion." The Subsections 1 and 2 of Section 10 reserves the right of the government to take over any water resource projects developed privately with necessary compensation if required, considering the wider public interest.

The Act also states that all concerned users associations shall have the ownership of the system turned over, and the concerned user association shall operate such systems as if it has a licence under this act. As per the Act, the WUAs are an autonomous and corporate body having perpetual succession (see Box 2.1). The Act has kept ownership of water with the state. However, it has made provision to transfer water rights by issue of a licence. Persons or corporate bodies are required to obtain a licence to carry out a survey, as well as for the utilization of water. The licence requires payment of annual fees, and it can be sold or transferred upon prior approval of the authority issuing the licence. However, it is not required to take a licence for domestic purposes and for irrigating individual land. The Act also sets out priority for water use with first priority given to drinking water before irrigation. Subsequent priorities in order are for other agricultural purposes, hydropower development, industry and mining, navigation and recreational use.

Two provisions in the Act greatly influence water sector reform. First, although the water right is vested with the state, it can provide concessions through licensing, such that the licence holder gets a right over the water it licensed. Second, it recognizes a WUA as an autonomous body with legal authority. It empowers the WUA to decide their operation and maintenance pattern, as well as to charge users for the service delivered, granting them the status of an individual licence holder.

Box 2.1 WUA as an Autonomous Body

- A Users association shall be an autonomous and corporate body having perpetual succession.
- A Users association shall have seal of its own for the purpose of all its business.
- A Users Association may as a person have the right to acquire, enjoy, sell, dispose or arrange of movable and immovable property by any means.
- A Uses Association may sue as a person or be sued.

However, the Act is unclear on three aspects. First, the provision for joint management is not clear. Second, the Act says nothing about the conditions of the transfer, like the obligations and duties of both government and WUA after transfer, and what properties and resources of irrigation systems owned by the government are to be transferred. Third, the procedures for issuing the licence and the conditions to obtain the licence are missing in the Act.

Following this Act, a Water Resources Regulation was enacted in 1993[17]. The main feature of this Regulation is that it formed a District Water Resource Committee (DWRC) to issue licences for water use for private sector actors seeking to develop water resource projects. It also simplified the WUA registration process, making the DWRC responsible for the registration of the WUA. The DWRC is headed by the Chief District Officer of the concerned district. The other members include the chief of concerned District Irrigation Office, Local Development Officer and Agriculture Development Officer. Previously, the registration of the WUAs was regulated under a separate Act called the Institution Registration Act (1976), which is more related to the registration of NGOs. Though the 1993 regulation cleared some of the limitations of the 1992 Act, it also failed to mention anything about the conditions for turning over irrigation systems to WUAs
In addition, all these policies and Acts have failed to address an important factor, considered crucial in the reform: the issue of an Irrigation Service Fee (ISF). In fully transferred systems, it is understood that the WUA can set the fees and collect them under

the rules set by them, because of their autonomous status. However, there are no legal provisions by which the newly established WUAs can enforce collection of fees. In jointly managed systems, it is unclear who will fix the ISF rate, or who will collect it. The Irrigation Policy was amended in 1997 to clear up some of these confusions. It allows the WUA in jointly managed systems to collect the ISF and fix its rate. Under this revised policy, farmers' payment to government decreases, as farmers take control of the larger part of the irrigation. (Table 2.2). Previously, only 50% of the collection could be retained. The policy also sets the percentage of contribution to be made by the WUA in the construction activities as given in Table 2.3.

TABLE 2.2 Division of ISF between government and DOI under varying management situations

Situation	*WUA Share (%)*	*Government Share (%)*
WUA management of whole system	100	0
WUA manage whole system except the head work	90	10
WUA manage whole system except the head work and main canal	75	25
WUA manage only up to the blocks	50	50
WUA manage only the tertiary canal	25	75

TABLE 2.3 Minimum contributions to be borne by the users in different scheme development

WUA managed systems (FMISs)				*Systems under IMT*			
New construction		Improvement		New Construction		Improvement	
Hills	Terai	Hills	Terai	Hills	Terai*	Hills	Terai
5-7%	10%	7-12%	15%	5%		10	10

Source: Irrigation Policy, 1992 (as amended in 1997)

*In the Terai, under new construction, users are required to build watercourses below 10 ha on their own and contribute 25% of the cost for construction of tertiaries serving 10 to 30 ha.

The problem is that these policy guidelines are not supported through new Acts and Regulations, and have no practical dimensions, as policy documents are not legally binding. So the question of ISF remained unclear among all the parties (both farmers and engineers) working in the field. In addition, the problem of transfer conditions from the government to the WUA also remained unclear. As will be seen in chapter 7, these created several problems at the time of handing over of the system management to the WUA. Realizing these difficulties, a separate Irrigation Regulation was proposed, and the process for it began in 1998. The regulation was finally passed in 2000, but instead of solving the field level problems, it created more confusion. This regulation actually seems directed towards more bureaucratic control (as will be shown in chapter 7).

2.5 From Irrigation Policy to Irrigation Management Transfer Program

The present policy of IMT originates out of the 1992 Irrigation Policy. With this policy, management responsibility for the AMIS is to be transferred to the WUA. The Agriculture Perspective Plan (1996) further plans to have all AMIS to be handed over to farmers or jointly managed by 2015. The framework of IMT in Nepal is shown in Figure 2.1 (Laitos, 1992).

FIGURE 2.1 Framework for management transfer process by the DOI

The turnover program aims at the complete transfer of O&M responsibilities of small and medium scale irrigation systems to legally recognized water user groups. 'Turn-over' is said to occur if the whole system is transferred to the WUA, as will be studied for the Panchakanya system. Joint management can follow several forms depending upon the size and technical complexity of the system. The most general form for the joint management is that the irrigation agency operates and maintains infrastructure to a certain point of delivery, after which a local organization takes over responsibility of water delivery (Molden 1998). However, joint management can also be achieved without partial turnover of the system. In this, a shared responsibility is defined between the state and the users for the OM of part or whole of the system. The Joint management domain in Figure 2.1 may be an intermediate stage to achieve full turnover (as will be studied for Khageri), or a final destination for the management of large-scale irrigation projects (as will be studied in the Nepal West Gandak system).

Following this policy statement and Water Resource Act, joint management programs were started in 1992 in five selected irrigation schemes covering 33,600 ha, including the Nepal West Gandak irrigation system (8000ha) and the Khageri irrigation system (3900ha)[18] studied here. They began with the formation and capacity development of WUAs in these systems. These activities were supported by the IMP, and the consultant firm CADI was involved in WUA formation and training them (see chapter 4). However, farmers in these systems showed their concern over the poor condition of physical infrastructure and asked for system improvement together with the institutional development program. According to engineers involved in the survey of these irrigation systems before beginning the joint management program, most of these systems irrigated only about 50% of their targeted area. This was mostly due to lack of proper O&M practices and poor condition of physical infrastructure.

The DOI then planned the rehabilitation of these systems together with the organizational development activities. According to some engineers, there were two different opinions within the IMD of the DOI, whether to carry out system rehabilitation together with the joint management program or after it. The first group was of the opinion that if the rehabilitation were attached with the IMT, it would be a time-bound activity, and participatory management could be jeopardised. They also feared that it might end up with 'construction as usual'. The other group argued that it would not be possible to encourage farmers to take up management responsibility unless system efficiency was increased. On the other hand, farmers were also not ready to take-over the management responsibility without proper repair and maintenance of the systems. Finally, the DOI decided to carry out early rehabilitation of the systems selected for the IMT program, as the majority of DOI engineers and the farmers favoured the system improvement together with organizational development activities.

A loan request was then made by the government with the ADB to finance the rehabilitation of the systems selected for management reform. The ADB, after a feasibility study in 1994, agreed to finance the rehabilitation of the identified schemes, under the Irrigation Management Transfer Project (IMTP). This loan request did not involve much discussion, as the necessary conditions for the management transfer program were already in place. The policy of the management reform was consistent with the ADB policy. The Irrigation Policy 1992 was in fact designed to address donor concerns regarding user participation in irrigation management. Likewise, the USAID was long involved (and a key actor as explained in earlier sections) in irrigation sector reform in Nepal through the IMP, and was interested to continue further support the process of management reform in Nepal. The DOI was desperately in need of funds to improve the system conditions. The match of interest of the key actors in the IMT program thus made the loan process much smooth.

The IMT policy ultimately changed into program action through the Irrigation Management Transfer Project (IMTP). The IMTP included seven more projects, among them Panchakanya (600ha), besides those selected for joint management earlier, but dropped one project, the Kankai[19]. So altogether there were 11 sub-projects at the start of IMT of the country. Only one out of these 11 sub-projects, the Chaurijahri, is in the hills: the remainder are in the Terai. These systems are scattered in all five-development regions of the country. These systems were irrigating 32000 ha against their target command area of 67000 ha in total (efficiency of less than 50%) because of physical and operational constraints (GITEC 1992). These systems cover about a third of irrigated area under the control of the DOI. The three case studies are selected from them.

The ADB was to finance the physical rehabilitation component of the IMTP whereas USAID agreed to provide the Technical Assistance (TA) to the program. The ADB loan was US$11 million, which is 59% of the total project cost of the IMTP. The remaining 41% of the costs were to be borne by the government and through farmers' contribution. In Chapter 5, I will show how the 41% cost was divided to 15% for the government and 26% to the farmers. The USAID assistance of US $ 3 million came in the form of grants and was meant to provide consultancy services to the program, and support capacity development of the DOI and the WUA. The ultimate aim of the IMTP was to transfer the O&M responsibility and/or ownership of the schemes in accordance with the farmers' capacity to mobilize local resources.

It was planned to implement the program in two phases over a period of seven years (1995-2002). In the first phase, three systems, namely the Khageri (3900 ha), Panchakanya (600 ha) and the West Gandak (3900 ha) were selected. No reasons are given for their selection in the first phase, but discussions with DOI officials and the consultants involved show that their selection was based on the previous levels of institutional development, water supply conditions and topographic location. In both West Gandak and Khageri, the WUA formation and its capacity development were already taking place since 1992 and farmers were already engaged in canal operation and maintenance activities. Besides, Gandak was a water-abundant system, with apparently no limit to water supply at the source throughout the year[20].

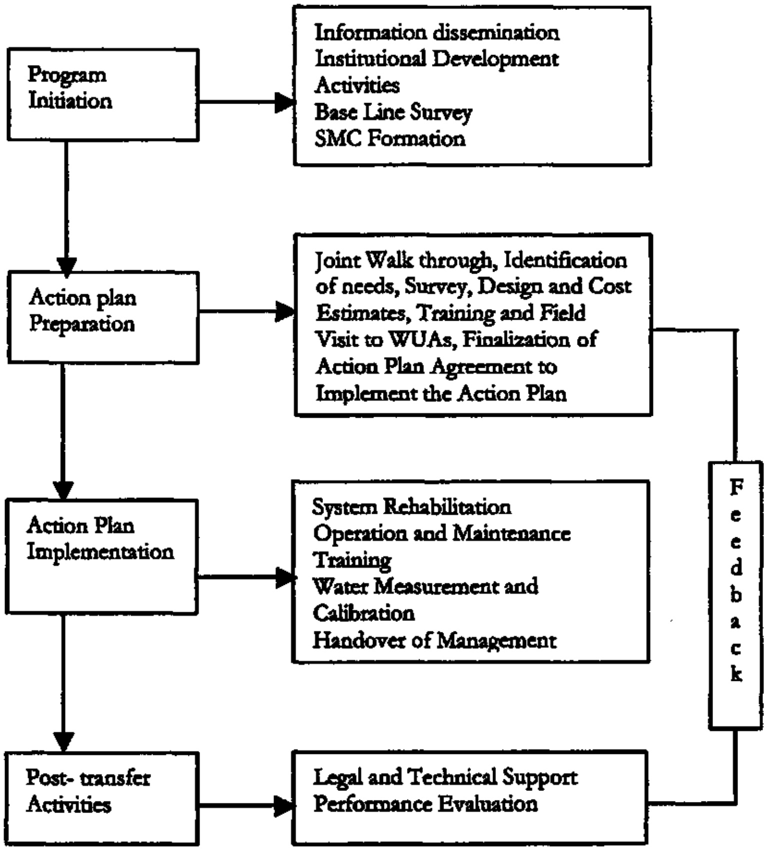
Khageri and Panchakanya were selected because of their relatively simple water control structures, and because the farmers in the area are known to be innovative. The government was expecting rapid institutional change in these two systems so that they could be models for other systems Panchakanya was specially selected because of its smaller size and its previous history: it was developed by the farmers and was a FMIS before agency intervention in 1974. Another reason for their selection was that both are relatively water-scarce systems[21] with opportunities for improvement through collective action.

2.6 The Framework of IMTP Implementation

The project framework for implementing the IMTP as adopted by the DOI is shown in Figure 2.2. The process has been developed on the basis of experiences from previous participatory intervention programs like IMP, ILC and ISP. It consists of four stages: the program initiation and institutional development phase; the action plan preparation phase; the action plan implementation phase; and post-turnover support phase (ADB, 1995). The action plan forms the basis of program implementation. It specifies the activities to be carried out during implementation, and the roles and responsibilities of different parties involved in the process.

As seen from this framework, the IMT process mainly involves the formation of the WUA and further support to them through participatory design innovations. It also requires new arrangements between the government and the WUA for the system management. This model of policy implementation for management reform is similar to those widely mentioned in irrigation literature (for example Vermillion and Sagordoy, 1999; Geizer, 1996; and Groenfeldt, 1998). It is influenced by the idea of designing irrigation policy to create conditions under which desired institutions would successfully emerge, for example that would ensure functional infrastructure, debate type and size of organization and allow user involvement at all stages and levels of project implementation.

FIGURE 2.2 Project framework for IMTP implementation



The framework shows a top-down approach to designing and implementing policy reform, which Kloezen (2002) refers to as institutional engineering. Farmers were not involved in the design of this framework, neither were they informed about the policy reform. The reform itself was not demand-driven, and was induced by the government, as explained earlier. Farmers were told by the DOI that they had to participate in the reform.

However, it is not only dominated by instrumentalist perspectives. The elements mentioned in the framework also refer only to the tasks, and the actual implementation process in the field is not laid down in the framework. Subsequent chapters of this thesis will show how the actors at local level involved in the process design, redesign, negotiate, adopt and transform these guidelines in practice in line with the prevailing environment surrounding the intervention. At the end of the book, I argue that these policy steps help in 'kicking off the process', and should not be treated as a rigid method for policy implementation. The actual processes have to be worked out and adopted through negotiation and learning during the implementation itself.

The program design also directs all aspects of water control: the organizational, technical and the socio-political. The major focus of the program is on the organizational component, where a multi-tier WUA depending upon the size and technical complexity of the system would be formed. This would be trained and provided with the necessary legal and technical support to carry out the management activities. The rehabilitation is a technical intervention, but its objective is to facilitate the new organization by providing better working conditions for farmers, with technology compatible with their management. The handing over of the system management with new laws and rules and regulations and conditions under which they can operate brings a new socio-political environment to the irrigation system. However, the means to enable complementary evolution of these elements were not really defined. Rather they were just expected to develop through the different phases defined for project implementation of the IMTP, as outlined in the following sections.

Initial Organizational Phase: The process begins with the formation of the WUA matching with the hydraulic boundary and structural complexity of the system. An introductory workshop is organized to explain the process and discuss with farmers, the objective and processes of management transfer. The structure of the WUA is finalized after several rounds of discussions with the farmers, to make the organization relevant to the prevailing sociotechnical complexity. The constitution of the WUA is also drafted in parallel with the WUA formation. The WUA is finally brought into being through democratic elections, and registered with the District Water Resources Committee. Agency personnel - which generally includes a sociologist, engineer and consultant - play a facilitating role in organizing these activities. The team carries out its activities through the Farmers Organizers (FOs) who are selected from the farmers' community on the recommendation of concerned farmer groups. Necessary training to the FOs and the newly developed WUAs is also carried out. The role of the FO is to prepare baseline data of the system such as household details, irrigated area, and problems in water delivery. They act as an intermediary between the irrigation agency and the farmers at the initial stage of WUA formation. Once the WUAs are registered, the FOs are discharged.

Parallel with WUA formation and capacity development activities, appropriate project orientation courses and training programs are also conducted for the agency personnel involved in these implementation activities. The objective of this training is to ensure people understand the project's guidelines and procedures, and are committed to attaining the project's goals and objectives. After completion of WUA development activities and the training of agency personnel, a Sub-project Management Committee (SMC) is formed. The SMC is chaired by the project manager concerned, and includes the officers of the WUA Executive Committee. The SMC is responsible for the implementation of the project activities ahead. The idea of involving the SMC is to make activities transparent to the farmers and to involve them in the decision-making processes, and also to coordinate between the WUA, farmers and the implementing agency staff.

Action Plan Preparation Phase: The second phase of activities includes the preparation of an action plan and agreement over it. DOI technical staff, together with WUA functionaries, carry out several diagnostic walkthrough activities along the entire system, to identify problems obstructing the smooth functioning of the system. The results of this joint walkthrough are then prioritized under five different headings: emergency maintenance; essential structural maintenance; deferred maintenance; catch-up maintenance and system improvement works[22]. Tentative designs and estimates of structural improvement works are prepared, and possible user contribution is also discussed. With the completion of these surveys and activities, the plan of action is prepared jointly by the WUA and respective project staff. The plan will describe the elements of technical improvement activities and institutional development activities. It thus includes: additional training to be provided to the WUA and farmers groups; rehabilitation and improvement works to be carried out with cost- estimates; the cost sharing agreement between the DOI and the WUA; the WUA's plan to raise its cost share; and the responsibilities of both the DOI and the WUA during the implementation.

After the preparation of the Action Plan, a Memorandum of Agreement (MOA) is prepared and finalized by the DOI staff and WUA representatives. The MOA will also specify: I) the bench mark indicators that must be satisfied before rehabilitation and improvement work can be undertaken; II) procurement, disbursement and quality-control procedures to be followed in connection with rehabilitation and improvement work; III) record-keeping and resource mobilization responsibilities of the WUA; IV) conditions for transfer of O&M and or ownership transfer to the WUA; V) the scope of transfer contemplated (including the case of ownership transfer, precise description of the facilities, land and equipment to be transferred) and VI) ongoing rights and responsibilities of DOI and WUA. The MOA is then signed, which opens the path for further program implementation. The MOA as used in IMTP is presented in Annex 1.

Implementation of the Action Plan: The third stage is the implementation phase, where the action plan conceived and agreed by the concerned irrigation agency and the WUA is implemented. It thus includes both physical rehabilitation activities, and strengthening the WUA through training and field-visit programs. It begins with detailed design and cost estimates of the elements identified during the action plan preparation phase. These activities are carried out in close co-ordination with the respective WUA or farmers groups. Any changes from the previous study are accommodated here and user contributions are negotiated again. Once the detailed design is over, tendering and awarding of construction contracts is carried out. Such a contract is awarded to either the WUA itself, or a contractor depending upon the WUA priority. Under the financial regulation WUAs are also allowed to execute the construction work if the construction cost does not exceeded 1.5 million rupees ($20,000) and the WUAs can mobilize the workforce. Among different types of construction work emergency work is carried out first. The remaining work is carried out linked with the institutional development of the WUA. The construction may take to two five years depending on the complexities of the physical work.

The construction is jointly monitored by the SMC, DOI and the WUA to ensure the quality of construction. Regular meetings between the DOI staff and the WUA initiated through the SMC are held to discuss and assess the progress of the work, to agree on any change /revision in the design or manner of undertaking the work, and to reconcile records of individual farmer contributions and project expenditure. Once the construction is complete for a particular contract, the WUA and DOI staff will run tests, review the work and correct the deficiencies noted during these tests.

Parallel with the construction activities, various types of capacity development programs for the WUA are organized by the DOI, as mentioned in the action plan. Such training is mostly on construction quality control, leadership development, canal O&M and resource mobilization. Such training is directed at different levels of WUAs such as the main committee and the branch committee. Field visit programs to successfully running FMIS are organized. The WUA will also, with support from the DOI prepare and test the O&M plan it intends to implement after taking over management responsibility. Actual progress depends in project supports and vision, as will be shown in later chapters.

Upon completion of the foreseen structural improvement and institutional activities stated in the MOA, O&M responsibility and/or ownership of the irrigation system, as specified in the MOA, is transferred to the respective WUA. At this stage, farmers are required to carry out the agreed post-turnover activities. The DOI will provide the WUA with appropriate evidence of the transfer and shall take all other necessary steps to make the transfer effective. The role of the agency at this stage is limited to providing technical and back-up support.

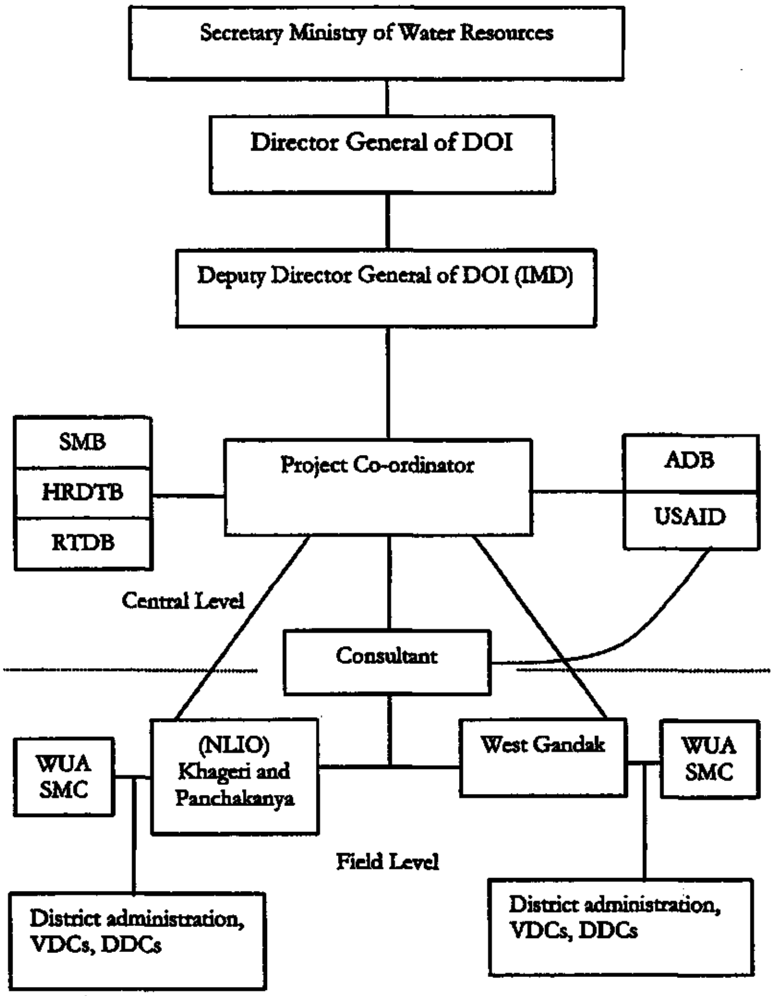
Post-Transfer Activities: After the transfer of management responsibility to the WUA, the government's other job is to establish effective monitoring and evaluation, besides providing other technical support to the WUA. The necessary data and feedback for this should be provided by the WUA. Further training programs to the WUA also continues as demanded by the WUA. The government will continue to provide technical assistance, and if required provide financial assistance in the case of system damage from natural disasters. If the system is under joint management, the O&M responsibility for the main canal and the head work remains with the government, and they are required to perform management activities at these levels in co-ordination with the WUA.

2.7 The Organizational Structure of Project Implementation

The project organizational structure for the IMTP implementation in Khageri, Panchakanya and West Gandak is shown in Figure 2.3. There were two levels of authority in the project execution: field level and central level. The field level actors included the project staff of the concerned irrigation offices, the WUA and the external consultants deployed in for the IMTP. The concerned field offices were responsible for the implementation of the project. For Khageri and Panchakanya, the NLIO was responsible for implementation whereas West Gandak had its own separate project office. Both these offices were headed by senior engineers of the DOI (like myself), who were at much lower position in the national hierarchy of the DOI structure.

At the central level, there was a co-ordinating office headed by a project co-ordinator to supervise the implementation of the field level project activities. The co-ordinator was responsible for dealing with both the donor agencies in getting funds released and furnishing project progress. He was also responsible for carrying training and other capacity development activities to the WUA in the field upon request from the field-level project offices. He was personally committed towards participatory approaches in irrigation management. The co-ordinator was supported by the System Management Branch (SMB), Research and Technology Development Branch (RTDB) and the Human Resources Development and Training Brach (HRDTB) of the IMD in executing the activities. The co-ordinator was again accountable to the Deputy Director General (DDG) of the Irrigation Department looking after the Irrigation Management Division (IMD)[23]. The DDG of the IMD was also the project director of the IMTP, but was not responsible for everyday project execution. His job was to oversee the overall implementation. The actors at the central level were at higher position in the DOI bureaucracy as compared to the field level project managers.

FIGURE 2.3 Organization of IMTP implementation in Khageri, Panchakanya and West Gandak



Consultancy to the project was provided by the Colorado-based American company Computer Aided Design Inc. (CADI). The consultants included an American expert and three local professionals: two irrigation management experts and an institutional development specialist. The consultants worked for both field and central level project authorities. One of the irrigation management experts had previously been chief of the HRDTB of the DOI[24]. Two local professionals, the institutional development specialist and one management expert (previously with HRDTB) were based in Chittwan to assist all three systems where management reform were being implemented at first stage. The remaining two consultants (one American and one local) were based in Kathmandu to assist the central coordinating office. In addition, a few professionals (both local and foreign) were hired for a limited period for specific services as required.

The consultants worked as an independent team, and were not involved in daily implementation of the IMTP. In this way, they were not dominating and dictating in the project activities. However their role was also not clear. They were mostly engaged in preparing evaluation reports, supporting WUA establishment and providing advice when asked by the field level offices.

Besides these irrigation institutions, two other important agencies were involved in the implementation: the USAID and the ADB, but not at the field level. The ADB was mostly concerned with the physical progress of the project. There was one mission visit every year from Manila to review the project progress. There were also other several political and administrative institutions who were involved directly or indirectly in the process including the Ministry of Finance (MOF), the National Planning Commission (NPC), the office of the Auditor General, the Village Development Committees (VDCs), the District Development Committees (DDCs), and the District Administration Office (DAO). They had a limited but important role in the process as will be seen in the ensuing chapters. The MOF is responsible for releasing the funds annually and the NPC is responsible for approving annual plans and programs. The Auditor General is responsible for the final auditing of the project expenditure. The VDCs and DDCs are local-level political institutions and the DAO is responsible for the over-all administration of the district. These organizations are always engaged in local-level intervention, although their roles are not specific.

This presentation of the organizational structure shows the multi actor environment of the IMTP. For the field-level implementation offices, the central project office and its supporting units are part of their 'influencing environment'. Likewise, the DDCs, VDCs, and the DAO are also as part of their 'influencing environment'. However, the MOF, NPC, USAID, ADB are the elements of the appreciated environment. However, the actors are not always visible, especially those in the 'appreciated environment'. They can be unpredictable, shifting and highly turbulent, as mentioned in chapter 1.

2.8 Conclusions

The IMT program in Nepal is a comprehensive one, trying to address all forms of water control: the technical, organizational and the socio-political. This differs from past efforts to promote participation in water management in several ways. The major difference is the inclusion of the socio-political dimension, with changing rules and regulation to support the new management. Past efforts to promote participation in irrigation were directed to technical intervention and organizational development activities only, like the CADP of the 1980s. They were more focused on on-farm development activities inside the command area (see chapter 3). The emphasis on a participatory design process to support new evolutionary organizations is another major difference in current IMT programs. In the past, design implementation was conventionally based on top-down approaches without user involvement. Another major change is in the concept of the organization itself. In the past, local organizations were seen as a unit to complement to the government agencies, co-ordinating in water distribution activities below the outlet level (see for example Hunt, 1990). But now efforts are towards governance change, replacing the government partially or fully depending on the scale of the irrigation systems. At the same time, organizations are being formed at system level without being limited to the outlet level as in the past.

The reform program also includes all the different development context of participation as mentioned in chapter 1. The current IMT program originates from the context of economic development and modernization and is driven both by the fiscal deficits in the country and donor influence. However, its implementation is based on a joint planning process, employing participatory tools like PTD, to arrive at locally specific design compatible with users' management. At the same time it aims to increase the capacity of the WUA to manage the system through training and field visit programs. It also aims to empower the WUA through legal support and bring benefit of irrigation to the people, which they were deprived of earlier. The inclusion of these different development contexts in the program also shows its comprehensive nature.

The chapter has also shown the framework of chapters 4-7, which are based on the elements of the project framework presented in Figure 2.2. These include: the development of WUA; joint action plan preparation; implementation of this action plan; and handing-over, monitoring and evaluation of the new management. Subsequent chapters examine how actors involved in these processes translate them in practice given their system and project environment

Though the reform is a comprehensive one, design of its implementation has several practical limitations. While the design tried to locate conditions for collective action to emerge, laws are not always that clear. They especially fail to consider how to sustain the reform beyond the launching phase, both socially and financially. The implementation of the reform is thus seen as an isolated activity, without any connection to broader development objectives of organizational evolution and participatory water management. The program design has also failed to bring the actors at different project environment levels (or different sub-systems) together in the program process, which is essential, both to facilitate the change process as well as to sustain the reform beyond the launching phase. As seen in Figure 2.3, the program involves a complex project environment, but actors at higher institutional layers are considered as either constraining or supporting factors rather than as a part of the change process. Participation has been limited to interaction between the engineers and the farmers (and the WUAs) at local level, with very different ideological norms of participation are present in the different project domains. The remaining chapters will show how both the process and outcomes of the reform were constrained due to this failure to bring different elements of the project environment together in the program process, and allow for the struggle to achieve participatory management as promoted by different actors.

The program is heavily focused towards technical improvement works to support organizational evolution, but failed to consider the influence of choice of technology in water management. Besides, systems themselves are not always amenable to improvement in water delivery as supposed, as the thesis will also show.

In addition, the new laws and regulations give norms without reference to past practices of local water management as they have evolved under complex shifts in local government and agency control, with which new organisations have had to struggle to assert their new roles and rules. Also possible choices of organisational structure, rules and roles are left to be shaped by key external actors and not just the farmers themselves. These strengths and weaknesses help to define the struggles of new organisations and their members, an ephemeral project structure, and old agencies to enable participatory irrigation management.

Notes

[1] These systems were initiated after the famine of the late 1890s in Northern Bihar.

[2] The British had constructed the Sarda Canal after entering into an agreement with the Rana Rulers. Nepal was allotted 460 cusecs (13 cumecs) of water during the monsoon season and 150 Cusecs (4.3 cumecs) during the dry season as per the agreement. Nepal developed the Mahakali Irrigation system (see Pradhan, 1996) utilizing water from this allocation. It is not clear whether the construction of Chandra Canal was in exchange of the Mahakali Agreement.

[3] The Rana Rulers were overthrown in 1951, establishing democracy in the country. However, due to political instability, elections were held only in 1959. The elected government was overthrown by the King in 1961, and a party-less political system called the Panchayat was established. The Panchayat system was again overthrown in 1990 by a people's movement and a parliamentary democracy system with a constitutional monarchy was established in the country.

[4] For different types of land tenure see also Poudel (2000), Regmi (1978).

[5] Kulo means a canal in Nepali

[6] See Pradhan (1989) for details of FMIS development in Nepal.

[7] See for example the regulation of 1935 and 1942 (Regmi 1979, cited in Pradhan, 1996).

[8] For a detailed account of the changes in local governance and irrigation governance, see Pant (2000)

[9] Administratively and politically, the country is divided into seventy-five districts, 14 zones and five development regions.

[10] In 2000, the government enacted the Local Decentralization Act. Under this Act the local political bodies, the District Development Committee (DDC) and the VDC are empowered to control natural resources within

their boundary. Under this Act, all the development activities at local level are to be overseen by DDC through its own technical office. This has also limited the role of the DOI, and a new structure was proposed to DOI reducing the 75 district offices to only 42 divisional offices (with reduced staff): while writing this thesis, I came to know this structure has been now put in place. However, because of the Maoist insurgency and political instability in the country, the Act is yet to be fully implemented and its impact in irrigation governance is yet to be seen.

[11] For these agreements see Sharma (1983).

[12] For a review of the research of Cornell University in irrigation, with its strong focus on both the interface between agency staff and water users, and on FMIS, see Levine (1992). Levine notes how the Cornell programme in Nepal, was designed to increase the institutional capacity of the Government of Nepal to enhance water user participation in system design, construction, operation and maintenance. It drew on their work in The Philippines and Sri Lanka, and also bought in professionals from these countries (Levine, 1992, p.29).

[13] The 1600 ha Sirsya Dudhaura system was constructed by USAID in 1957.

[14] It is believed that there are about 1700 FMISs in Terai and 11000 in the hills of Nepal (Poudel, 1992). By the late 1980s, there were many studies by the government (WECS, 1981) and other independent researchers (Martin, 1986; Yoder, 1986; 1987a; Pradhan, 1989) on the FMISs and their contribution in the agriculture development was found to be considerable.

[15] CADA stands for Command Area Development Authority in India.

[16] The Act is meant for the hydropower sector as well as for the implementation of the irrigation policy.

[17] In Nepal, Acts generally set broad guidelines for the rules. The provisions of Acts are further explained and clarified by the Regulations following the acts. Both Acts and Regulations are law. Policy guidelines, however, are not law.

[18] The other systems were: the Kankai Irrigation System (8000 ha), the Banganga Irrigation system (6200 ha) and the Manusmara Irrigation System (6200 ha)

[19] The ADB refused the Kankai system because it had recently been completed with its own funding and ADB was not convinced to finance its rehabilitation soon after. The other six additional projects were Hardinath (2000 ha), Chaurijahri (800 ha), Pathraya (2100 ha), Kamala (25,000 ha), Chandra Canal (6800 ha) and Mohana (3500 ha).

[20] However, subsequent chapters will show there were water distribution problems in West Gandak.

[21] Relative water scarcity is a situation, in which water availability slightly fall short to the actual requirement such that there is scope of improving

water management situation through collective action. The argument is that when water is plentiful, there is no incentive in organizing as they have already enough water. At the same time where the water is very scarce, only strong leadership can resolve the situation, which is beyond resolution by co-ordinated exchange and collaboration between farmers. Areas with moderate water scarcity are thus likely to succeed in collective action.

[22] These are the improvements to be made in order of priority. Emergency maintenance includes those, which are in a position to damage the system if not improved immediately. Essential maintenance includes those activities which have severely affected the systems' functioning. Deferred maintenance includes those that have not been done due to lack of funds (like canal desilting). Catch-up maintenance includes regular maintenance. System improvements are meant to improve the efficiency of the system (like canal lining and re configuration of gates).

[23] There are five DDGs in DOI: Planning, Groundwater, Surface Water, River Training and Irrigation Management divisions. The DDG of IMD looks after the operation and maintenance of completed systems: the IMTP was thus under the IMD. The DOI is headed by a Director General (DG) and is responsible for overall administration of the DOI. The DOI is under the Ministry of Water Resources (MOWR).

[24] Most of the consultants working in irrigation sector in Nepal are retired DOI professionals.

3

The Research Sites, their Evolution and Agroecology

This chapter uses an agro-ecology approach (Altieri, 1990) to understand how the technological forms of Panchakanya, Khageri and West Gandak systems evolved with choices and adaptations of farmers and agencies. It used this approach to trace the evolution of the three irrigation systems, and the interventions to take water for irrigation and distribute it, and resultant agriculture and agrarian conditions that shape the agroecology of the systems. Manzungu (1999) has also describes how water distribution is shaped by: the water source, irrigation technology, socio/political relations and commodisatizion effects: these are also described here, in relation to river regime, social dynamics after settlement, and the land tenure and agricultural patterns in the systems studied. This chapter thus shows the history of their technical and organisational development up to the period of the IMTP. From this, the conclusions discuss the opportunities and constraints faced in the IMT project, to initiate and help evolve new systems of effective water control with complementary technical, organisational and socio-political control.

3.1 Irrigation in the Terai and Farmer-Agency Interfaces Before IMTP

The Terai is one of the three main physiographic zones of Nepal, and is the zone of low-lying plains, ranging in elevation from about 60-500 metres. It is also divided, to distinguish the Terai proper south of the Siwalik hills (where the West Gandak system lies) and the Inner Terai between the Siwaliks and Mahabharata hills – a zone of large valleys like the East Rapti of Chittwan district (where the Panchkanya and Khageri systems lie). Critical differences for irrigation between the two include the regimes of their rivers.

Chittwan District lies in the inner Terai, where the Panchakanya and Khageri systems lie, 139km south west of the capital Kathmandu. It is also referred to as the Chittwan Valley[1], as it is formed between the Mahabharat and the Churia Hills. Chittwan District is divided into two sections: Eastern and Western parts divided by a narrow corridor of dense forest (Mahendra Aaraskha, see Figure 3.1) which links the Royal Chittwan National Park (RCNP) and the Mahabharat forest. The Forest is the main corridor for the movements of the RCNP wildlife. The environmental importance of this forest zone eventually came to limit some options for the Khageri irrigation system (as will be explained in Chapter 7). Most of the valley was uninhabited jungle forty years ago, but there were a few *Tharu* and *Darais*[2] settlers since ancient times. There are numerous small and medium streams in the eastern part of the valley, from which the *Tharus* could develop irrigation schemes to support their livelihood. Panchakanya is one such system developed in the eastern part of the district by the *Tharu* community in the past. However, the western part of the valley had no such irrigation facility. The whole valley was then the preserve of wildlife like rhinos and tigers, and part of the valley is still covered by the National Park.

Once uninhabited jungle, Chittwan has now been converted into a green valley after the implementation of a planned resettlement program and subsequent irrigation development. Government policy in Nepal during the 1960s encouraged resettlement by clearing forest in flat Terai and Inner Terai areas[3] of the southern plains to boost agricultural production in the country. In Chittwan, a planned resettlement was implemented under a high-level government authority, called the Rapti Valley Multipurpose Development Board. Besides implementing the resettlement program, the board was also responsible for malaria eradication programs[4] and rural road network development. The board was supported by the USAID in carrying out its activities. The settlers in the area were mostly from the nearby hill districts. The new settlers were given five *bigha* (3.3 ha) land for cultivation.

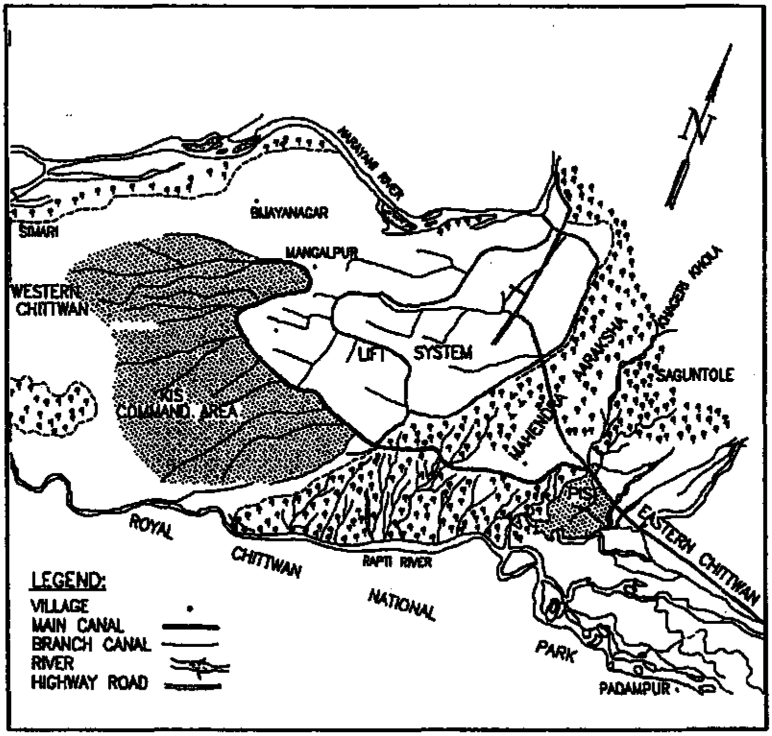
There were actually two groups of migrants. The first group was the victims of floods and landslides in 1953. They were encouraged by the government to resettle in the valley by clearing the forest and cultivating the lands of which they eventually become the owner. The second group of people came under the government's planned resettlement program in the valley through the Board. The planned resettlement program began in the mid-fifties and continued until the mid-sixties. Even after the completion of the resettlement program, migration from the nearby hill districts continued but at lower rate through individual initiative. Out of the total migrants to Chittwan, about 42 % migrated in 1960s, whereas 27% migrated earlier. The migration rate later declined sharply, with only about 10% migrating between 1980 to 1995 (ICON, 1996)[5]. The beginning of the National Highway through the district in the late 1960s also increased its attractiveness.

Parallel to the re-settlement program, irrigation needs were identified especially in the western part of the valley, due to non-availability of water sources. This led to the birth of the Khageri irrigation system in the 1960s, which was completed by 1967. Chittwan continued to be a major focus for irrigation development, as it could provide food for the growing population in Kathmandu, due to its fertile soil from decayed forest material and water supply. The migrant community had a strong agricultural background and knowledge of irrigation management. In 1972, the government formed a separate board, the Chittwan Irrigation Development Board (CIDB) to direct the irrigation development in the valley in recognition to its potential. Under this board, an executing agency, the Chittwan Irrigation Project (CIP) was set up to construct irrigation projects in the district. The Board was chaired by the Minister of Agriculture and Irrigation, as the Irrigation Department was under this Ministry that time (it is now with the Ministry of Water Resources). The project manager of the CIP was the Secretary of the Board.

The major focus of the CIP was to construct a lift irrigation system by pumping water from Narayani River to irrigate an additional 4700 ha of land adjoining to the Khageri command area. The CIP was funded by the ADB. With the CIP now taking responsibility of irrigation development in the district, the O&M of the Khageri system was also put under the CIP authorities: previously it was managed by a separate division office. The CIP also carried out some improvement works like drainage improvement, canal lining and a service road network in Khageri between 1980 and 1985. The lift system was also supposed to augment the Khageri water supply by 2.4 cumecs[6], to overcome the water shortage in Khageri. However, owing to several financial and technical problems, the lift system could not reliably augment Khageri water supply, although it occasionally supplements it, in times of scarcity. The CIP also carried out rehabilitation and expansion of the Panchakanya system from 1974, and took over its management responsibility from the farmers. This rehabilitation and expansion was carried out under the influence of newly migrated communities who were dominant in the area by then.

The construction activities of the CIP were completed in 1989. However the body continued to manage the three irrigation systems it had been involved with, namely the Narayani lift system, the Khageri and the Panchakanya, until it was dissolved in 1994. The layout of these three systems is given Figure 3.1. The lift system is not part of the current study.

FIGURE 3.1 Irrigation systems under the NLIO in Chittwan Valley



It has been a practice in Nepal that large construction projects are implemented through an autonomous development board, to keep it outside the regular bureaucratic processes such that smooth project execution is possible. Once the major construction activities are completed, the board is dissolved and a smaller unit is established to look after the O&M of the system. In this case, a smaller unit called the Narayani Lift Irrigation Office (NLIO) was established to look after the O&M of the three irrigation systems previously under the authority of the CIP. The number of staff was reduced to 64 from more than 250 persons as a result. There was major conflict between the government and the retiring staff over this staff reduction. The problem was finally settled by offering additional benefit to staff losing their jobs. I was transferred as Chief of NLIO in December 1994.

The Nepal West Gandak Irrigation System (hereafter called West Gandak) was constructed under an Indo-Nepal agreement, and later on expanded under the Command Area Development Project (CADP). The system is located in the Nawalparasi district in the Western Development Region of Nepal. It is located 22 km south east of District headquarters and 8 km south of the East-West Highway. West Gandak emerged out from the Indo-Nepal agreement on the use of Narayani River water (in India it is called Gandak River, in Nepal both names are used). The construction started in 1963 and took about 7 years to complete. It now provides irrigation to about a million hectare of land in India through two large canals: the Gandak Western Canal, which irrigates areas in Uttar Pradesh State of India and the Eastern Canal[7], which irrigates areas in Bihar. Under the agreement, Nepal receives 300 cusecs of water[8] to irrigate about 8700 ha of land, through an offtake structure placed 600m upstream of the barrage. Additionally, Nepal also receives water to irrigate 1600 ha land drawing water directly from the Western Main Canal going to India, through two offtake canals called Piparpati and Parsauni, which are not discussed in this study.

Before the agency's intervention to develop the West Gandak, there were some FMIS taking water from small drains and rivers lying within the present command area. Farmers say that they used to build diversion weirs with earthen bunds and woodbrush, which were repaired after each flash flood in the rivulets. Canal networks were earthen, short in length and were cleaned out before the irrigation season. Their main problem was maintaining the diversion weir throughout the irrigation season. Due to the absence of flow in winter and spring, irrigation was possible only for monsoon rice. The exact numbers of FMIS that existed in this area is unclear, but local farmers say that about 1000 ha of land were under such FMIS.

Unlike Chittwan, the command area of West Gandak is not a newly settled area. Much of the command area was already used as agricultural land even before the construction of the NWGIS. However, there has been an influx of outside migrants from across the Indian border as well as from the hills of adjoining districts over time. The Indian migrants came to settle in the area after several harvest failures and widespread famine in the 1930s and 1940s in Uttar Pradesh and Bihar (Shukla *et al*, 2000). Migration from adjoining hill districts however started only after the malaria eradication program in the 1960s, and after the beginning of the national highway construction. So, most residents of the command area have been there since before the construction of the West Gandak that started in 1973.

The present scheme was originally constructed with the aid provided by the Indian Government. In 1982, the DOI launched the CADP[9] in this system, as a lack of farm level structures and support services were identified as the major constraints in effective water utilization. The CADP was funded by the ADB, the IFAD and the UNDP. The CADP's objective was to increase crop production and increase farm-level income through providing year-round irrigation facilities and providing other agricultural support services.

The CADP was completed in the NWGIS in 1989 at a cost of $11.2 million, and was also under a Project Office. As well as extensive construction, the project also developed water user groups (WUG), and federations of WUG, to whom they envisaged handling over the project, which became defunct almost immediately, for reasons explained later. The changes brought about by the CADP could not be sustained after its withdrawal in 1989. During the CADP, a high level of service was possible due to massive funding, not available thereafter. After the end of the CADP in 1989, there was no proper repair and maintenance in the system, and lack of desilting work in the main canal reduced the main canal's capacity considerably. The Project Office was also scaled down to a much lower unit and a new Project Manager joined for the IMTP work.

3.2 The Panchakanya Irrigation System

The Panchakanya Irrigation System (PIS) is believed to have been started some 200 years ago[10] by the then local *Tharu* community inhabitants to provide supplementary irrigation to 100 ha of land. Later the government took over its control after rehabilitation and expansion. This shift in control resulted from in migration of outsiders, who became dominant in irrigation affairs. The migrant community outnumbered the natives, and had access to better land and local economic opportunities. However, the management take-over by the government could not provide the service as planned due to poor quality of construction. Despite two attempts of rehabilitation and expansion, the targeted command area of 600 ha was never met. The poor condition of the system made farmers again interested to take over the management responsibility when the management transfer policy was started by the government in 1994. The layout map of the Panchakanya system is shown in Figure 3.2.

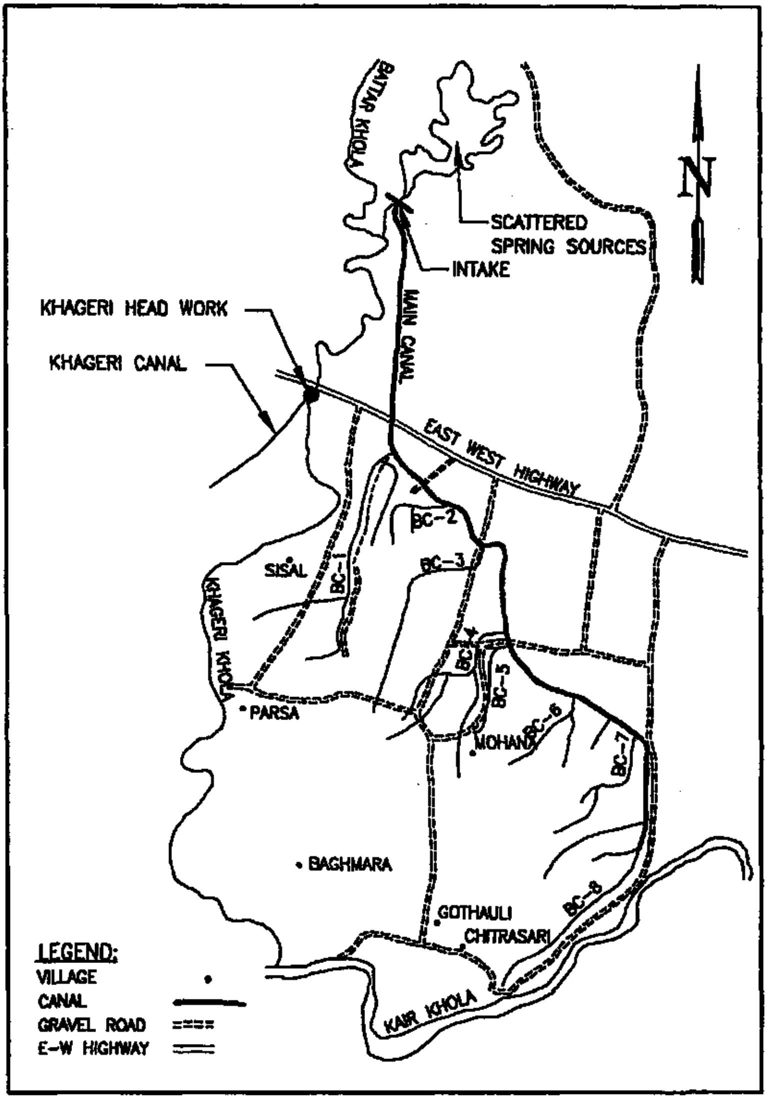
The evolution of the system

In the past, most of the present command area including Debauli, Golhauli, Baghmara, Mohana, Bhedi, Gadauli and Nippani *Maujha*[11] (see Figure 3.2) was irrigated by a separate canal called Budi *Kulo*[12] (not shown in Figure 3.2), which had an intake in Kair *Khola*[13]. According to local farmers, in a major flood in Kair *Khola* in 1967, the intake of Budi *Kulo* was completely destroyed and the river altered its course, rendering subsequent irrigation from Budi *Kulo* impossible. The users of these *Maujhas* then approached Panchakanya farmers for access to irrigation, as Panchakanya had ample water at the source. A proposal was made in 1968 to dig a canal 150m upstream from the current intake site, but the Panchakanya farmers rejected the proposal claiming their prior right over water However, the native Panchakanya farmers could not resist the pressure for long to expand the system to serve these *Maujhas* as:

- The flood affected *Maujhas* had no alternative for irrigation and Panchakanya had ample water to irrigate monsoon rice.

- The massive influx of migrants had left the existing *Tharu* population a minority. The new settlers who were the majority had already gained control in economic and political affairs.

FIGURE 3.2 The layout of Panchakanya System



The farmers of the flood affected Maujhas were mostly the new settlers. They approached to the CIP for expansion of Panchakanya. The CIP finally took control over the project and started rehabilitation and expansion activities in 1974.

After the expansion of the system by the government, there were two major changes in the system. Firstly, the new migrants became dominant in irrigation affairs and in leadership[14]. Secondly the government now took over the management control of the system from the farmers. However, even with this rehabilitation and expansion program, the targeted 600 ha area could not be supplied with irrigation due to physical deficiencies, massive canal losses and lack of branch and tertiary canals. The canal operators of that time say that the maximum irrigated area was about 300 ha after this expansion. The major works during this rehabilitation were construction of a permanent weir at the intake and enlargement of the existing canal section to accommodate the increased discharge in the canal.

The second phase of rehabilitation and improvement was again carried out by CIP between 1982 and 1983, and aimed to provide irrigation to 600 ha. The construction activity this time mostly included canal lining work and development of branch and tertiary canals. Local farmers say that the irrigated area increased to 400 ha during the monsoon season after this second phase of rehabilitation and expansion program. Due to the poor quality of boulder masonry lining, the canal sections cracked soon after the construction, which rapidly increased leakage and seepage from the canal section. In 1994 November, I was involved in a discharge measurement activity in Panchakanya under a training program for the engineers where we found as much as 50% seepage loss within the first 1.4km reaches of the canal section. At this time the irrigated area had already decreased to 265 ha.

There were two reasons for the poor performance of the Panchakanya. First, poor construction quality meant rapid deterioration of structures and lined canals, resulting in heavy seepage and leakage from the canals. Secondly, the budget allocation was low after the funding to CIP from the ADB was stopped in 1989. The average annual requirement for regular O&M then was Rs.120, 000 (Rs.200 per ha, $5 at that time), but the budget allocation were quite low as shown in Table 3.1. According to technicians, except in 1993, the budgets were only enough to pay for the labourers operating the canals and cleaning of the main canal. In 1993, they were able to repair some of the seepage-prone canal sections. Farmers tried to improve system performance by forming a WUA in 1989 of their own initiative. The WUA used to help the CIP by providing voluntary labour for canal cleaning, and also in co-ordinating the water distribution activities. According to the then chairman of the WUA (who is still Chairman), they could not increase the command area beyond 265 ha during the monsoon season because of the poor condition of the main canal.

The water supply regime

The source of irrigation water of Panchakanya is Panchanadi (meaning five rivers), which is formed by the confluence of five natural springs. The total catchment area of these springs is about 40 ha. Part of this area is wetland, and a small reservoir has been formed as a result of the construction of the permanent weir. The Panchanadi joins Battar Khola 100m downstream from the intake weir of Panchakanya. These again join with Khageri Khola, source of Khageri Irrigation system 500m downstream (see Figure 3.2). The water is free from silt, even during monsoon season, except during heavy rainfall. One of the major concerns of the Panchakanya farmers was the decreasing water supply. According to the farmers, the reasons were changing land use pattern, encroachment of reservoir area and lack of silt flushing mechanisms in the weir

TABLE 3.1 Budget allocation for O&M in the systems after the ADB withdrawal

Year	*Panchakanya*		*Khageri*		*West Gandak*	
	Total Budget NRs.	*Per ha* NRs.	*Total Budget* NRs.	*Per ha* NRs.	*Total Budget* NRs.	*Per ha* NRs.
1990/1991	40,000	66.6	254,000	65.0	400,000	69.0
1991/1992	50,000	83.0	158,000	40.0	1,500,000	172.0
1992/1993	297,000	478.0	500,000	128.0	2,200,000	253.0

Source: Account sections of NLIO and West Gandak Project Office.

Previously, the catchment area of Panchanadi was totally covered by forest, and according to farmers, this was gradually changed into cultivated land. Farmers claimed that over the last 25 years (before1997), as much as 50 % of the forestland had been converted into cultivated and grazing land affecting water supply. However, there were no measurements available on the variation in water availability over the years.

Another problem was that farmers with land adjoining the reservoir had encroached on part of the reservoir, converting it into cultivated land. Farmers had great concern on how to take back this land and convert it back into reservoir space. Generally, taking back these lands causes much confrontation and can quickly become politicised. However, the first challenge for the Panchakanya farmers was to allow no further encroachment on the reservoir.

The Panchakanya weir had no silt flushing arrangement[15], so the silt load carried by the river during floods piled up in the reservoir. The silting of the reservoir was further accelerated by the cultivation in adjacent fields. Farmers feared that this sedimentation could close down the five springs supplying water to the reservoir. Farmers felt they needed a silt flushing arrangement in the headwork. They also believed that if the silt build-up was cleaned away, there could be an increase in the water supply from the springs.

Water conveyance and distribution technology

Panchakanya is a gravity scheme designed mostly to irrigate the monsoon rice. Before 1974 the system had no permanent intake and consisted of an unlined canal under the farmers' management. The successive rehabilitation and expansion by the CIP in 1974 and 1985 brought changes in the infrastructure and the command area. A permanent weir was constructed, most of the main canal sections were lined with boulder masonry, and networks of branch canals were developed. The aim of these improvements was to increase the command are from 100 ha to 600 ha by means of new water control structures. The system, however, had no tertiary development and associated water control structures and was thus an extensive type of development[16]. The features of the system as of 1994 (before IMTP intervention) are presented below.

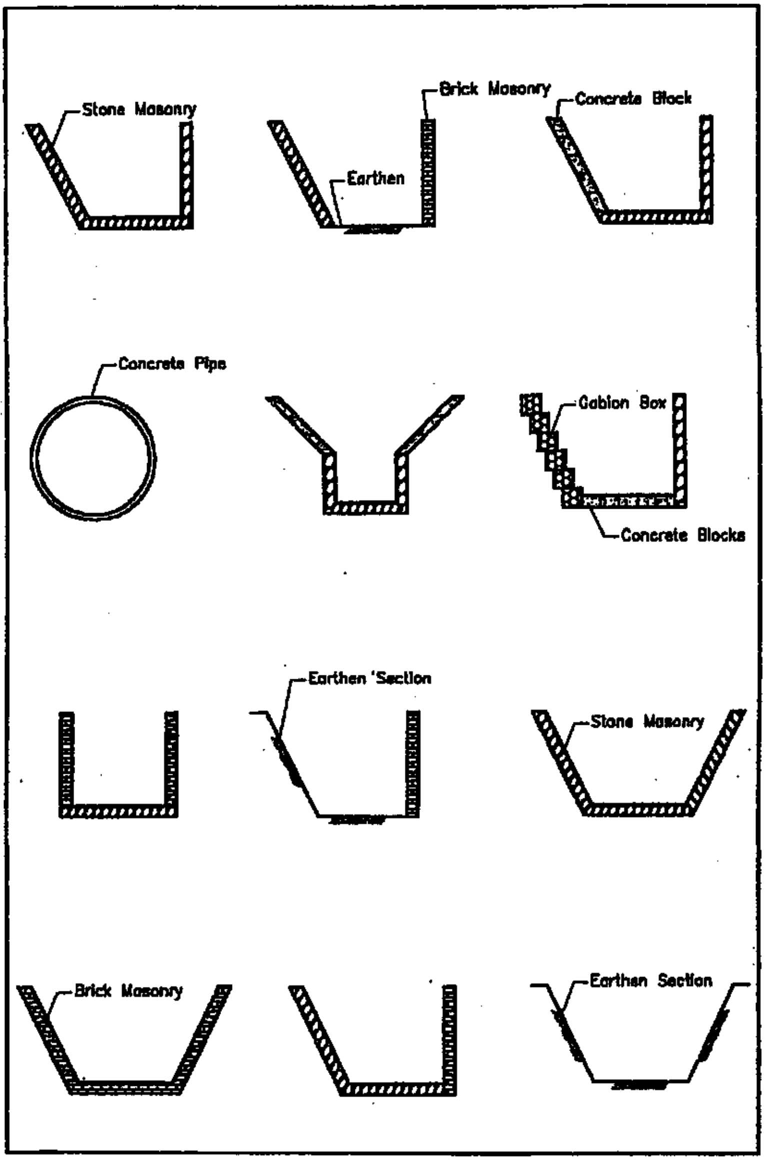
The headworks consist of a solid concrete weir, with a side intake with a head regulator constructed during the first rehabilitation in 1974. It was in sound condition, but lack of an undersluice had created problems of upstream silt build-up, explained previously. There were minor problems of leakage from the embankment walls.

The main canal is 4.94km long and lined in most of its sections. It was designed to carry 1200 lps of discharge. Interestingly, there were all types of canal sections that were geometrically possible, except the triangular section. There were circular (pipe), rectangular, trapezoidal, and combinations of these canal sections. At the same time, every type of construction material- cement, concrete, stone, gabion wires and bricks- were used. I do not think one can find such a combination of different canal sections in any other canal systems of this scale. The various types of canal sections of the main canal are shown in Figure 3.3.

I was very much surprised to see these different canal sections at the time of walkthrough for planning rehabilitation during IMTP in Aug 1995, and could not imagine why this was so. The main canal was constructed on depressed land, filling the ground with earth, which necessitated canal lining to control the seepage as well as to provide stability. But just a few hundred meters away, higher ground levels (the ridgeline) was available where the canal could have been constructed entirely on earth cutting eliminating the costly lining. That could have been the best alignment. Discussion with the local farmers and the engineers of the time reveals that this option was discussed, but rejected by farmers mainly for two reasons. First, it required new land to be acquired, which farmers were not willing to contribute and would add extra cost for the government. Second, if the alignment were shifted, a greater area would have been brought under irrigation on the upstream side, whereas the present tail end areas would have been left out from the irrigation service. However, the rehabilitation and expansion programs were done through the initiation of the downstream farmers. These factors restricted any change in canal alignment during the previous programs. The different types of section and material used were due to interventions at different times and with different actors[17] involved and also due to absence of standard design practices in the DOI.

There are 8 branch canals and 10 direct outlets from the main canal. The branch canals are shorter in length and are mostly unlined except branch 1, which is lined in most of its length, The eighth branch canal was already abandoned by 1994 as water never reached there. The branch canal had no major problems in water conveyance and were free from inundation and flooding problems. The details of canal sections are shown in Table 3.2.

FIGURE 3.3 Canal sections in Panchakanya



Water distribution arrangement

The system used to be operated on a rotational basis. The main canal was usually divided into three different sections for the purpose of rotation among the branch canals. The duration of rotation used to be decided by the then informal WUA, depending upon water availability. According to farmers, despite the rotation, branch canals below the fourth branch hardly received water in the spring season because of the massive seepage. They used to receive water in monsoon season, but at a much lower rate compared to upstream farmers. There were three cross regulators in the main system - in front of branch 1, branch 3 and branch 5 - with manually adjustable steel gates. According to farmers this was enough to maintain the rotational schedule, but their condition was poor, for example the spindle was missing or the gate plates were broken. On the other hand many of the branch canals and direct outlets from the main canal had no gates and were vulnerable to water theft. There was a need to redesign and adjust these control structures to facilitate the rotational practices

TABLE 3.2 The features of canal networks in Panchakanya

Branch Canals	*Length in m*	*Command Area in ha*	*Remarks*
Main Canal	4920	-	
Direct Outlets		51	In total 10 outlets.
Branch 1	1359	100	
Branch 2	645	45	
Branch 3	1101	41	
Branch 4	735	22	
Branch 5	1126	72	
Branch 6	1180	45	
Branch 7	827	65	
Branch 8	820	80	Not functional
Total		521 ha	441 ha, deducting the 8th branch

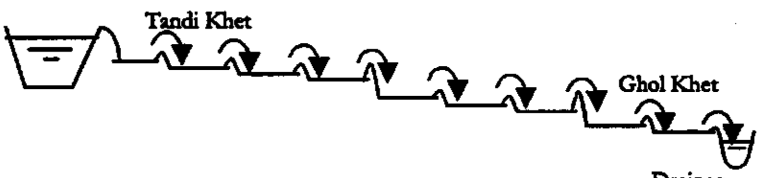
Source: baseline study 1994, Shukla *et al.* (2000)

Water distribution within the branches was usually through on-off gates made of concrete, or open-close type of adjustment using mud and grass, arranged by the farmers themselves. There was again a practice of rotation between the outlets, and each hectare of land used to have 4 to 6 hours' supply depending upon the rotational interval from the main canal to the branch canal. There were no gated check structures inside the branches. Tertiary and field channels were not developed, and were temporarily constructed during the irrigation season. Field-to-field irrigation was dominant throughout the command area.

Land topography

Water management in Panchakanya also faces particular challenges due to its land topography. Farmers here classify the land in two different categories: *Tandi* and *Ghol*. *Tandi* refers to higher land and the *Ghol*[18] refers to lower land. The situation is described by the diagram in Figure 3. 4.

FIGURE 3.4 Terrain Situation in Panchakanya



Tandi farmers have to rely on canal water year-round, irrespective of the cropping season. *Ghol* farmers do not need canal water in the monsoon season, as rainfall and seepage from the higher lands and canal are enough to meet the irrigation demand. According to *Ghol* farmers, they get higher production in low rainfall years. In the spring and winter season, the *Ghol* farmers partly depend on canal water as there is only seepage from the higher land or canal: this can not fulfil the irrigation need and there is no effective rainfall during the spring and winter season to meet the water demand. The area between the *Ghol* and *Tandi* fully relies on canal water in winter and spring season, whereas in monsoon season, they are only partly dependent on canal water.

The above situation is due to the fact that water applied to Tandi area ultimately reaches the *Ghol* area as overland flow and underground seepage, and joins the drainage. This gives *Ghol* farmers an advantage compared to *Tandi* farmers. As will be seen later, this situation has been one of the reasons for the low collection of the Irrigation Service Fee (ISF) in the monsoon season. In many cases, *Ghol* farmers even try to avoid being a member of WUA, as nobody or no method can prevent them from getting water. At the same time, for the farmers having land between the *Tandi* and the *Ghol*, there is always a way to evade paying of service fee as access to seepage and rainfall can fulfil the irrigation demand.

Agriculture and land tenure

Among the irrigators, 88% are owner cultivators whereas tenants account only for 1%. (ICON, 1996). The rest are the owner-tenants. Small farmers with 1 ha or less land[19] account for 81% whereas only 19 % are large farmers holding more than 1 ha. The average land holding in the system is 0.67 ha. The average land holding in small farm category and large farm category is 0.4 and 1.75 ha respectively. The much smaller landholding given the original allocation has been due to division of land among the sons (after the death of father) and also due to high transactions in land induced by increasing economic activity in the area.

As in other parts of the Terai there are three agricultural seasons: the monsoon season (June/July-September/October), winter season (October/November-January/February) and spring season (Feb/March-May/June). The average rainfall is more than 1600 mm, more than 80% of which falls during the monsoon season between June and September (the mean monthly hydrological and meteorological data are presented in Annex 2). Paddy is the dominant crop in the area during the monsoon irrespective of access to irrigation water. The monsoon paddy is mostly followed by lentils and wheat in winter. The area under wheat is very low. In spring, maize and spring paddy are cultivated depending upon the water availability situation. The cropping pattern as of 1996 (at the beginning of IMTP) is given in Table 3.3.

3.3 The Khageri Irrigation System

The system lies in the western part of the Chittwan valley, and was developed to provide supplementary irrigation for monsoon rice in 3900 ha land. Since its construction it has been a water-scarce system, as flow in the Khageri River is highly variable both within the season and across the season, which is the major constraint to the system. However, from an O&M point of view, it is an ideal system requiring low management input. Its main canal is almost in regime condition, that is, with no problems of silting or scouring. Its canal networks are safe from risks of flooding and inundation, common in other large irrigation schemes in Nepal. It is again an extensive development, with few water control structures and canal networks inside the command area. At the beginning of IMTP, it did not have any technical constraints in water delivery. Its only major challenge was the limiting supply at the source. The canal layout is shown in Figure 3.5

TABLE 3.3 Cropping intensity and crop yields

Season	*Monsoon*	*Winter*			*Spring*		*Total*
Crops	Paddy	Wheat	Oil seed	Puls es	Paddy	Maize	
Coverage	91%	9%	26%	47%	3%	46%	222%
Yields (t/ha)	3.21	1.44	0.33	0.34	3.6	0.62	

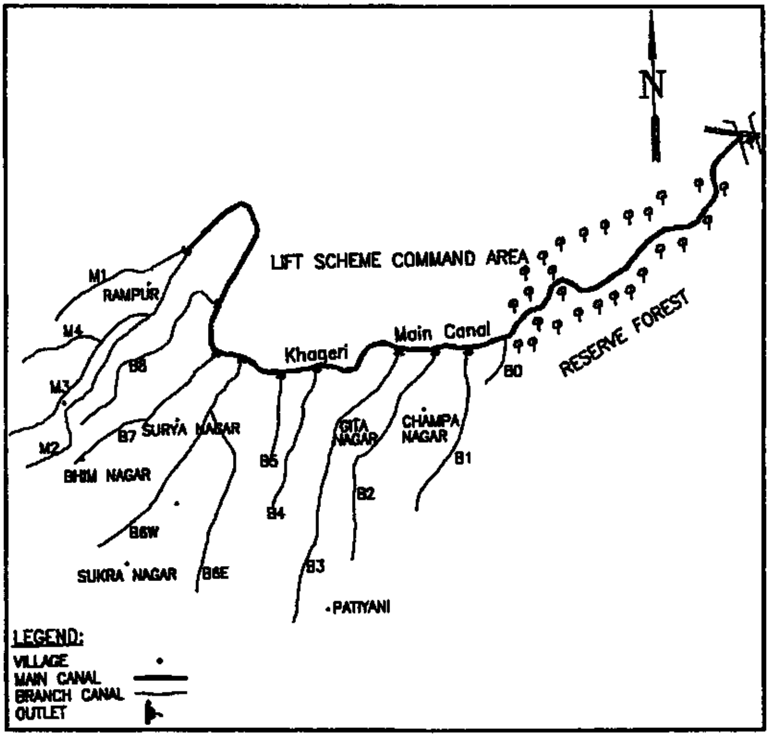
Source (ICON, 1996, NLIO crop cutting survey reports)

System design shortfalls

The design of the Khageri System was conceived in 1960 by the Department of Irrigation (DOI). There were two objectives behind the development of the KIS: to support the livelihood of newly settled people and to supply surplus food grain to feed the growing population in the capital city of Kathmandu. The project was approved in June 1960 by the government and then by the Rapti Valley Multi Purpose Development Board. The original planning of the project was done by an FAO irrigation expert and the proposal was submitted to the Government in September 1960 (according to available design report). Construction began in 1961 and was completed in 1967 at a cost of NRs 7.3 million (some $1.2 million at the 1967 exchange rate).

The development of the Khageri system shows how system design in the early days was constrained by the absence of agrometrology data as well as by the limited experience of designers at that time. The DOI at that time had no experience of constructing irrigation scheme of this scale; it was mostly engaged in the development of small-scale schemes. It was supported by the FAO in carrying out its activities. The external experts were not in favour of construction of this system: they argued that the KIS command area had a highly porous soil, not suitable for rice crops. It was suitable only for maize cultivation. The design report cited that the Khageri would need a higher water requirement due to the porous nature of the sandy loam soil. Other reports had a similar view, suggesting that this type of soil needed comparatively more water than that of the Indo-Gangetic plain. However, the construction proceeded later with support from the Chairman of the resettlement committee.

FIGURE 3.5 Canal Layout of Khageri System



At that time, there were no data available on the duties[20] of the crops nor any data for their estimation. Likewise, there was no reliable data on available water flow in the river. In the original design, a duty of 54 acres per cusec at the head of the rice crop was assumed. The duty at the main canal head and branch canal head were assumed to be 58 and 60 acres per cusec[21] allowing the conveyance and other types of losses. Likewise the measurement in the river over short period (discharge was measured in the monsoon season from 1959 for a period of five years) showed that about 280 cusecs could be available during the monsoon season. With this basic assumption, the area for rice cultivation was assumed to be 15120 acres (6123 ha). During the winter periods, it was assumed to provide irrigation to about 7000 acres (2800 ha) acres for wheat cultivation considering a duty of 100 acre per cusec.

As construction proceeded, the command area was drastically reduced to 10000 acres (4000 ha) from the planned 15000 acres. The design report of 1967 mentions two factors for this reduction in the command area. First, the designers realized that the crop water requirement could be much higher than anticipated due to high percolation losses. Second, because of erratic monsoon rainfall with respect to its onset and amount, water supply to the system was highly variable both from season to season and within a particular season. A survey by CIP later on found that the potential irrigable area in the system was 3900 ha.

Construction was completed in 1967 and its management responsibility was transferred to the CIP from the existing Khageri Canal Division in 1974. The CIP also carried out canal lining work in selected branch canals and added cross regulators in the main canal in 984 to 1985. As in Panchakanya, with the termination of the loan period to the CIP in 1989, the maintenance budget to KIS was also drastically reduced as shown in Table 3.1. According to the technicians, the budget was low as compared to its requirement of NRs. 200 per ha that time. However its performance was not as poor as in Panchakanya because of relatively simple water control technologies, functional canal networks and silt free water. However, its targeted command area was never met, because of the variable flow at the source.

River regime and water availability

The water source of the KIS is the Khageri River, which is a tributary of the Rapti River in the Narayani River Basin. The annual rainfall in the catchment averages 1600 mm, about 80% of which falls during the monsoon months of June to September but can be highly variable. Water supply in the rainy season is mainly from the runoff produced in the catchment and springs flow, while the dry season flow is entirely dependent on the base flow seeping from groundwater of the catchment. Water measurement activities in later years show that Khageri flow is highly variable across the years and across the seasons. Its average flow from August to October is more than 6000 litres per second, which drastically falls to 700 litres per second towards the end of May. The main problem with the source is that flow in the month of July is highly variable as seen from Table 3.4, which makes the planning of rice transplantation problematic.

According to farmers, it is also uneconomic to supplement the canal water through groundwater because of the deeper groundwater table (more than 30 m) and poor discharge available. Except in the month of July, paddy cultivation is not a problem, as the river discharge becomes stable. There is a saying in the Khageri area that if you are able to transplant the rice, then your crop is guaranteed. The observed discharge between July to October from 1992 to 1999 is presented in Table 3.4. The Table also presents the average water requirement for each month for the rice crop.

TABLE 3.4. Observed monthly discharge and monthly water requirement

Year	*Discharge and monthly water requirement for monsoon rice (for 3900 ha) in lps*							
	Jul	*AFR*	*Aug*	*AFR*	*Sep*	*AFR*	*Oct*	*AFR*
1992	3840	6103	6270	7468	6660	7176	8550	6103
1993	3620		7260		NA		NA	
1994	2960		6460		6280		6970	
1995	6840		7350		7570		8140	
1996	3920		6580		7590		8210	
1997	5740		5620		6080		6750	
1998	7520		7000		7460		8140	
1999	7930		8680		8680		6220	
2000	6750		7260		6750		5740	

Source: Kalu *et al.* (2000); RTDB, DOI and CEMECA consult (2001)

AFR: Average flow required

Due to water shortage and variable flow in the river, water delivery has always been on an *adhoc* basis in Khageri, and irrigated area also varies accordingly. The farmers' first concern was about the limiting source, when discussions to start joint management began in 1992.

System configuration and water distribution

The Khageri Irrigation System is a typical medium-sized, extensively developed surface irrigation system. It consists of a barrage, a 23km long main canal, 8 branch canals and 4 minor canals (see Figure 3.5). These minor canals also receive drainage water to supplement the canal irrigation.

The headworks and canal networks

The headwork consists of two gates spanning 10 m each separated by a 2m thick pillar. It was originally designed to pass 6000 cusecs of flood water. In order to pass the excess flow, a causeway was proposed alongside the headwork barrage which was replaced by a permanent bridge later. A sluice has been put on the right-bank of the barrage to divert water in the canal. There have been no problems associated with the headwork.

The main canal can be considered as a regime canal, with no problem of silting and scouring. It was developed as a contour canal to irrigate the area south of this canal. Its original designed capacity was 7850 lps. However, flows of more than 8500 lps have been also observed in this canal (see Table 3.3). It was designed to collect water from both the Khageri River (7000 lps) and the surrounding drainage (850 lps). The main canal in its head reach is 9km long and passes through the forest. The topography of land in the jungle reach is full of ridges and valleys, where several small reservoirs have been formed like 'melons in a vine' as the result of the construction of the main canal. These reservoirs act as intermediate storage for the main canal, and have been of great importance to maintain the water delivery in the system. The canal reach after this jungle involves several cross drainage structures.

All the nine branch canals and four minor canals are aligned on well-defined ridges. In an earlier report by the FAO expert, it was proposed to line the branch canals, but this was rejected due to financial limitations. It was also assumed that the porous canal would become lined by the silt over time, so lining may not be required in future. The canal networks and their respective length and command area are shown in Table 3.5.

TABLE 3.5 Description of canal networks

Canals	*Length in Km*	*Command Area ha*	*Remarks*
Main Canals	23.20	-	-
Outlets		483.0	Total 41 outlets
BC 1	3.77	266 .0	
BC 2	4.98	505.8	
BC 3	7.30	392.1	
BC 4	2.90	127.5	
BC 5	2.30	194.0	
6 Main	1.44	165.0	
BC 6 East	4.52	429.5	
BC 6 West	3.00	341.9	
BC 7	2.80	238.1	
BC 8	4.8	177.3	
Minor 1	3.6	189.9	
Minor 2	5.5	256.7	
Minor 3	3	99.9	
Minor 4	1.4	60.8	
Total		3927.5	

Source: NLIO office records

Water distribution

Water distribution from the main canal is carried out by means of cross regulators with manually adjustable steel gates. There were five such structures along the main canal in front of Branch 1,2,3, 6 and 7. Branch canals offtakes are overflow weirs and also have manually adjustable gates. Inside the branch canals, there are no gated structures, and water delivery takes place through piped outlets. The CIP had started a pilot experiment with construction of cross regulators inside two branches (1 and 2) with the aim of providing flexible distribution, but the program was later cancelled after strong objection from tailend farmers.

So, the water distribution arrangement was relatively simple in this system. There were no gated structures inside the command area, and gate operation was required only in the main canal, which were also few in number. Due to the limiting and highly variable flow, rotational distribution was practiced. Most common was the weekly rotation, in which branch canals were divided into two groups. However, during very low flow situations, there was another type of rotation, called the sectional rotation. More details about negotiations of these rotations are discussed in chapters 5 and 8. Khageri had also similar problems in water management inside the command area due to the characteristics of its land topography, as explained in Panchakanya.

Agriculture and land tenure

About 97% of the farmers in the Khageri are owner-cultivators (Wallingford and DOI, 2001), whereas tenants make up less than 0.5% of the total population. The remaining are owner-tenants. The average land holding here is 0.87 ha, slightly higher than in Panchakanya. The population with more than 1 ha of landholdings here also account for only at 19%, with remaining landholdings of less than 1 ha. The average landholding for farms of less than one hectare is 0.6 ha, whereas for farms larger than 1 ha that figure is 1.9 ha. Like in Panchakanya, this shows that social differentiation due to landholding status is limited.

The major crops grown in the area are rice in the monsoon, wheat and pulses in winter and maize and spring paddy (only in the first branch canal, B_1) in Spring. Except for rice, these crops are grown under rainfed cultivation. The intensity and yield as in 1995 are presented in Table 3.6. The yields are similar to those realized in Panchakanya.

3.4 The West Gandak Irrigation System

The system was initially constructed by India according to Indo-Nepal agreement and handed over to Nepal in 1979. However, canal networks at field level were not developed and irrigation could only take place in part of the command area. The CADP feasibility report (1982) mentions that there was only one temporary turnout for every 300 ha, and only 900 ha land was under irrigation. But the government reports of same period mentions an efficiency of 50% for monsoon rice and 30% for winter crops (Silt Consult, 1989). This means about 4000 ha was under irrigation during monsoon and 2500 ha during winter crops. The lower figure mentioned in the CADP feasibility report might have been cited to justify the CADP investment. Whatever the case may be, it can be concluded that irrigation provision at this time was far less than the potential area. Its layout is shown in Figure 3.6

TABLE 3.6 Cropping intensity and crop yields

Seasons	*Monsoon*	*Winter*			*Spring*		*Total*
Crops	Paddy	Wheat	Oil seed	Pulses	Paddy	Mai ze	
Coverage	92%	30%	12%	25%	5%	40%	206%
Yields (t/ha)	2.9	1.46	0.33	0.34	3.45	0.62	

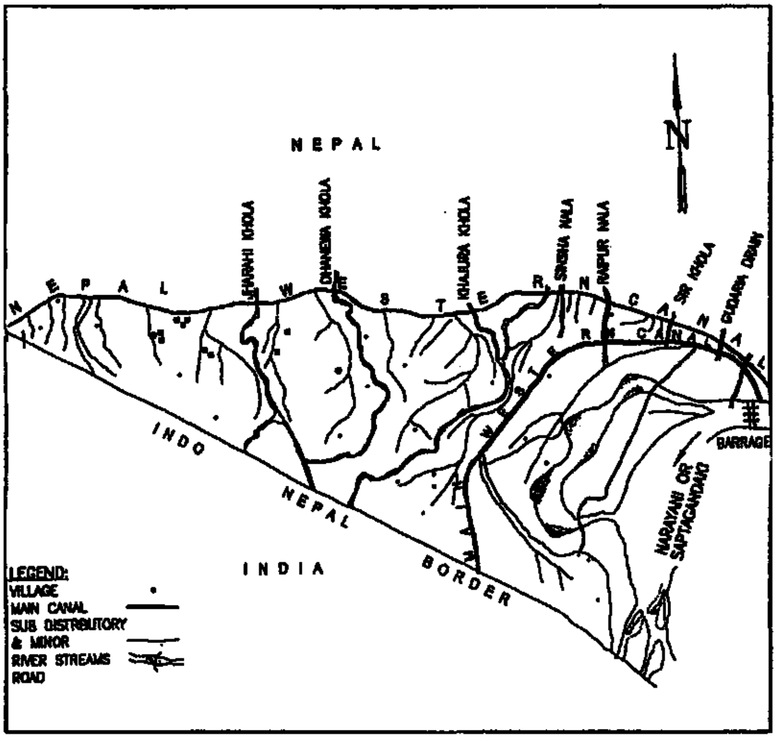
Source: NLIO crop cutting survey reports. Other crops cover about 2% area.

Command area intervention and operational change

In 1982, the DOI launched the CADP [22] in this system, as a lack of farm level structures and support services were identified as the major constraints in effective water utilization. The CADP was funded by the ADB, IFAD and the UNDP. The CADP's objective was to increase crop production and increase farm-level income through providing year-round irrigation facilities and providing other agricultural support services.

The CADP was completed in the system in 1989 at a cost of $11.2 million. It was an intensive type of development with irrigation facilities extended up to the 7-12 ha blocks. In the hierarchy of canal networks, 8 different types of canal networks were developed, depending upon irrigated area and canal discharge capacity. The CADP also carried out drainage improvement activities by constructing embankment dykes to control the problem of flooding inside the command area. The CADP also provided rural village road networks of more than 122km to facilitate transportation of the agriculture produce in the area.

FIGURE 3.6 Layout of West Gandak system



The changes in the livelihoods of the people brought on by the CADP were considerable. Silt Consult (1989) mentions that yields of major crops like rice, wheat and sugarcane increased by 61%, 100% and 56% after the command area intervention. The changes in cropping pattern over time in the system are shown in Table 3.7. The report also mentions that the amount of chemical fertilizer use also increased from 51 kg/ha to 93.3 kg/ha in the same period.

Local farmers say that with the availability of irrigation water, they also started cultivating improved varieties (especially paddy and wheat) bringing the seeds from India. Extension activities by the District Agriculture Office (DAO) and credit facilities by the ADBN had also a major role in improving productivity. According to the farmers, the newly established large-scale Lumbini Sugar Mill in the vicinity had a greater role in increasing sugarcane production. The factory had carried out several programs to increase the productivity of the sugarcane.

TABLE 3.7 Changes in the crop yields after CADP

Crops	*Change in Crop Yields, t/ha*		
	1982/1983	*1988/1989*	*1993/1994*
Paddy	1.37	2.2	3.4
Wheat	0.62	1.24	1.54
Maize	-	1.2	2.06
Oilseeds	0.3	0.53	0.56
Pulses	0.32	0.38	0.63
Sugarcane	21.97	34.17	47.7

Source: Silt Consult (1989); CADI and APTEC (1999)

During the CADP, a high level of service was possible due to massive funding, not available thereafter. One engineer who worked in NWGIS during the CADP intervention told that there were more than 100 supervisors and gate operators to operate the system. Water delivery even up to the tertiary level canal was carried out by these operators. Likewise, canal cleaning, including at tertiary level was done by the project office. After the end of the CADP in 1989, there was no proper repair and maintenance in the system, and lack of desilting work in the main canal reduced the main canal's capacity considerably. The Project office was also scaled down to a much lower unit. There were now only 18 operators to look after the operation of the system. Available funds were very low to provide maintenance activities as compared to a required O&M cost of NRs. 300 per ha, shown in Table 3.1.

The CADP had carried out radical changes in the infrastructure to provide an adequate and reliable supply of water to farmers. It had planned continuous flow at all canal levels during the monsoon season for rice, and continuous flow up to the tertiary level canals and four-day rotation among the farm ditches for wheat (CADP Design Main Report, 1982). Each turnout was provided with check structures employing manually adjustable gates. There were more than 1000 gates added in the system to achieve flexible distribution. But this water delivery arrangement proved useless in the absence of manpower and funds. The assumed flexible O&M plan as envisaged by the CADP could not be retained in practice.

The system deteriorated rapidly and by 1992, only about 50 % of the area received water. The discharge in the main canal fell to 2200 lps against the design discharge of 8500 lps due to heavy sediment build up. GITEC (1992) mentions that the actual irrigated area declined to 2200 ha for monsoon rice by 1992, and several of the tertiary- and farm-level canals and related structures were either abandoned or dysfunctional. Both farmers and the canal operators say that such rapid deterioration of the structure was not only due to the budgetary constraints, but also due to faulty design of canals and structures. They also say that much of the damage involved lower-order canals, rather than on the Main Canal and the Branch canals. Farmers were never consulted in the design and construction of these canals and associated water control structures. In many cases farmers found the location of the check structure and field channels inappropriate, and they dismantled the control structures and started irrigation after constructing the checks and field channels they felt appropriate. Canal operators told that within two years after construction most of the gates inside the command area were either removed or made dysfunctional by the farmers. Damage to lower- order canals and associated structures done by farmers had also been cited in the post- evaluation study of CADP (Silt Consult 1989), which was carried out immediately after the completion of CADP.

System maintenance was not given required attention after the CADP. According to the Project Office, about 70% of the Main Canal was silted up by 1992. The situation inside the command area was no better. The Project Office expected the farmers to clean the lower-order canals, but farmers expected the government to clean up them like in the past. Some groups who used to clean their canals also lost the interest due to unreliable flow, in turn the consequence to decreasing flow in the Main Canal.

Effort to involve farmers

One of the objectives of the CADP was to involve farmers in system O&M activities. Water user groups were set up to: ensure proper distribution of irrigation water in farm ditches; promote proper and effective communication and co-ordination between irrigation personnel and water users; assure financial and organizational incentives to fellow farmers; and form and strengthen existing village co-operatives[23]. It had envisaged handing over the O&M responsibility of lower-order canals like MFD and MCs and SFDs (the details of this lower-order canal appear in next sections) to Water users groups (WUGs). According to the Impact Evaluation Study of CADP (Silt Consult 1989), three levels of water user groups were set up: the farm ditch group, to serve farm ditches of on average about 7.5 ha; the WUG to serve MFD canals (an average area of 50 ha) and the Federation of Water Users Groups (FEWUGs) to serve supply-level canals like the Minor (average area of 200 ha). However, this activity started towards the end of the project when the construction activities were almost over. A total of 132 WUGs and 11 Federations of WUGs (FEWUGs) were formed, most of them within a very short period of time, as shown in Table 3.8

TABLE 3.8 WUGs Formation During CADP

Year of Formation	*Number of WUGs*	*Number of FEWUGs*	*Total numbers of training sessions to WUG*	*Number of Participants*
1986	3			
1987	12			
1988	72		16	763
1989	45	11		
Total	132	11		

Source (Silt Consult, 1989).

Such groups were formed from gatherings of farmers, and the consultants and Project Office staff were jointly responsible for forming these groups. The groups became defunct as soon as they were created mainly due to the following reasons (according to interviews with farmers and engineers who worked during CADP):

- Farmers had seen massive investment during the command area development project and felt that government would continue to provide support. They were not involved during the whole project implementation, and thus were not convinced that they should involve themselves at the later stage in operation and maintenance activities.
- Even the Irrigation Department had no framework for users' involvement in irrigation development and management at that time. So the project officials at that time also did not pay attention.

By 1992, there were only a few WUGs remaining, and neither the agency nor the farmers were performing their required maintenance jobs. The agency could not provide the service, as the annual fund provided by the government was too low. On the other hand, farmers saw no sense in maintaining the farm ditches, as water delivery to their fields was unreliable. Each party was blaming the other for the declining performance of the system. Government blamed farmers for damaging the structures, the gates and destroying the tertiary and field channels and drainage network, while farmers blamed the agency for not cleaning out the main and branch canals which decreased the main canal flow considerably. This lead to an accumulation of the deferred maintenance works, and early rehabilitation became inevitable.

With the beginning of IMT Policy in 1992, the government initiated the Joint Management program in this system, aiming to stop further deterioration. According to the IMD engineers the main reasons for its selection was the abundance of water at the source. Besides, it had tremendous potential to increase agricultural productivity because of the strong agriculture community, fertile soil and easy market access. Many farmers told that they were very enthusiastic to participate in the new program, for several reasons. They were faced with the declining performance of the system after the withdrawal of CADP due to a lack of repair and canal-cleaning activities. Even with radical changes in technology and infrastructure by the CADP, the two major problems in the system the inundation and flooding and silting of the main canal had remain unresolved (details appear in the next few sections). They expected a new program could bring better water supply conditions. The Gandak system, its physical features, and the challenges it presented to its operators, managers and the farmers in 1992 are further explained below.

River regime and associated problems

The system draws its share of water from a reservoir formed by a huge barrage built across the Narayani River along the Indo-Nepal border. The intake point of the West Gandak lies about 600m upstream of the barrage. Out of the three gated openings, each with a capacity of 300 cusecs (8430 lps) at the offtake point, only one was in use with the others closed off with concrete walls. There was no need to open the remaining two gates, as the canal downstream was designed only for 8500 lps. Farmers in the area say that they had heard that initially there were plans to irrigate about 27,000 ha land, and the provisions of three gate openings were made accordingly. However, only 8,700 ha was developed afterwards diverting 8500 lps of water. The reasons for this massive reduction in the area and hence in water diversion remain unclear.

Operational problems

West Gandak does not face any water shortage problem at the source as its diversion requirement is only 300 cusecs whereas the expected low flow in the Narayani river is 20,000 cusecs, which occurs during the month of February /March (as per the original design report). The system can have full discharge year-round if infrastructure downstream are in proper condition. However, due to operational constraints resulting from occasional floods and silt-laden water, water availability during the monsoon season is always variable. The control of barrage operation is with the Indian authorities, and farmers also feel that they are not sincere in maintaining the required pond level at the barrage location.

Silt problems: Silt intrusion in the main canal is another major problem in the system. The Narayani River carries a tremendous amount of silt during the monsoon which directly enters into the main canal of the NWGIS. There are no mechanisms to control the silt load entering the main canal. According to the project technicians, the average silt deposition is 45 cm in the head reach section which gradually falls to 20 cm at the tail end after each monsoon irrigation season. A good design of channel however, should allow the silt to be transported with the flow, and be deposited in the field so that canal is not silted up[24]. However the CADP overlooked this criterion, providing large numbers of check structures in the main canal which retards the flow, encouraging sediment build up.

The major portion of the main canal thus requires de-silting work annually. This work is not only costly, but also requires mechanical equipment like excavators and dump trucks. The desilting process is also difficult, as both sides of the canal embankment consist of Sisoo tree forest. In the 1980s, all of the canal networks in Terai were planted with Sisoo trees by the Forest Department (DOF) under the Terai Community Forestry Program funded by the WB. The forest have now become one of the major problems in canal cleaning and maintenance activities in all of the irrigation systems in Nepal. There are three problems relating to this plantation. First, they hamper the canal- cleaning activities as trees restrict the movement of heavy machines. Second, the roots of dead trees upon decaying have been responsible for weakening the canal embankment. This not only increases canal seepage, but also makes canals susceptible to breaching. Thirdly, upon falling on the canal, dead trees obstruct the flow, which disrupts the canal operation and increases the frequency of canal breaching.

Problems of flooding and inundation: The West Gandak also faces particular challenges from problems of flooding and inundation. The problems are more dominant in the upper part of the command area, where there are several rivulets flowing from north to south which are blocked by the big canal embankment going to India (see Figure 3.6). Though siphon structures have been constructed at many places to drain flood water, they are not found sufficient and are less effective due to lack of proper and timely repair and maintenance. This causes part of the command area to be always inundated during monsoon period, destroying whole crops. According to the Indo-Nepal agreement, the responsibilities to clean and maintain these siphon structures lies with the Indian Government. However, according to project technicians, these problems are given low attention by the Indian Authorities. In many cases, at the time of flooding, farmers of the area organize and dismantle the embankment of the irrigation canal running into India in order to pass the floodwater. The different letters exchanged between the Project Office and the Indian authorities show that there are one or two incidents every year, and this is one of the major problems for the concerned authorities of both the governments.

According to the Indo-Nepal Agreement, damage to crops is to be compensated by the Indian Authorities. In 1992, the West Gandak project office had asked for NRs. 893038 (about $ 20,000 that time) in compensation from India for crop damage in that year. Several letters exchanged between the West Gandak, the Indian Authority and the DOI show that this compensation was never given[25]. Since then, the project engineers in West Gandak lost their interest in calculating the degree of such damage. There is also a Standing Committee between India and Nepal to look after the issues of floods and inundation between the two countries. A review of the minute book of this committee shows that West Gandak problems are always on the agenda of discussions.

However, such discussions have always ended with recommending further study on the matter!

These problems were there even before the CADP, and resulted from the construction of the canals and the bund by the Gandak project, which obstructed the natural flow of drainage causing flooding and inundation. The CADP had tried to solve this problem by constructing the dykes at the riverbank, as well as by constructing cross-drainage structures and drainage channels at several locations. It was expected that the dykes would confine the flow along the river channel and save the cropland from inundation. However, the dykes became less effective in controlling the flow over time due to: erosion of the dykes and rise in the riverbed level due to confined water width. This has resulted in a situation such that the riverbed is higher than the adjoining farms, which has further increased the risk of crop damage upon failure of the dykes. Farmers of the West Gandak systems have been thus suffering from the same problems; flooding and siltation since the initiation of the project. Radical changes in technology by the CADP could not bring any change in these problems. These problems require continuous attention and many of the issues cannot be addressed by the concerned local agency only. It also requires good understanding and co-operation by higher authorities in the Government of Nepal, and also co-operation by the Indian authorities.

Water conveyance and distribution system

The CADP aimed to increase system efficiency by means of radical improvements in the system technology by implementing: rehabilitation and improvement of the existing main canal, construction and/or improvement of major drains, collector drains and associated structures and improvement of access roads. The resulting conveyance network is complex, owing to the presence of different sizes of canals at different locations. In its hierarchy of canals there are eight different levels of canals: the Main Canal, the Sub Distributary (SD), Minor Canals (MC), Minor Canal Blocks (MCB), Water Course, Special Farm Ditches (SFD), Main Farm Ditches (MFD), Farm Ditches (FDs). The Sub-distributors, Minors, MC blocks and SFD draw water directly from the main canal whereas the MFD and FD and watercourse are lower-order canals of the sub-distributary and the minors.

This type of terminology for canal networks had never existed in other irrigation systems in Nepal (and even today exist only in the three systems where CADP intervention took place) and were introduced by the consultant involved in the design and construction. The design supervision of the CADP was carried out by the International Engineering Company (American) and NIA CONSULT of the Philippines, and the nomenclature was borrowed accordingly. The schematic diagram of the canal network in NWGIS is shown in Figure 3.7. There are four sub-distributaries with a total length of 46.07 km and 6 minor canals with a total length of 20.43 km.

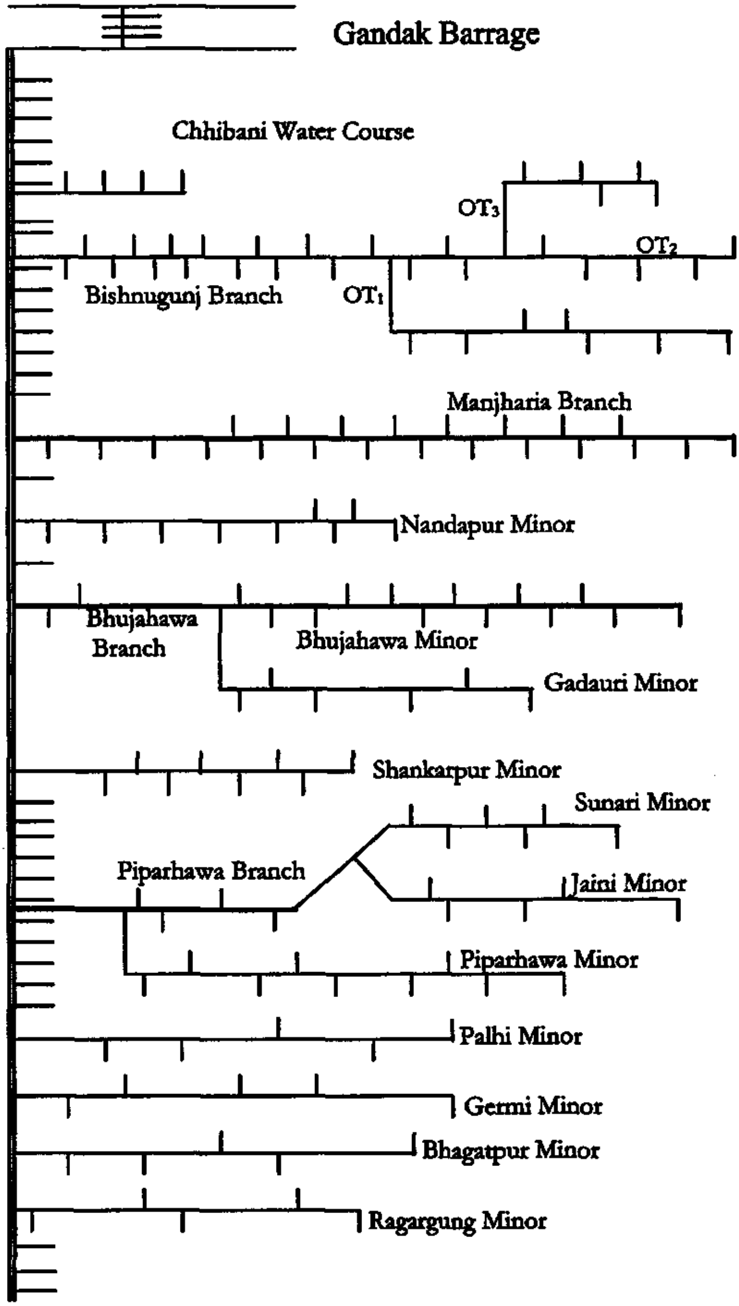
The total length of lower order canals like MFD, and FD is more than 650 km. The FDs are the lowest-order constructed canals which deliver water to seasonally prepared water courses, to finally deliver the water into the fields. The features of the canal networks are presented in Table 3.9.

TABLE 3.9 Details of West Gandak canal system

S.No.	*Name of Canal*	*Length in Km*	*Command Area in ha*	*Capacity in m^3/s*	*Remarks*
1	Main Canal	32.0	1686.77	8.5	
2	Sub-distributary canals				termed as branch canals in the thesis
a	Bishnuganj	18.15	1310.81	1.31	inclusive of 3 sub branch
b	Majhariya	8.60	1241.8	1.24	
c	Bhujahawa	9.80	1147.62	1.15	including 1 sub branch
d	Piparhawa	9.52	1347.67	1.36	including 2 sub branch
3	Minor Distrabutaries				
	Nandapur	4.20	372.49	0.37	
	Shankarpur	5.80	456.99	0.45	
	Palhi	2.88	189.10	0.19	including 1 sub branch
	Germa	3.45	259.58	0.25	
	Bhagatpur	2.05	240.3	0.24	
	Ragargang	2.05	247.23	0.25	
		29.43	8700	8.5	

Source: Silt Consult (1989)

FIGURE 3.7 Canal Network details of West Gandak



The main canal and other canal networks

The main canal was extended to 32.7km from 25km by extending the tail end portion, and four more minor canals were added to the system during the CADP. The designed capacity of the main canal is 8500 lps (300 cusecs). The main canal has 25 check regulators and 41 head regulators of different capacity. It is primarily an earthen canal with both cut and fill sections. There is dry boulder pitching in deep cuts and sandy zones, and in areas adjacent to structures. The canal slope for the first 30 km is 0.00018, and 0.00023 for the remaining 2km section. The designed diversion water requirement is thus about 1 litre per second per ha. A minimum free-board of 60cm has been provided in the original designed section. It is a contour canal and thus irrigates only one side of its alignment (in this case only the left side).

The construction of the main canal has blocked many of the natural waterways. The canal systems thus include several cross drainage structures like aqueducts, canal siphons, and drain siphons. Provisions for interceptor drains to connect the natural waterways into these cross drains were developed during the CADP. The main canal includes all kinds of structures that are mostly found in supply-oriented gravity canal irrigation network as given in Table 3.10.

TABLE 3.10 Major structures of the main canal

Type of structures	*Numbers*
Aqueduct	3
Cross regulators	25
Head regulators of major off taking canals	7
Canal escapes	3
Canal siphons	16
Drain siphons	9
Village road bridges	44

The designed carrying capacity of the Sub Distributary canal varies from 0.34 to 1.25 cumecs while a minor canal has a capacity up to 300 lps. The same applies for each MFD and FD are 90 and 30 lps respectively. A FD commands 4 to 10 ha or an average area of 7.5 ha, depending upon the topography. A MFD commands a 50 ha irrigation block. The SD, MFD, and FDs are earthen canals. Some portions of SFDs and MFDs pass through depressions and weak sandy zones and are fortified with boulder lining. The network of tertiary canals (MFD), farm ditches and associated water control structures are shown in Table 3.11.

The intensity of these structures show the extent of development CADP had carried out in the system. As mentioned previously, most of the farm ditches and their turnouts were already damaged or made dysfunctional by 1992. This section has thus highlighted the high amount of infrastructure to be operated and maintained by the WUA and DOI as well as problems of flooding and inundation beyond local capacities to resolve.

TABLE 3.11 Details of tertiary canals and farm ditches and associated structures

191 km of MFD
446 km of FD
173 MFD turn-out gates
305 MFD cross regulators 1884 FD turnouts
375 MFD culverts
443 FD culverts

Water distribution technology

The West Gandak system was designed as a highly flexible system in terms of water distribution and consisted of check structures at every turnout, which can be clearly seen from the Tables above. The gates used in the division structures were manually adjustable gates. It was assumed that with introduction of this flexible supply-oriented water delivery, farmers could receive the desired amount of water in accordance with their need at any moment. But this requires more than 100 operators and a relatively large maintenance budget. The designers overlooked the operational reality, as this level of management input was hardly possible in the Nepalese context.

The large numbers of check structures were also the cause of silt deposition in the main canal. Interviews with the engineers involved in the design and construction of the NWGIS revealed that there was no discussion about the design prepared by the consultant. The construction was carried out as designed by the consultant. The design did not pay any attention to the silt problem and operational problems of the future. Pradhan (1996) has reviewed a similar design in the Banganga Irrigation system which was also under the CADP and designed by the same consultant. His study also shows how such technology causes problems in canal O&M, and he considers this type of intensive development unsuitable to encourage self-management by farmers.

So the West Gandak had two major challenges at the beginning of the management reform. The first was the challenge posed by the physical environment (the problem of inundation, flooding and silt) and the other was the constraint of the technology which demanded higher and skilled management input and a large O&M budget. However, it did not have the water scarcity problem at the source that the Khageri and Panchakanya schemes had.

Agriculture and land tenure

As in the previous two cases, more than 95% of the farmers are owner-cultivators where as tenants account for less than 1%. The rest are owner-tenants or practice share-cropping. The average landholding here is 1.89 ha (Everest Research Centre, 1993). Based on the records of the three branch canals studied in depth (the MC5, Mangharia and the Germi minor), the percentage of farmers with more than 1 ha of land is 18% and they cover 49% of the total land, whereas those with less than 1 ha constitute 82% and cover 51% of total land holdings. The average holding on the smaller farm size is 0.45 ha whereas for the large landholding range it is 2.10 ha. The land holding size is slightly higher here as compared to the previous two cases with a wider social differentiation between irrigators.

Monsoon rice, wheat and sugarcane are principal crops grown here. Maize is not grown here, whereas sugarcane is gaining momentum because of number of sugarcane factories around the area. Table 3.7 has already shown the change in crop production over the years.

3.5 Conclusions: Opportunities and Constraints for Irrigation Management Reform

This chapter has provided a background to why management reform has become essential in the irrigation sector in Nepal. As shown in the cases of West Gandak and Panchakanya, successive attempts to improve service delivery and area expansion failed to meet the expected targets. Besides, all the systems were totally dependent on government funding, which was insufficient to meet the operation and maintenance cost. Though the Panchakanya farmers tried to improve their situation by forming an association, it was not effective because of the poor condition of the conveyance system. Top down approaches in project design and implementation, and lack of farmers' involvement in operation and maintenance after the project launch, made successive intervention programs ineffective to deliver the intended benefit to the farmers.

The system features described here also show they have different opportunities and constraints to encourage farmers' participation. Both Panchakanya and Khageri are relatively water-scarce systems, which is considered as a positive factor to induce collective action (Uphoff *et al.*, 1992; Meinzen-Dick *et al.*, 2002). The power to resolve water scarcity is a positive role for a WUA, which operates alongside the more difficult tasks of fee collection and conflict resolution. However, the scale of scarcity is different in different seasons. Panchakanya has enough water at the source for monsoon rice, but has been facing water shortage because of heavy seepage in the main canal. Khageri faces scarcity in monsoon too, but it does not have the potential to irrigate in winter and spring. The Gandak system has plentiful water at the source, but for farmers, this too has become a water-scarce system because of the technical and operational constraints. The thesis will further show that considering only the linear relation between water scarcity and collective action is not helpful: it needs broader understanding of how water availability is influenced by several technical and physical factors.

The technology in both Khageri and Panchakanya is relatively simple. Inside the command area, there are no gated structures to operate and maintain in these two systems. That means operational and maintenance requirements of these systems are low. Whereas in West Gandak, there are networks of canals extending up to 7.5 ha irrigation blocks, which also contain associated water control structures, requiring high levels of management input. Besides, the Gandak also faces severe challenges from the chronic problem of inundation and flooding. The solution to these problems requires the co-operation and support from the Indian authorities across the border. The scale of work required to overcome these constraints, however, is daunting to a WUA.

The pattern of system evolution has also brought different socio-political structures in these systems. Both Khageri and Panchakanya are newly settled community from adjoining hill districts, and were provided with uniform land holdings. At the same time, they also have past knowledge of collective action in irrigation development and management. The society here is more homogeneous in this respect, which is often considered as favourable situation for collective action to emerge (Meinzen-Dick *et al.* 2002). Because of its proximity to the capital Kathmandu, and its central location in the country, Chittwan has developed rapidly over the years with increased economic and political opportunities to the local communities. However, in NWGIS, there are three different communities with different origins, and at the same time have more dominant caste relationships. The different communities speak different languages and many of the farmers do not speak the official Nepali language. Because of better access to economic, political and educational opportunities, farmers in Chittwan are more politically conscious and economically better off than in West Gandak. The socio-political dependence of local farmers on locally powerful people is thus greater in West Gandak as compared to Khageri and Panchakanya. One similarity in all the systems, however, is that all of them pose similar land tenure pattern, as more than 97% of the farmers are owner-cultivators.

The following chapters of this thesis will show how these opportunities and constraints were analyzed, debated and adapted during the implementation of the management reform in these systems and how they influenced the water management change after subsequent management transfer. They will show how understanding these opportunities and constraints is an important part of strategizing participatory processes in irrigation management, for both farmers and professionals involved.

Notes

[1] The valley also consists of part of the adjacent district, Nawalparasi. It is also called the Rapti Doon Valley, a name derived from the major river in the valley, the Rapti.

[2] These are the local tribes of Nepal.

[3] Nepal is divided into three main geographic areas: the Himalayan, Mid-Hills and the Terai Regions.

[4]. Owing to malaria, people were initially afraid to settle in the area, which was popularly known as Malaria hell (Belder, 1972, cited in Shukla and Sharma, 1997). The countrywide eradication programmes in the 1960s and 1970s attracted many migrants to the Terai.

[5] These figures are from the Panchakanya system, but reflects the temporal variation in migration in the Chittwan valley

[6] One Cumec equals to 1000 liters per second (lps)

[7] There was already an inundation canal without any permanent diversion structure in the eastern part constructed by the British Rulers in India in 1911 (see Chapter 2).

[8] The agreement does not specify the amount of water. Nepal also receives 1000 cusecs of water to irrigate 29000 ha under the Narayani Irrigation project from the Eastern Main canal at a location 90Km downstream from the barrage. At the Western Main Canal, a 15 MW powerhouse has also been constructed for Nepal.

[9] There were three irrigation systems under the CADP, the Mnausmara, Banganga (Pradhan, 1996) and the West Gandak. All these systems had more assured water supply and potential of providing year-round irrigation as compared to others irrigation systems in Nepal.

[10] The exact date of construction of the system is unclear: GITEC (1992) puts it as 1933 in the IMTP project appraisal whereas Adhikari (2000) mentions a construction date of 1923. According to many native *Tharu* settlers, the Chittwan valley was divided into four different administrative zones called '*Praghanna*' in the past. The Panchakanya was in the 4th *Praghanna* and the irrigation system was constructed under the directive of Ratan Chowdhary who was the official representative of the *Praghanna* some 215 years ago. The WUA's annual report (Devkota, 2001) also mentions that the system is already 218 years old.

[11] *Maujba* refers to a land grant, as mentioned in Chapter 2.

[12] *Kulo* refers to small canal constructed by the farmers.

[13] *Khola* means stream.

[14] *Tharus* were a majority until the mid-late sixties but by 1992, were only 25% (Gitec, 1992). A Baseline Study by ICON (1996) shows the ratio of migrants to natives as 59% to 41%.

[15] Generally a weir contains a gated opening at its side adjacent to the off-taking canal. The crest level of this gate is kept at a lower level than that of the offtaking canal bed, so that water with higher silt content passes under the sluice gate and relatively silt-free water passes through the canal. During floods the sluice gate is kept open to prevent silting up of the area upstream of the weir.

[16] Pradhan (1995) distinguishes two types of development of irrigation systems: the extensive and intensive. In extensive development, canal networks are not developed at the lower level and have relatively fewer water control structures. In intensive development, canal networks are

developed at the lower field level (say up to 7. 5 ha block) and include large numbers of water control structures.

[17] DOI staff are transferred to new locations at every 2 to 3 years. So both contractors and engineers were different during the two different rehabilitation and expansion programs.

[18] *Ghol* generally means a submerged area in monsoon season

[19] There are different farm size classifications between Nepal Rastra Bank (the national bank of Nepal), National Planning Commission (NPC) and other institutions. The Agriculture Perspective Plan (APP) has set a land-holding of 1ha as the size below which the average income is below the poverty line (ICON, 1996). The same criteria is used here for land holding classification.

[20] Duty is the area irrigable by a cusec (or cumec, if expressed in metric system)

[21] I have put the data in imperial units as they appeared in the initial design report. The duties of 54, 58 and 60 acre per cusecs represents a design flow of 1.30, 1.19 and 1.17 liters per second (lps) per ha respectively. One cusec represents flow of 28.6 liters per second and 1 acre is 0.4 ha.

[22] There were three irrigation systems under the CADP, the Mnausmara, Banganga (Pradhan, 1996) and the West Gandak.

[23] Village cooperatives were being promoted by the government throughout the country to provide agricultural support services to the farmers. There are hardly any such cooperatives operating successfully these days.

[24] Canals in the Indo-Gangetic plains are designed on the basis of Lacey's regime theory, which assumes an ideal situation of canal section, which allow neither scouring nor silting in the canal. Details of Lacey's regime theory can be found in most of the Indian text books in irrigation engineering (see for example Bhart Singh, 1988; Varshney *et al*, 1983)

[25] At the time of writing of this Thesis there were three incidents of flooding in West Gandak (between July to September 2002) and according to newspapers, the canal is not operational. The Water Resources Minister from Bihar State visited the system and has promised to compensate the damage this time.

4

Initiating New Local Organization: Forming the WUAs

This chapter is about the initial organizing processes of the WUA. It first presents farmers' reaction to government decisions to transfer management responsibility to them, and then describes how the WUA development proceeded. It shows how the outcomes of group formation process is shaped by existing societal conditions, although they are based on similar design principles and follow similar approaches. This shows that the organization design should not be confined to structural design of the organization only, but also consider the social and political relations within the irrigation systems, as well as the technical demands and inequities of the water distribution. My own involvement in the IMT program in Khageri and Panchakanya came after these group formation activities were over.

The first case, that of Panchakanya shows how the previous tradition of collective action shaped the negotiations and the processes of group formation. The second case, that of the Khageri, shows how farmers struggled within their own domain in negotiating their water rights and representation in the organization. The third case, the West Gandak shows very different outcomes from the other two. It is an example of how the powerful local elite captured the process, to provide continuity of their interests. In this case, politicians used the WUA as a platform to demonstrate the strength of their political parties. It also shows how a few selected people capture the WUA in a unitary organizational model.

4.1 Reviewing the Organizing Process

The development of the WUAs in IMTP in Nepal is steered by the concerned irrigation project office looking after that system, usually with support from external professionals. The DOI has its own Association Organizers (AOs) in all the district-level offices and a Senior Sociologist at Regional Offices. The idea of using an AO was borrowed from Philippines, and was first introduced in IMP (see chapter 2) and other participatory management programs of the DOI that began at the end of the 1980s (Gautam, 1990; Pant *et al*, 1992). The AOs and sociologists were initially hired on a contract basis, but were later given permanent positions within the DOI structure: it was found that they lacked motivation with a short span of contact and lack of long-term career security. By 1992, all the positions of the AOs were converted into permanent positions, and their status was also upgraded later on from the Non Gazetted II class to Non Gazetted I class[1]. Permanent posts of senior sociologists were also created to provide career opportunity as the next higher position of the AO. Besides the involvement of the AOs and the sociologists, Farmers Organizers (FOs) are also recruited from among the farming community to work as an intermediary between the irrigation agency and the local farmers. The use of FOs was also started by the American consultant firm involved in the IMP. The FOs are involved in preparing the inventory of the system, to establish the boundary of the irrigation system and also to find out system constraints in water delivery. They are temporarily hired, paid, and relieved after the formation of the WUA.

With the rapid expansion of IMT programs worldwide, government agencies are often directly involved in organizing local groups. In Mexico, the staff of the National Water Commission (CNA) along with staff from the Institute for Water Technology (IMTA), which is the sister organization of the CNA, are used for organizational development (Kloezen, 2002). In India, states like Harayana (Narain, 2003) and Andhra Pradesh (Mollinga, 2001) use agency staff, such as the technical staff of Command Area Development Authority (CADA) for organizing the WUA. Some states on the other hand use NGOs for organizing purposes, for example in Maharastra (Narain, 2003). The Indonesian IMT program also uses agency staff, the Canal Inspectors, for organizing purposes (1990; Bruns and Atmanto, 1995).

The use of agency staff in establishing the WUAs, however, has been also subject of debate (Groenfeldt, 1998). The argument in favour is that the staff are already within the bureaucratic structure of the agency so the lines of authority is clear, there is little additional expense and the staff are already familiar with the physical systems and with the local farmers. Arguments against are that they lack necessary training and incentives, and they may not be interested as they started their job under a different job description. At the same time their superiors need to be trained and re-oriented so they understand and appreciate the new role to be played by their field staff (ibid). However, forming the WUA is not end in itself, but the beginning. The functioning of the WUA ahead depends largely on the cooperation and support from the irrigation agency. So the issue is not who organizes, but how the program is accepted within the irrigation agency. A WUA design requires understanding of the irrigation system, its network, the social structure, and users' familiarity with the irrigation system: outcomes are highly shaped by how the facilitators perceive these contexts and act upon them.

The basis of organizational design

The WUA design in Nepal is based on the same criteria as defined by Freeman (1989) and Ostrom (1992). It involves: defining the boundary of the system, the membership criteria, type and size; and the rules and regulations of the WUA. The organization usually exhibits a combination of both the unitary and federated characters. It is single-tiered or multi-tiered depending on the scale and network of the system and us usually based on hydraulic boundary. The membership is linked with land ownership. However, tenants or sharecroppers can get membership, with the approval from the landowner. In IMT, the membership is defined in terms of a 'Share System Administration' (Freeman, 1989, Wilkin Wells, 1994). The origins of this concept of a share system can be clearly identified. The consultant of the IMTP (and also in previous IMP) were the Colorado-based organization, Computer Aided Design Inc (CADI), and Wilkin-Wells, a proponent of the Share System, was himself involved in training the DOI officials and the WUAs at the beginning of the program. I was also given training in 'Share System Administration' before I joined the project later.

The Share System links the right to use water in an irrigation system with payment of cost to maintain the system. Freeman defines two essential components of the Share System: (i) it confers legitimate access to the water resource within certain pre-arranged rules and (ii) it imposes on the users a specified obligation to share in paying the water management costs. Therefore the concept of 'share' unites two essential aspects of organizational operations: resource allocation and resource acquisition[2]. However, materials in this chapter shows that the concept of share as envisaged by the program has not developed in reality, and farmers practice sharing principles their own way. The reason is simple. The share system links the volume of water given with the payment for a share. However, farmers are used to payment on the basis of area under cultivation irrespective of the level of water use. It is more transparent to them. Volumetric measurement is difficult to put into practice in Nepal. The amount of water one receives is never fixed, and can change year-to-year and throughout the irrigation season depending on the rainfall. Irrigation systems are also not equipped for water measurement and the farmers are not trained to perform water measurement activities.

4.2 Organizing the WUA in Panchakanya

Panchakanya was a FMIS irrigating some 100 ha of land until 1974, after which it was taken over by the government to expand the irrigated area upon the influence of newly migrant groups. They formed their own committee to get involved in canal operation and co-ordinate with the irrigation agency (CIP) in the matters relating to O&M. The WUA also became involved in providing voluntary contribution for canal cleaning. The CIP staff also had a feeling that Panchakanya belonged to the WUA, and although the WUA was informal, it was recognized by the CIP and its meetings were attended by the CIP officials.

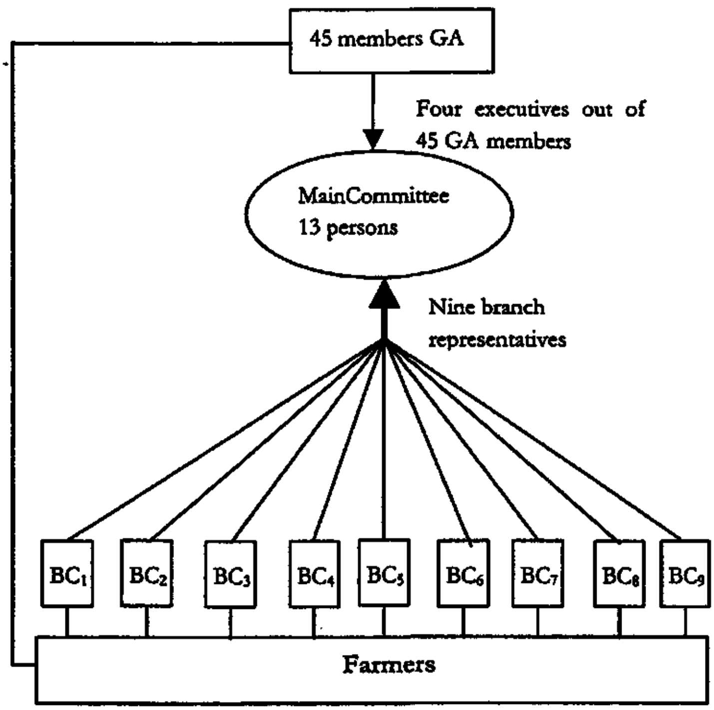
The WUA of the Panchakanya were told about the management transfer program by the then CIP[3] officials in April 1994. A meeting between the water users and the CIP officials was then organized to discuss the implementation of the program. The meeting was held at the Khageri headwork site (the Khageri headwork is at the highway, adjacent to the Panchakanya, and is suitable for holding meetings with Panchakanya farmers). It was attended by WUA members, local water users[4], the local VDC chief, the institutional development specialist from the consultant (who was based in Chittwan), the CIP Project Manager and CIP engineer looking after the Panchakanya system. In this first meeting, which was called by the CIP, a 13-member 'Constitution Draft Committee' (CDC) was formed from among the users. Most of the members of this committee were the members of the then existing WUA. The institutional development specialist and engineer of CIP looking after Panchakanya system were assigned to support the CDC.

The technical officials from the CIP, together with WUA members, then carried out a base line survey of the system to establish the area under irrigation in each branch /tertiary canal, number of users and their landholdings to design the structure of the WUA. This team found that the system was only irrigating 265 ha of land against the target command area of 600 ha during the monsoon, whereas only 13 ha land was under early paddy. The survey team also found that the potential area of the Panchakanya was only 450 ha against the previously designed area of 600 ha, due to limitations of water supply. The team registered the membership on the basis of then irrigated area (265 ha), but kept it open to the farmers of remaining area, who could receive irrigation in future.

The CDC drafted the constitution of the WUA by the end of same month (April) of the first meeting. They proposed a two-tier organization. A Main Committee (MC) for the system level and Branch Committee (BC) for the branch canal level. The MC had 13 members altogether, 9 representatives from the seven branch canals and 10 outlets, and four executives: the Chairman, Vice Chairman, Secretary and the Treasurer. In fact there were eight branch canals in Panchakanya (see Figure 3.2) but the last, the eighth branch canal, was not functioning and was not represented in the MC. The 10 outlets were divided into two groups and each group was given the status of a BC to be represented in the MC. The total area served by these 10 direct outlets was 51 ha: individual representation in the MC from these outlets was impossible because of the smaller area irrigated as compared with the branch canals. By dividing the 10 smaller outlets into two groups, small outlets from the main canal were also represented in the MC.

The General Assembly (GA), as an apex body of the WUA, was proposed to have 45 members, one per area of approximately 10 ha, as the potential irrigable area after the field survey showed only 450 ha. They were to be elected in the elections of the BCs concerned. The BCs were to have 5 to 9 members depending on the area served by the branch canals. The Chairman of the BC also acts as the member representative in the MC. The organisational structure of the Panchakanya is shown in Figure 4.1. The basis for the organizational design is the hydraulic boundary, but equal geographic representation in the WUA was also considered. The structure mostly exhibits the unitary character, as the MC is not separately formed, but formed out of the branch canal representatives.

FIGURE 4.1 The WUA structure of Panchakanya



BC_8 and BC_9 are formed dividing 10 outlets into two groups

The first election of WUA was held in May 1994 after the formation of the draft constitution. It began from the branch canal level. Registered farmers of the respective branch canals formed the BC and also selected the GA members (on the basis of one person per 10 ha). With the completion of this election at branch level, the GA and the MC representatives were also selected (as the MC representatives were the BC chairman). The GA then selected the four executives of the MC. The whole election process took three days (two days for branch committees, and a day for MC executives). The election was co-ordinated by the CIP engineer. According to this engineer, all the functionaries both at BCs and MC and in the GA were selected through consensus, without balloting. Except the Chairman, all the members in the MC were different from the previous informal WUA. The newly formed GA passed the constitution[6] of the WUA and the association got registered in the District Water Resources Committee (DWRC). Thus the initial process took only two months time.

One interesting feature of the WUA here is that it ignored the some of the provisions of the Acts and Regulations concerning the formation of the WUA. The Water Resources Regulation (1993) requires that the MC should be limited to 7 members: however the total membership here was 13. Likewise, the Regulation requires that at least 20% of the total seats in the WUA has to be reserved for women members. But there was not a single women representative either in the MC or in the BCs. This was also not feasible, according to the constitution of the WUA: the membership is attached to land ownership, and the majority of land ownership lies with the male members of a household (see chapter 8). The DWRC knew these field level realities and did not raise any objection against the violation of the rules and registered the WUA.

After the election was over, the WUA drafted the operational rules and regulations at the beginning of June, and by August, the rules were already in place. It also introduced the concept of a 'Share System Administration' in the WUA. They defined share on the basis of area: one share per *Kattha* (0.033 ha), that is, a farmer with 1 ha owns 30 shares. By December 1994, the WUA also started collecting the Irrigation Service Fee (ISF) of Rs. 60 per ha (Rs. 2 per share) in the command area. Farmers found it difficult to allocate the share in terms of volume of water as they were not aware of flow measurement and the system itself was not equipped with flow-measuring devices. Chapter 9 will show the WUAs have maintained this tradition, even after their increased experience in system management, without changing to a volumetric share.

The preceding discussions show that the process of organizing the WUA in Panchakanya was smooth, and without any conflict and struggle. The whole organizing process was over within a few months. The CIP engineer involved in the WUA formation and development told me he had no major problem in constructing WUA and holding its elections. The main reason underlying this rapid response from the farmers was that the Panchakanya farmers had a long tradition of user involvement in operation, maintenance, decision making and resources mobilization.

The process here was directed at turning the WUA into a 'formal' organization from its previous 'informal' status, with registration and written rules and regulations. Before this, the WUA had no written rules and regulations, and was not formed by election. They were selected on an *ad hoc* basis, selecting a few individuals from different parts of the system to make up the executive committee. So for Panchakanya farmers, the present exercise was just a process of legalizing their status and participating in management transfer was regaining the old status of FMIS (the situation prior to 1974). They knew about collective action and had been practising it even under the previous agency management. Farmers in Panchakanya saw the management transfers an opportunity to make the WUA formal and empowered to perform irrigation management activities. Another reason for the fast institutional change was that the farmers here already knew about the Irrigation Policy and the management reform process from the adjoining Khageri System. In Khageri, the WUA development had started in 1992, immediately after the formulation of the Irrigation Policy. All these factors contributed to the rapid institutional change in the system.

4.3 The Organizing Process in Khageri.

The organizing process in Khageri was not as smooth as in Panchakanya, for several reasons. First, it is a large system with complex canal networks, and hence the large numbers of water users enjoyed different levels of water supply. Secondly, the farmers here were not involved in canal operation and maintenance activities as Panchakanya farmers were[7]. They were less aware about their system network and water delivery pattern, as the system had been operated and maintained by the government until then. A common aspect, however, was that a majority of the users here belonged to the same group: migrants from nearby hill districts. The Khageri farmers, like the Panchakanya farmers, also had knowledge of collective action in irrigation development and management because of their past experience in the hills.

The organizing process here faced several challenges, because of the conflicts and struggle between different groups of farmers regarding the rights and representation in the WUA. The Khageri organizational development case shows how farmers struggle within their own domain to establish their rights when their governance structure changes. However, because of the relatively educated status and political consciousness of the farmers, and their past knowledge of collective action, the conflict arena provided them an opportunity to learn about their system. Finally, farmers were able to settle their disputes and craft the organization over time.

Initial negotiation

In Khageri, a discussion program was organized at the agency (CIP) office in August 1992 to disseminate information about the 1992 Irrigation Policy, and the management transfer program. The meeting was attended by the farmers of different branch canals and local politicians. The farmers who participated in the meeting were those who used to co-ordinate with the CIP technicians in matters of water allocation and distribution. These farmers were clearly known to the canal operators of the concerned branch canals. In addition, farmers who were already active in other parts of village life also participated in the meeting. The canal operators working in the Khageri system were also farmers belonging to the irrigation system, and knew the active farmers in the area. The local politicians participating the meeting were the Chief of the VDC and the members of the DDC representing the command area. The participants were briefed about the irrigation policy 1992 and the irrigation management transfer program by the CIP project manager and the engineer responsible for the system.

The participants displayed different responses regarding the management reform. Their main concern was about the water shortage and variable flow in the river source. They questioned the engineers briefing the program how under such conditions it would be possible for them to maintain the water delivery service to farmers. According to the engineer involved in organizing the meeting, some farmers even argued that the government was trying to dump their responsibility on them. Some were in favour of the program, considering it empowering, but asked the government for system improvement before transferring the system management to them.

There was no decision in the first meeting. The news about the IMT program quickly spread around the command area. According to local farmers, the idea of WUA formation and the IMT program was discussed informally around the Khageri command area for several days among the farmers groups. The majority of them finally were in favour of WUA development and management transfer because of the reasons described in below paragraphs.

The transfer program also coincided with the period of democratic reform in the country. The party-less political system was overthrown by a people's movement and a constitutional monarchy with multiparty democracy was established in 1990. With this political change, several local-level NGOs and workers' unions were evolving throughout the country during this period. Under these circumstances, farmers also adopted the governments' program to promote WUA in the system without resistance. The change was seen as empowering, through which they could increase their political power to bargain and negotiate their agendas with the government and other institutions.

Farmers had experienced poor system operation and maintenance over the years with the lack of funding after withdrawal of ADB funding (see chapter 3. They saw advantages in being involved to obtain system improvements and ensure their water rights.

There was also a compelling reason to participate. So far the government was managing the system and farmers enjoyed a free service, whether good or bad. Now the government wanted to share the responsibility. The Irrigation Policy specified that if a system did not participate in the reform program, the government would not provide any kind of support to it in the future. There was thus a risk of losing government support in future by not participating in the program. Under these circumstances, farmers saw no choice but to accept the program. However, as explained earlier, their acceptance was not only due to this compelling reason, but also motivated by several other factors.

After farmers agreed to participate in the reform process, several rounds of discussion were made with different farmers groups on how to proceed further to implement the program. The organizing process here was facilitated by an institutional development specialist (local) from the consultant, CADI. She was supported by AO and technicians of the CIP. According to farmers, she was highly motivated and committed in organizing activities. Following these discussions, it was decided first to select a farmer representative in each branch canal, to work further in organizing activities. These representatives were selected on a consensual basis by farmers gathering in each branch canal. After the selection of the representatives, a seven-day training program was organized for them to help carry out their job as Farmer Organizer (FO). They worked in their respective branch canals in carrying out the organizational development activities.

The FOs were involved in carrying out the baseline survey of each of the branch canals to collect data about the household membership, status of the canal system and constraints in the water delivery. The FOs were supported by the facilitating team. The CIP technicians also prepared the details of the canal conditions together with FOs through diagnostic walkthrough activities. Discussion sessions between the CIP personnel and the farmers about the process of joint management were also organized at concerned branch canals, to share information on the management transfer program with wider group of farmers. When these discussions at the wider scale were over, a Constitution Draft Committee (CDC) was formed with members from each branch canal to draft the constitution of the WUA. The members were selected by the farmers' gathering in respective branch canals. The facilitators supported the CDC in preparing the draft constitutions. The constitution development process here met resistance due to two major problems: a water-rights dispute between two groups, and the issue of who gained the representation in the MC.

Dispute over water right and representation in the WUA

A major problem in this early phase of WUA development (and subsequent management transfer) concerned the rights to water among different branch canals. So far, the responsibility of water distribution had lain with the government, and some branches were getting better water distribution than others. Farmers wanted equal shares of water to be guaranteed before management responsibilities were transferred. The main concern was over the first branch canal, the B_1, which used to enjoy continuous delivery during the monsoon rice season whereas others had rotation between them. Likewise, it also used to enjoy irrigation facilities for early paddy, which no other branch canals did. Early paddy was being transplanted in the whole command area of B_1 and parts of B_2. The B_1 farmers wanted no change in their status.

The other branch canals, especially the tailenders, were dissatisfied with the current status of water supply. But the B_1 farmers insisted that their canal section was smaller as compared to other branch canals (in relation to the irrigated area) and that seepage losses were high in their canal. It is true that seepage loss was high in this canal but given its area, it has no smaller section compared to others. Local farmers say that B_1 had access to better water supply because of the influence of some influential persons and powerful administrators in this branch. It was upon their influence that this branch used to enjoy better water delivery as compared to the others[8]. They also had the advantage of their topographic location, being the first off-taking canal from the main system. This provided them with relatively better water delivery as compared to the others.

Besides enjoying continuous water delivery in the monsoon season, the B_1 also had access to irrigation during the spring season to cultivate early paddy. There is an interesting story behind how B_1 started early paddy transplantation. During spring, water supply is very low in the Khageri river as explained in chapter 3, and farmers never cared for water in the winter and spring seasons. Most of the command area used to grow wheat and maize in winter and spring seasons under rain-fed conditions, but B_1 had problems in cultivating wheat and maize. Its area is joined with the National Park (RCNP) and the crops were damaged by the wild animals (mostly rhinos), so they used to leave the field barren in the winter and spring. Once a farmer started a local brick factory bringing water from the canal. He could not run the factory and as he had already cleaned the canal to bring water, he thought he should utilize it. He started early paddy cultivation upon advice from farmers of nearby area who had experience of early paddy cultivation. It was highly successful and with this initial move the area under early paddy expanded over the years: by 1992 all of the

B_1 command area and part of B_2 were cultivating the early paddy[9]. As they were at the head, none of the other canals objected and the B_1 established its right over water during the spring season.

On the other hand the four minor canals at the tailend had a less equitable water share. In the original construction plan of the Khageri system, there were no provisions for the construction of the four minor canals that presently exist. The areas currently being irrigated by them were supposed to get water from the branch canal B_8 (according to the engineer in charge during design and construction) through the construction of tertiary canals called 'minor canals'. But later on, it was found impossible to irrigate the tailend areas by constructing minor canals from the B_8, due to topographic limitations. Four separate canals were then designed and constructed as exist presently. However, their names remained as 'minors' although two of them (M_1 and M_2) are actually branch canals[10] (see Figure 3.3), and irrigate more areas than some of the branch canals (Table 3.3). These minors have access to drainage water during the monsoon and are less dependent on Khageri canal water.

The upstream canals were of the opinion that these minors had a right over the surplus water only, and they should be given secondary status (lower representation in the WUA) in the constitution. For the minor canal farmers, this was the only opportunity by which they could claim their full right to water. The Minor farmers argued that they were also part of the Khageri system, and they should not be deprived of water rights equal to those of other branch canals, just because of their name as 'minors'. Another issue was that, out of the four minor canals, minor 3 and 4 had smaller command areas (99 ha and 60 ha, see Table 3.3) resulting in questions whether they should have representation in the MC. These canals bifurcate from M_2 and head-end farmers could not agree to recognize them as a branch canal. The farmers on these minor canals feared that if they failed to achieve representation in the MC, the head end canals would have a majority position there. The head-end farmers, on their part feared to lose their relatively better water supply condition.

According to farmers, the conflict situation was helpful afterwards, because it gave them an opportunity to learn about their system and search for solutions. Accordingly, a solution was found. The first point agreed by all the parties was that all the four minors and the 9 branch canals would have at least one member representative in the General Assembly. Considering the area irrigated by each branch and minor canal, it was decided that there would be a GA member from every 50 ha command area. By doing this, the smallest minor 4, which has a 60 ha command area, would also have one representative in the GA. Another point of agreement was that all the branch canals and the minor canals were considered branch canals. There would be a separate committee on each of them to look after irrigation management inside their respective canals. Thus thirteen branch committees were proposed, one for B_1, B_2, B_3, B_4, B_5, B_{6e}, B_{6w}, B_7, B_8, M_1, M_2, M_3 and M_4 each. However, M_4 was not given representation in the MC, it was combined with M_2 to be represented in the MC (M_4 bifurcates from the M_2 and the CDC could not agree to give it an independent seat in the MC, see Figure 3.5). So the MC was proposed to have 15 members: 12 representatives - 9 from branch canals and 3 from minors and - the three executives. The three executives, the Chairman, Vice Chairman and the Secretary were to be elected by the GA. The issue of representation was over. The only thing the tail-end farmers lost was that M_4 did not have its representative in the MC. The tailend farmers were more vocal and conscious - many are retired Army personnel, and thus able to retain comfortable position in the MC.

Regarding the water right, the tail end farmers now did not object the B_1 having its right over water in spring. They realized that there was no sense in bringing limited water to tailend areas in spring, as it would be lost during its conveyance. In addition, they could establish better representation in the main canal. On the other hand B_1 agreed to co-operate for rotational distribution under scarcity situations in the monsoon seasons. However, this point was to be further negotiated in the WUA by-laws to be formed later on, not in the constitution. The parties agreed that this would be taken care of when preparing operational rules.

In all these processes, there was no involvement of the politicians or any third parties. The facilitating group and the constitution draft committee members carried out the discussions and negotiations. The setting of the 50 ha land unit to be represented in the GA was the first unifying element. The committee had fixed this considering the fact that each canal unit would have at least one representative in the GA. This took care of the tail-end farmers. At the same time, all the minor canals were also given equal status of the BC having rights to establish their own office and form their own rules and regulations. The group was able to settle disputes, as farmers here were educated, they were aware of this kind of needs and there was a political consensus. Farmers also said that the institutional development specialist involved was competent in bringing the different conflicting parties together.

Approval of the constitution, and election processes.

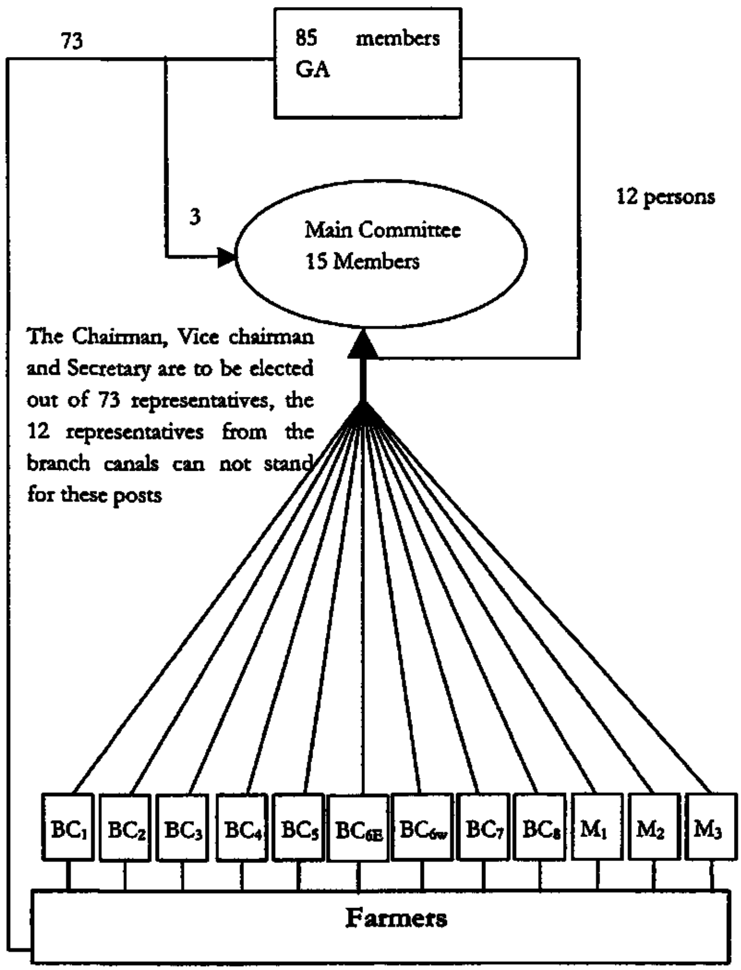
With the draft constitution completed, a farmers' meeting was again organized in Shivanagar (where the present WUA office is located) by the CDC to discuss the structure of the WUA and the draft constitution. The CDC had designed the WUA as a two-tier organization: the MC at system level, and BC at branch canal. Above the MC would be a GA, a policy-making body for the MC. The GA would have 85 representatives. Of this, 73 members would be elected by the farmers of respective branch canals in proportion to their command area on the basis of one member for each 50 ha area. The remaining 12 members were the member representatives of the MC, one from each branch canal.

The MC would have 15 members in total: twelve representatives from the 12 branch canals and the three executives: the Chairman, Vice-Chairman and the Secretary. The three executives were to be elected out of 73 GA members. The 12 representatives were not the representatives of the branch canals as in Panchakanya, but were to be elected separately by the branch canals farmers. The chief of CIP was also an ex-officio member of the MC, but his attendance would not be included in the quorum of the MC meeting. The BC would be formed by the farmer members of the respective branch canals, who are also the GA members of that particular branch. Each BC was also proposed to have a Chairman, Vice Chairman, Secretary and four members. By forming the MC and BC separately through direct elections from the farmers, the Khageri WUA takes on a federated character.

Besides the branch canals, there are also 41 direct outlets withdrawing water directly from the main canal having an average area of 10 ha. Instead of forming separate groups for them as done in Panchakanya, the outlets here were merged with the nearest branch canals for organizational development purposes. According to the farmers, this was done to make the organization simple and equally representative. The responsibility of water allocation to these outlets was also given to the concerned BC to which the outlet belonged.

The gathering at Shivanagar approved the proposed structure of the organization. In the same meeting, it was decided that any change needed in the draft constitution would later be reviewed and approved by the GA to be formed after the election. This opened a path for the WUA formation. The proposed structure of the WUA organization is shown in Figure 4.2.

FIGURE 4.2 The WUA structure of the Khageri System



The meeting in Shivanagar, after accepting the proposed structure of the WUA, asked all the farmers to organize elections in their respective branch canals. By December 1992, the elections in the branch canals were over, and members were mostly selected by consensus. With the completion of elections at branch canal level, the GA was also automatically formed, as its representative were to be elected by them on the basis of one representative per every 50 ha. The 12 representatives in the MC were also already there, who were also elected together at the time of BC elections. The only vacant posts were for the posts of the Chairman, Vice Chairman and the Secretary of the MC, which were to be elected by the GA members.

The election for these posts was held in January 1993. In accordance with the constitution, the candidates for these posts were selected from the 73 GA members: the 12 members from branch canals were not allowed to compete for the post. The post of the chairman was selected from branch canal B_{6c}, which is in the middle of the command area and is also the largest branch canal in the system. The Vice-Chairman was from M_1 in the tail portion, and the Secretary from branch canal B_1 in the head portion. The selection clearly showed farmers' determination to balance the power within the WUA for equitable water distribution by selecting key officials from head, middle and tail reach of the canal sections. The BCs had also a similar composition, where at least one of the key positions in the committee was elected from the tail-end portion of the command area.

4.4 The Organizing Process in West Gandak

West Gandak is a large system with communities of different composition. There are three different groups of settlers here: the Indian migrants, the native Tharus and the hill migrants. It has a complex and challenging ecological environment as explained in chapter 3. The majority of farmers here were unused to collective action, and past efforts to involve users in management could not succeeded as explained in chapter 2. When IMT was discussed here, it did not face any disputes. The process was as smooth as in PIS. But the reasons were different. Here, political leaders took over the process. The area overlaps to two parliamentary constituencies, out of four constituencies in the district (it also slightly touches the third one) and the WUA could provide a platform to increase (party) political activities.

The beginning of WUA formation

The process of initiation of management reform here was similar to that in Khageri. It started with the formation and capacity development of the WUA. Upreti (1999) has documented the detailed process of this initial WUA development activities. According to this report, a meeting was called on 17 July 1992 by the West Gandak project office to inform and discuss about the joint management program and the 1992 Irrigation Policy. The meeting was attended by 256 people including the two MPs of the area. The MPs and other political figures like the VDC chief were personally invited by the West Gandak project office, whereas the VDCs were requested to pass the information to common farmers about the gathering. As the joint management program started from this project (in Khageri it started a month later), the higher officials from the Irrigation Management Division (IMD) of DOI in Kathmandu also attended the meeting. The meeting welcomed the idea of involving farmers in the irrigation activities. Some of the participants showed their concern whether this would be again another WUA formation, as in the past during CADP. The IMD officials and the West Gandak project manager explained the gathering about the newly adopted Irrigation Policy, and how the department was committed towards the participatory management as per the irrigation policy. They also said that the WUA development this time would be at all levels of the canal system, not only in the lower order canals as in the past.

The organizing process here was facilitated by the West Gandak project manager and a sociologist (institutional development expert) supplied by the consultant, CADI. A second meeting was again called in September 1992 in which 160 people participated, discussing how to proceed for development of the WUA. The meeting decided to select Farmer Organizers (FOs) to work further in the development of the WUA. For this purpose, the command area was divided into 12 divisions and separate meeting were held in these divisions to select the FOs. The division was made considering an area of 700 ha per FO as an appropriate unit for organizing purposes. In Khageri, the FOs were selected based on hydraulic boundary: one FO per branch canal. Here, they decided to select FOs on area basis, due to complexity of canal networks (see Figure 3.7). A meeting between the facilitating team and the farmers was then held in each divisions to select the FO. The FOs here were required to have 10th grade education, and were selected by the gathering. Whenever there was more than one candidate, one of them was selected by voting. A total of 715 persons participated in the FO selection activity in total.

As in Khageri, the FOs were hired on a temporary basis and were paid[11]. They were used to collect necessary data like household numbers, and status of canal alignment in their respective divisions. They were also to explain to farmers how joint management program works. They worked as intermediaries between the DOI and farmers groups during this early stage of WUA development. They were given basic training for carrying out these activities. Parallel with the FO activities, two more meetings were organized to discuss about the development of the constitution of the WUA which were attended by 146 and 106 interested farmers respectively. The final meeting, held in February 1993 decided to form a 15-member committee, one from each division to draft the constitution for the WUA.

Proposed WUA structure

The CDC recommended a four-tiered organization based on the hydraulic boundaries and structural complexities of the system. The four levels are: (i)) the main committee at the system level (ii), branch committee to serve branch canals (iii), *toli* for tertiary level canal and (iv) *upa-toli* (sub-tertiary level groups) below the tertiary.

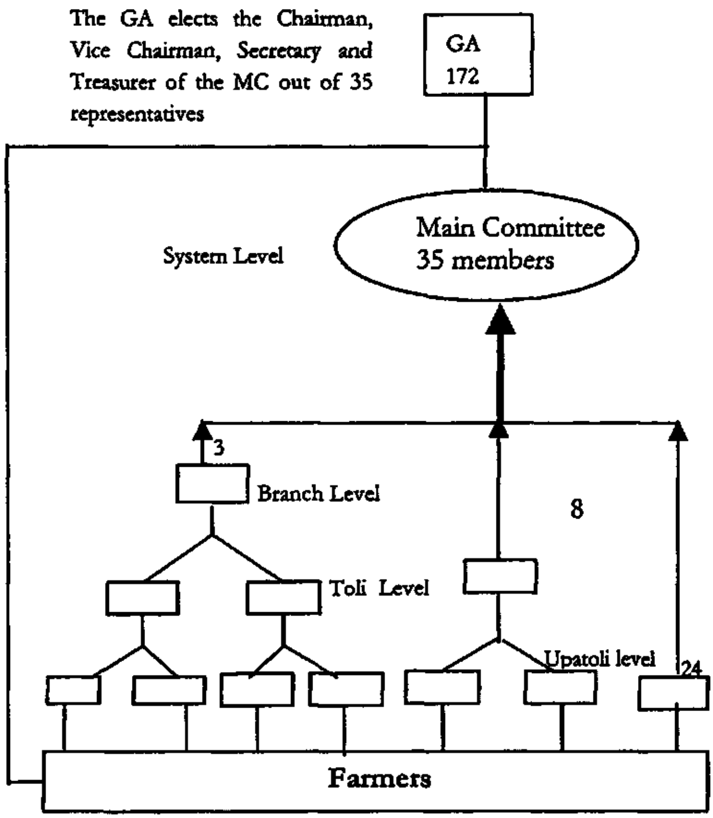
The *Upatoli*, the lowest tier of the WUA, would be formed at the tertiary level canals that irrigates approximately of 50-150 ha area like the MFD, main canal blocks (MC blocks) and SFD (see Figure 3.7). There were 172 such blocks and thus were 172 *Upatolis*. The *Tolis* would be formed out of the *Upatoli* representatives and represent the minor canals. There are 19 *Tolis* in total, out of which 8 are directly connected with the main canal. The BC would also be formed out of the representatives of the *Upatolis* and *Tolis* inside the Branch. Three BC were proposed each for the Bishnujung, Piparhawa and Bhujawa branches. The Mangharia branch canal was not considered for a branch committee. The reason for this was that in designing WUA, only those branch canals that bifurcate into two or more divisions downstream were considered branch-level committees. The Mangharia does not have a major bifurcation downstream and was thus given *Toli* committee status (se Figure 3.7).

The MC was to be formed out of the representative of the Upatoli, Toli or Branch that directly off takes from the main canal. As seen from Figure 3.7, there are 24 main canal blocks and 6 SFDs, which together would claim 24 representatives in the MC (the SFDs were merged with the nearest main canal blocks owing to their smaller size). Likewise, the 8 minor committees and 3 BCs would have 11 representatives in the MC in total. The MC would thus have 35 members. The executives of the MC - the Chairman, Vice Chairman, Secretary and Treasurer - would be elected out of the 35 members of the MC by the GA members. The GA was to have 172 members, one from each *upatoli*. The WUA configuration as proposed by the CDC is presented in Figure 4.3.

The WUA structure is a perfect example of the unitary model as defined by Freeman. It is highly concentrated towards the MC and has highly unequal representation. There were two major defects in this structure. First, it is solely based on hydraulic boundaries. In doing so, it gave representation to each and every offtake from the main canal irrespective of their command area. This led to a situation where the small offtake canals (24 MC blocks and 6 SFDs) irrigating 1686 ha had 24 seats in the 35-members MC whereas the four large branch canals totalling 5047ha had only four seats. That is, canals irrigating about 19.4. % of the area had 68.5% of the membership in the MC, whereas areas serving 58% of the land only had 11.42 % of the membership. As we have seen in the previous cases of Khageri and Panchakanya, farmers chose different strategies to make the MC equally representative. In Khageri, the small outlets were merged with the branch canals for representation in the MC. In Panchakanya, the 10 outlets were divided into only two groups so that the the MC is equally represented from different canal reaches.

Another serious limitation was that the executive posts were to be elected out of the 35 representatives only, and the GA members were not allowed to stand for these posts. Whereas in Khageri and Panchakanya, these representatives were not allowed to stand for these posts, instead they were to be selected from the wider group, the GA. By the structure itself, the power of the committee could be kept in the hands of only a few individuals in West Gandak.

FIGURE 4.3 The WUA structure of the West Gandak



I asked the then project manager of the West Gandak and the consultant involved in preparing the constitution of the WUA why the MC was designed with such an unequal representation. They told me that it was done so that MC decisions could be passed to all the off-taking canals. The then project manager of the West Gandak said that small canals were given equal status to the larger ones as any disturbances by these small canals would also affect the main canal operation, which ultimately would affect the functioning of the large canals. But this is a minor operational problem, whereas the new WUA configuration could have great impact on WUA functioning.

Regarding the second issue of not allowing the GA members to be elected in the executive posts, they had no precise answer. There are reasons to believe that this was deliberately done by the involved actors facilitating the WUA development to promote selected people to the leadership. Many of the farmers in the area also share the view. They say that it was due to influential persons from the small canals, the main canal blocks, that the WUA structure was designed that way and that GA members were stopped from standing for the executive posts. The two successive Chairmen of the WUA were in fact from these small canals, which also suggests some truth in farmers' views.

However, the ordinary farmers were not aware of the WUA structure and the constitution. Because of low political awareness and literacy, they were not very active like the earlier systems discussed, and were dependent on their leaders whom they had selected to form the constitution.

The election process

After the completion of the draft constitution, the election process started from the *upatoli* level. The constitution draft committee worked as the election commission for the purpose of conducting the elections. However, it was supported by the West Gandak project office. The *Upatoli* committee was formed out of the meeting of the farmers of that *upatoli*. They were informed about the time and venue of the election by the concerned FO of that area. The size of the *upatoli* varied from seven to eleven members, depending upon the size of the particular canal. The committee members then selected a Chairman, Vice-Chairman and Secretary and selected one member to be represented in the GA. The members also selected another member to be represented at the next level up in the organization, the *Toli*, branch or main canal level depending upon whether the *upatoli* is located. The *Toli* and the BC were formed out of the members sent from the *upatoli* level. The members selected the Chairperson, Vice Chairperson and Secretary from among themselves.

With the completion of the election of the *Toli, Upatoli* and BCs, there were already 35 members for the MC, as well as the 172 members of the GA. The only remaining job was to elect the executives of the MC. Before the election of the executives, the candidates were allowed to speak and campaign on their behalf. The time and venue of the election was notified to the GA members and the MC members in advance. There was no ballot: the executives were selected by census within the GA. As in Khageri, the key posts of the MC was shared by the head-enders and tail-enders. The Chairman was from the tail of the canal, the Vice-Chairman from head, and the treasurer from the tail and Secretary form the middle section. The whole election was over by June 18, 1993. The process documentation report also shows that the WUA development process here took seven months and cost US$3925, excluding the cost of the consultant and the West Gandak staff involved. There were four farmer gatherings, 15 regional meetings, and 146 discussion programs. In total, 7784 persons participated in this whole process.

Once the election was over, the GA ratified the constitution prepared earlier by the constitutional draft committee. The WUA was registered in the District Administrative office on June 29, 1993[12]. The WUAs were given training on Share System Administration and other capacity development training. Field visit programs were also organized to selected successful FMIS.

However, the case here questions the value of those interaction programs. Ultimately they resulted in an organization, which was highly unequal in its representation, and was concentrated towards a few individuals. There can only be two reasons for this. Either the actors, the engineer, consultant and the constitution draft committee were less aware of the WUA development process, and just followed the routine procedures, so that the structures came into being by coincidence, or these people deliberately designed the organization favouring particular groups of people to emerge in leadership.

Election politics in West Gandak

Both farmers and NWGIS project officials say that the first WUA election in NWGIS was heavily influenced by party politics. Nepal entered multiparty democracy in 1990: the new emerging political parties tried to influence every sector, and irrigation was no exception. Organizational development activities in the West

Gandak also coincided with this period. In the first election, the political influence and connections dominated the dynamics of election process. However, there was no dominance by a particular landlord or rural elite. People having connections with political parties and contractors were the frontrunners in the election. The reasons for this were:

- People had seen massive investment during the CADP period. They had heard of another rehabilitation program coming in future to support the organizational development activities. They had heard from the visiting IMD officials and the West Gandak staff that a project named 'Irrigation Management Transfer Project' was about to be implemented in the system under the funding from ADB. It was thought that ADB was again going to make huge investments, and contractors and local politicians sought to be elected to gain access to future project resources.
- For contractors, representation in WUA would provide easy access in getting the construction contract.
- The NWGIS includes two constituencies for the election of Member of Parliament. So for politicians, it could provide a platform for their political career. Political parties also used the WUA election to measure their popularity among the voters.

The WUA thus elected was a mix of politicians, contractors, and other local powerful men. They had their own vested interests to be elected in WUA, as mentioned above. The contractors were there to get opportunity in construction activities. Politicians were for measuring the strength of their respective political parties. Many farmers whom I interviewed said that the election was based on party politics. Interestingly, landlords were not interested to sit on the MC. Instead, they preferred to be in the branch or *toli* committee. They said that they were interested in getting water in their canal rather than being part of the wider politics in the MC. My discussions with the technicians involved in the NWGIS and several other informants shows that the composition of the WUA was as shown in Table 4.1

The Table should not be read in terms of exact figures, but reflects discussion with various farmers and technicians involved in the election. The objective here is to indicate that the WUA was dominated by party politics. The question is thus: what enabled the political parties to become so dominant here?

The West Gandak has a different social setting than that of the Khageri with three different immigrant groups. More than 52% of the population here is from lower castes whose exploitation by the upper castes is dominant. The literary rate stands at 39% and political awareness like that the Chittwan farmers do not exist here. The majority of the population depends on the local elite and politicians for jobs and other economic opportunities. This situation allowed local leaders to exploit the farmers with ease.

TABLE 4.1 Percentage of WUA representation by different political groups

Politicians holding position in local government posts	*Affiliation with political parties, but not in government posts*	*Contractors*	*Common farmers*
35%	25%	20%	20%

4.5 Conclusions

This chapter began by describing how farmers reacted to the government policy when they were told about the shift of management responsibility to their domain. In all the three cases farmers did not object to this, except for showing some local concerns facing the irrigating systems. There were three main reasons for their non-objection to participating the management transfer. The first was that farmers had no alternative, because they feared that the government might withdraw support to their system if they did not participate in the program. The irrigation policy specifies that for those systems not willing to participate in the management transfer, would not receive any kind of government support in future. So there was a danger of losing the government support if not participating, whereas there was scope of improving system condition by participating in the program.

The second reason was that the WUA development almost coincided with the political change in the country. This also motivated farmers to form the WUAs, as similar organizations were being formed in other sectors of the society as a way of empowering themselves. Farmers in these irrigation systems also recognized the WUAs as a means to increase their political power to negotiate and bargain for their cause with the government and other institutions. Thirdly, all the systems were physically deteriorated and farmers did not want to lose the opportunity of system improvement offered by the reform program. Farmers participation in the reform was thus not only from the compelling factors of the Irrigation Policy, but also due to their own individual interest too.

The chapter then described the process of group formation and the struggles therein. The discussion on these cases show how the organization design is shaped by the existing socio-political structure. This is illustrated by the different outcomes of the organization design in the three systems. In PIS, the process was shaped by the existing practices of the collective action. There was already an existing organization, established and recognized in the system and farmers knew about collective management. So farmers designed the WUA in accordance with their prevailing practices.

In the case of Khageri, there were negotiations between the farmers groups regarding water rights and representation in the organization. The conflictive environment at the beginning gave farmers an opportunity to learn about their system and find solutions. In this case both parties got what they wanted finally. The tail-end farmers got equal representation in the GA as well as in the MC, except that M_4 had no representative in the MC. However, all the minor canals, including the M_4 got the status as of branch canals and could have their own committee. By agreeing this, the head-enders had nothing to lose. On the other hand, the tail-enders came to realize that there was no advantage to objecting the first branch canal using the water in spring, as they could not access it. So the head-end canal was able to keep up its relatively better water availability. Because of relatively greater education and political consciousness, Khageri farmers were in a position to craft their WUA as demanded by their context.

But in NWGIS, a few were able to capture the process and the rest were silent because of the pattern of social and political dependence. The WUA was used as a platform to monitor the strength of the political parties. One of the reason for high level of (party) political influence has been also due to its scale. The area of West Gandak overlaps with two parliamentary constituencies. It is a rural area and other forms of economic and political activity and related forums are almost non-existent here. So the WUA was the first and only organization in the area where political parties could enter to increase their influence. Whereas Chittwan was already a developed area and there are several other economic and political platforms to represent the political parties.

The organizational structure of all the three systems was based on hydraulic boundaries. But in Panchakanya and in Khageri, farmers also took care of geographical boundaries to arrive in a balanced WUA. Interestingly this factor was overlooked in the West Gandak, resulting in highly unequal representation in the WUA where 68.5% of the MC members are controlled by farmers cultivating 19.4% of the land, whereas farmers holding 58% of the land has only 11.42 % representation. Another interesting feature is that the posts of the executives were limited to only for the representatives of the MC, not to the wider group the GA. To my knowledge, the executives in the MC are always elected out of the GA. This resulted the Gandak WUA being a perfect unitary model with power concentrated on few key political figures.

The chapter has also shown how the prescriptive views on organizational design can clash with local concerns at implementation. Farmers discarded the rules set by the Water Resources Regulation, on the other hand, the DWRC set up to register the WUA also did not pay attention to violations of the law by the WUA. Likewise, a 'Share System' with volumetric measurement was highly advocated in the design. Farmers did not reject the concept of share, but practiced it the way they found compatible with their water availability scenario and canal networks, linking irrigated area with payment, not with the volume. If the water delivery pattern is acceptable to farmers (as decided by their WUA), then linking cropped area with the payment is the same as linking it with the water volume. Farmers avoided shares being based on volumetric basis because of the highly variable flow and difficulty in establishing water measurement mechanisms. The Share System did not materialize the way it was designed, just because it was not designed on the basis of what was already there in practice or what people were familiar with. Instead it started with prescriptive design which farmers found new and complicated.

WUA cannot be designed just by following a set of routine activities. The chapter has shown how the actors in the project, their actions, and their understanding of the irrigation system environment shape the outcome of the organization. In Khageri, the facilitators made several efforts to bring different conflicting parties together and finally succeeded to find a win-win situation to both the parties. In West Gandak, despite several interaction meetings and group discussion activities, the organization finally resulted in a highly unequally representative system, concentrated towards a few individuals, which gave further room to capture the process by political parties. Another point is how the Colorado-based Consultant remained unaware of the unitary model, while Freeman had warned about its danger of being captured by a few influential people[13].

The critical question in developing the WUA is thus not who organizes it and what process are to be followed, but is what values and interests the actors have, their understanding of irrigation systems and its environment (both physical, technical and social) and how they translate the opportunities and constraints of these environments into their actions.

Notes

[1] Civil servants in Nepal are appointed at two levels: Gazetted and Non-Gazetted. Non-Gazetted positions are the junior officers, and are further ranked into three classes, I, II and III.

[2] A share can be also obtained by initial investment on system development and can be sold and exchanged and this practice exist in many FMIS in the hills of Nepal (see Martin and Yoder, 1986)

[3] The CIP was dissolved only in August 1994 establishing NLIO as mentioned in chapter 3.

[4] The WUA had informed all the water users about the meeting, but only those who were active in water management and other parts of their village life (teachers, Red Cross members) participated the meeting.

The constitution prepared earlier is only the draft constitution formed for the purpose of holding the election, and according to this constitution, it requires to be passed by the newly formed GA of the WUA (who can also change provisions of the constitution prepared by the CDC). Only then can the constitution be registered to the District Water Resources Committee.

[6]The constitution prepared earlier is only the draft constitution formed for the purpose of holding the election, and according to this constitution, it requires to be passed by the newly formed GA of the WUA (who can also change provisions of the constitution prepared by the CDC). Only then can the constitution be registered to the DWRC.

[7] However, this does not mean that farmers were not aware about the system at all. This was relatively a water scarce system, and farmers and local politicians were generally in contact with canal operators and engineers to know about their irrigation turn. According to operators, they also used to help in coordinating the water distribution.

[8] During the Panchayat System (before 1990), there were provisions for a zonal commissioner to look after the administration and development affairs in each of the zone. There were 14 such commissioners in the country for the 14 zones. Part of the command area of the B_1 was owned by one such commissioner. In addition, a large portion of the land was also owned by one of the influential politicians in the country.

[9] Local farmers say that the rhino does not damage the rice crop, so this cultivation was possible.

[10] Minor canals are the one which bifurcates from the branch canal, whereas the branch canals are the ones which bifurcate from the main canal.

[11] Payments to temporarily hired persons differ from district to district. Payment to the FOs are slightly lower than those to AOs.

[12] Before water resources Regulation (1993) was enacted forming DWRC, the WUAs were registered in the DAO.

[13] Freeman from Colorado University has discussed about different models of the WUA while the consultant, CADI, is a Colorado-based firm and also has an affiliation with the university (to my knowledge). John Welkin Wells, the researcher of the Colorado University himself was also involved in training the WUAs in Shares system administration.

5

The Joint Planning Process

The next two chapters of the thesis present the participatory design construction process to support organizational evolution. This chapter concerns the joint planning processes, which is the first activity of any PTD process, whereas the next one describes the implementation of the Action Plan (AP) prepared out of these joint planning exercises. Before describing the joint action planning, I introduce how I began work in Khageri and Panchakanya, and what values, knowledge and perceptions our project team had, as these also affected the outcome of the process, and affected our struggle to make the process stable. It then describes how the different actors have perceived the context of management reform and how they struggled to gain control over the process. The chapter then documents the AP development process. The chapter concludes with a description of issues in facilitating the participatory development process, as well as the limitations and scope of the methodologies used.

The objective behind the joint planning process is to identify local problems and needs to be prioritized by the users; to find workable solutions; and to find and agree upon the implementation regimes after discussions and negotiation with the farmers or their organization. The planning process is based on incorporation of local knowledge and skills, and also combines the technical and scientific knowledge of the external agents. For this purpose, it utilizes range of methodologies like Participatory Rural Appraisal (PRA) and Rapid Rural Appraisal (RRA) and other group discussions (Gill, 1994). In irrigation, especially in the planning of maintenance and in the rehabilitation process, 'Diagnosis

Walkthrough Activities' (Neupane, 1992) are the mostly advocated and used tools, as a first step in a PTD process. This involves the joint survey of the functional condition of the structures and the problems in delivering the services, with a main objective to find agreed options for change.

The PTD process should be client-driven, such that knowledge, needs, criteria and preference of farmers are given weight in decisions about technical innovation. Addressing client needs means that designs should be site-specific and locally adaptive. The design should be interactive, evolving through time with users participating at an early stage of development. Interactive designs that utilize the local knowledge and skills also form the basis of learning process approaches (Scheer, 1996; Korten, 1980) where changes are discussed and integrated throughout the intervention process. Interactive design implies a dialectic action-reflection process in which users, as well as assisting support teams mutually investigates with each other and learn from each other, through the actions they undertake jointly and from the reflections on these actions (Boelens, 1998). Decentralization is another key feature of the PTD, in which end users (or their representative situated at different organizational levels) are directly involved in adoption and testing of the developed technology.

It will be shown here that mere use of walkthroughs as a methodology is not enough to appreciate the users' needs and preferences in the planning of rehabilitation process. The most important element is the question "who participates in the process", as the knowledge and values of the participating team strongly determines the outcomes of these diagnostic processes. In large-scale irrigation, there is also another risk, as only a few individuals (the WUA members) participate on behalf of larger groups: the outcomes thus depend on how accountable and knowledgeable (about the system) these individuals are. The process of local knowledge sharing is also shaped by the project structure as well as by the activities of the key actors within it.

5.1 First Meetings with WUAs: Frustrations and Encouragement

When I came to NLIO in December 1994 as its project manager, the initial WUA development process discussed in Chapter 4 was already over. Before leaving Kathmandu, I was briefed by the coordinator of the IMTP about my future role to facilitate the management change in Khageri and Panchakanya Systems. I was assigned three specific tasks. First was the development of an AP to facilitate the management change. This AP was to be developed both for technical improvement and further capacity development of the already established WUAs. Together with this AP, the terms and conditions for the future transfer of responsibility were also to be negotiated with the WUA. The second job was to implement the AP jointly with the users and the third was to hand over the system management after the implementation of the AP.

I began my work both with both encouragement and frustration and some personnel decisions. On the second day of my arrival in December 1994, a training program was being held in the Panchakanya system. This program was organized by the co-ordinator office in Kathmandu and I was told to join the training session to introduce myself to the farmers. The trainer, an engineering colleague come from Kathmandu, introduced me with WUA members. At the end of the program, the trainees were given their daily allowance of NRs 60 (75 US cents). The participants however did not keep the money but donated it to the WUA to open the bank account for the association I was very much encouraged to see the kind of understanding the Panchakanya farmers had between themselves.

After the training session, we had a discussion about the system and its problems. I was also impressed by their knowledge of the irrigation system and its constraints, and that they were even discussing possible solutions. I also came to know a little about history of the system and how farmers had struggled so far to keep the system running. Farmers were cooperative, knowledgeable and willing to work jointly. When I had left Kathmandu, I was not so confident on whether I would be able to take up the challenge of management transfer. Due to my study in Bangkok, I was less aware of the recent policy changes, and was also not involved in field-level implementation activities for the past two years. My brief encounter here helped to boost my confidence. On the way back to my office, I thought it would be exciting to work with this group of people. I also came to know that there was mutual trust and understanding between the project office and the WUA.

But the project's relation with the WUA of the Khageri was strained. This was due to a dispute between the project office and the WUA over the authority regarding tendering and contracting procedures. Just after the WUA formation, the government had allocated some funds for the financial year 1993/1994 for system O&M. The money was specifically meant to carry out maintenance work that had been deferred for many years: this mostly included de-silting of the main canal and some structural improvement works. The project office had made a tender call to carry out this maintenance work without consulting the WUA. When the WUA heard about this, they seriously objected, arguing that they should have been consulted on how to carry out the work: and if the job were to be done by the contractor, the decision should have been taken jointly. The WUA vigorously protested to the DDG of the IMD in Kathmandu. The tender call was finally cancelled. The matter was then discussed with the WUA. The WUA decided to do the job itself, as it mostly involved earthwork. The WUA hired different labouring groups to carry out the job and completed the work in time. They were also able to save Rs. 356,000 (about $7000 in 1993) out of total contract funds of Rs.1,300,000 (about $20,000). They deposited the saving in the bank, which worked as seed money for further organizational development to be followed in the future.

The then project manager told me that this situation came about due to lack of understanding about the duties and responsibilities between the agency and the WUA at the beginning. However because of this incident, the WUA was very suspicious about project activities and had little faith in us. The first challenge for me was to bridge this gap between the Khageri WUA and our office.

The office environment

The environment inside the project was also frustrating. There were 64 staff to look after the three irrigation systems. They were from different disciplines including civil engineering, mechanical engineering, electrical engineering, sociology, finance and administration. Except for the electromechanical group, which worked only for the lift system (not part of IMT), the remaining staff worked for both Khageri and Panchakanya. Out of these 64 people, only 21 were permanent: the remainders were hired temporarily on a yearly basis. With IMT now being implemented in Panchakanya and Khageri, the number of staff was going to be reduced in future. There was no planning for this, but it was clearly understood that many of the staff, especially those working on a contract basis, would lose their job in the years to come. Those who were on contract started asking me whether their position would be retained next year. Even though I knew some of them would lose their job, I had to be diplomatic, and used to tell them that I would try my best to keep their position. Otherwise this would not only hamper our work, but could be a threat to my life[1].

Beside myself, there were two engineers and four overseers (juniors to engineers) working for IMT implementation in Khageri and Panchakanya. All of them worked for Khageri, but in Panchakanya only one engineer and an overseer was assigned due to its smaller scale. The problem was that none these project staff had any prior experience in participatory projects or had any ideas of participatory tools and methodologies. My own expertise was only from previous work. I was equipped with practical experience but less aware of the theoretical insights behind the tools and methodology. For the rest of the team it was almost a new experience. The two engineers however were very committed and motivated to work with farmers. We were told by the co-ordinator office that there would be training programs in the future (but to my surprise such training never happened) for the field level staff to train on tools and methodologies. Training and capacity development activities of the field level project staff were directly handled by the co-ordinator office, and the field- level project offices had to depend on them.

There were two (local) consultants: an irrigation management specialist and institutional development specialist to support the project implementation. However, they were not involved in everyday project implementation. They were involved in capacity development activities of the WUA, providing logistic support to them, and monitoring progress and preparing progress reports of the project implementation.

Confronted with the poor relations with Khageri WUA and the uncertain environment of the project office, at once I told the DDG of IMD that I did not intend to stay in NLIO and briefed him about the office environment and the project relation with farmers. I was not confident I could facilitate management changes in this situation. However, the DDG insisted I stay and assured me of any help that I needed from the department. I could not say no to him for two reasons. The first was about the discipline of being a civil servant. I was not supposed to run away from an assignment given to me. The second was about my own personal reasons. Chittwan was a good place to stay. It is near to Kathmandu and centrally located in Nepal, where all the major highways meet. There was a good residence facility. For me it would be the best place to live next to Kathmandu.[2]

I also realized another advantage in working here. In the past I had enjoyed working with farmers in design innovations, and always believed in working together. But my previous works was in small farmer-managed irrigation systems where groups were small, mostly homogeneous, and farmers were already familiar with collective management and with their agroecology. The present systems were large and the context was different. It was a context of disengagement from the state to the farmers, whereas in previous cases the systems were already farmer-managed. I thought working in IMTP would help me discover new learning, provide new experiences and insights, and build up my capacity and confidence to implement participatory interventions like IMT which was gaining world-wide attention. I thus preferred to take up the new challenge and decided to continue the journey in Chittwan with encouragement, frustration, confusions and self-doubt.

5.2 The Struggle over Project Control

Committing myself to facilitate the management reform, I moved to the first activity: the preparation of the action plan. In the project design guidelines, it was mentioned that the AP would include the elements of both technical improvement and also capacity development of the WUA. Likewise, a Subproject Management Committee (SMC)[3] to oversee the implementation of the AP at field level was also to be formed in each of system (see framework presented in Figure 2.2). But neither the WUA nor myself had any idea how to prepare this, what elements should be included, and what would be our roles and responsibility. We also did not know the status of SMC, who was to form it and how it was to be formed. Our project colleagues in the West Gandak had a similar dilemma.

This situation developed because the field level project actors (both WUAs and the field project mangers) were not involved in the design of the implementation framework. It was design and developed by the actors at higher institutional levels: the Co-ordinators office, donors and consultants. The field level actors were neither aware of this framework, nor were they satisfied with some of the content of the framework when they were asked to implement it. We put our concerns to the project co-ordinator in Kathmandu, and a workshop was organized in Kathmandu to discuss the preparation of AP and an SMC to oversee it.

The meeting was held in July 1995, and all the relevant stakeholders and the project actors participated. These included: the co-ordinator of the IMTP, the DDG of the IMD; representatives of the major donors the ADB and the USAID; the Chairman and Secretary of the WUAs of all three systems where IMTP was being implemented at first stage; the project manager of the concerned irrigation projects (but the West Gandak Project manager was not present in this meeting); and the project consultant firm. The objective of the workshop was to discuss and finalize the details of design implementation of the action plan.

The project co-ordinator briefed us about the different stages of project implementation and the activities to be carried out (the implementation framework is presented in chapter 2). The WUA leaders had two major objections to this framework: the formation of the Sub-project Management Committee (SMC) and the WUA contributions to the rehabilitation process. I also had different concerns regarding the proposed SMC.

The farmer leaders were not satisfied with the concept of the SMC presented. As per the loan agreement with the ADB, a SMC was to be formed to supervise and execute the overall implementation procedure. It was to be headed by the concerned sub-project manager with four farmers' representatives other than the WUA executive members. The four farmers' representatives however were to be selected by the WUA themselves. The SMC was designed to bridge the gap between the WUA and the irrigation agency. The idea was also to involve farmers into decision making process, through representation in the SMC. So far farmers were mostly involved in providing contribution in labor or cash, and in prioritizing the type of improvements with in the system. Now efforts were made to empower farmer groups by involving them in decision making process.

The WUA leaders had three major concerns regarding the SMC. Their first concern was on the Project Manager being the chief of the SMC. They did not express it openly, but it could be understood that they did not want this. They were in favour of a

SMC headed by the WUA chairman. Another objection was against disallowing the WUA executives to be in the SMC: they wanted the SMC members to be from within the MC of WUA. Some WUA leaders were comparing the SMC with the "Polit Bureau[4]" of the communist parties, with all the powers vested to it. They feared that non-representation of WUA executives on the SMC would reduce their influence over the farmers. They argued that SMC would bypass project execution to the WUA and said that they did not want the SMC. Instead they suggested that the concerned irrigation agency and the WUA should implement the project jointly. The third concern of the WUA leaders was about restricting the numbers of farmer members to four.

My own argument against the SMC as presented was that the roles and responsibilities, as well as the accountability of the SMC members including the project manager, were not clear. So far, according to the prevailing financial rules and institutional arrangements within the DOI, the project managers were responsible for the financial expenditure they made and the quality of the work in any project. Now the SMC was made responsible for the project execution, and the responsibility was to be shared. But there was no clear mention about this in the SMC framework. The rest of the participants were silent on these issues, as the provisions were designed by themselves. Also, they were not to be involved in the every day project execution processes at field level to which the issue being raised were related.

What to do with the SMC? The question was put to the farmers' side by the project co-ordinator. The farmer leaders were in difficulties: they could neither reject nor accept the SMC in its present form. They did not want to reject it as they realized that it tried to involve farmers in the decision making process. Some of the farmer leaders also did not object to the concerned project manager being the Chairman of the SMC. Their view was that the chairman must have good knowledge of the financial and administrative management. Farmers are not very familiar with the bureaucratic process of project execution. All the farmer leaders knew this. After discussion with each other, they agreed about the need for the SMC and also agreed on the concerned project manager heading the SMC. However, they demanded that the WUA executives themselves be allowed to become members of the SMC, and that the numbers should not be limited to four. This was acceptable to donors and the DOI. The issue over the SMC was resolved.

Farmers agreed to have a SMC because they realized its importance. They also thought that a small group would be more effective for day-to-day execution of the project. Farmers' acceptance of the Project Manager as a SMC chairman was a compromise. They did not want to confront the managers with whom they had to work beforehand. Besides, the majority of funding was from the project, and farmers themselves were less aware of the bureaucratic processes and procedures of the project administration. Regarding the representation in the SMC, The WUAs got what they wanted.

Higher contribution from users: another cause of disagreement

Another disagreement over the project framework was over the users' contribution in the technical rehabilitation. The IMTP required a contribution of 26% from the farmers. In fact this was not clear from the loan agreement with the ADB, which only states that 59% of the total cost of the IMTP would be borne by the ADB. The general trend within the DOI regarding its own contribution is usually 15% of the total cost of the project. So, there was a deficit of 26%, which was proposed to be generated from farmers' contribution. None of the projects so far in Nepal had targeted this scale of contribution from the farmers side. The WUA leaders attending the meeting vehemently opposed this. The Irrigation Policy requires a minimum of 10% contribution under such circumstances. They said that they would be unable to generate this 26% contribution and therefore would not participate in the program.

Farmers had two objections regarding the higher contribution. Farmers' contribution in construction work is generally voluntary. Mobilization of voluntary labor is easy and effective in construction activities involving earthworks (like canal digging and land filling). However in the rehabilitation of these irrigation systems, most of the construction activities included structural renovation with less earthwork. The scope for farmer mobilization was thus limited. That meant the farmers' leaders had to convince fellow farmers to contribute in cash, which they found impossible. The problem was also that management transfer was not demand-driven, and farmers were not told at the beginning of the group formation (chapter 4) that they had to contribute a higher percentage during system improvement work.

Another reasons for the WUA leaders' objection was that in the adjoining East Rapti Irrigation Project, the amount of contribution to be borne by the farmers was about 10%, and it was also funded by the ADB. The WUA leaders questioned the donors, the coordinator of IMTP and the DDG why should they pay so much, when other users in the vicinity were contributing less in the construction program implemented by the same department with financial assistance from the same funding agency. This was not an invalid argument by the WUA leaders. The WUA leaders knew that there was no way in which they could convince their fellow farmers to agree with 26% contribution back in the field. I also believed that this would be difficult, as it had not been communicated to the farmers at an early stage of group formation. I told the project coordinator that it would not be possible to generate a 26% contribution in this context and it was necessary to adopt a flexible approach, he agreed with me. The farmers were ready to agree to a 10 % contribution, but above that they would not decide on their own and had to consult with farmers back in the field. I felt that the best way to compromise was not to insist on a 26% contribution in strict sense, and at the same time to convince farmers to contribute the maximum possible. This was acceptable to both the government and the WUA. Finally, farmers' contribution to the project was stated like this: 'efforts shall be made to achieve maximum contribution from the farmers without limiting to 26% in strict sense. This satisfied the WUA, donors and the DOI. (Chapter 6 explains the ways in which WUAs later dealt with this contribution issue in the field).

With our concerns and confusion cleared up after the workshop, we came back to the field and started preparing the AP. Before this, SMC were formed in both Khageri and Panchkanya. In Khageri, the Chairman, Vice Chairman, Secretary and two other members of the WUA were nominated by the WUA main committee to represent in the SMC. Likewise, in Panchakanya also the Chairman, Vice Chairman, Secretary and two additional members of the WUA were nominated as members of the SMC. In West Gandak, the Chairman and Vice Chairman stayed away from the SMC, and five other members, from within the WUA main committee, were selected to sit on the SMC.

5.3 Back to the Field: Preparing an Action Plan in Panchakanya

The major objective and content of the AP was to evaluate the system constraints and find options for change such way that the WUA could manage the system after transfer. In the Panchakanya system the fundamental problems were mostly at the main canal and head works. There was massive seepage and leakage from the main canal which had drastically reduced system efficiency. The problems in the headwork concerned the encroachment of the reservoir area and lack of silt flushing arrangements. There was also a problem of depleting water resources due to environmental change in the upstream catchment. Farmers in Panchakanya were saying that if these problems were solved, they could manage the system on their own. They were not worried about the branch canals, as they said that inside the branches, they could manage the affair themselves owing to shorter canal lengths and limited technical problems. It was thus decided that the walkthrough activity would be carried out along the main canal only.

Walkthrough activities in the PIS

Before the process could start, we formed a joint team to carry out the Walkthrough. The team consisted of Chairman, Secretary and one member from the WUA, one member from the SMC, one engineer and one overseer from our office, who were assigned to Panchakanya. The WUA and SMC members were not fixed, but selected on the basis of who had access to information at a particular reach of the canal. However, any members were welcomed to participate in this process. Due to parallel activity in Khageri and other work schedules in the lift irrigation system, I could present myself only partly in the walkthrough processes[5]. There were no standard questionnaires prepared in collecting the information. The key information to be noted were: the existing condition of the structures; whether they were able to provide the intended services; what type of changes (incremental or radical) were required to provide the services; the water allocation and distribution methods; and the WUA's future plan on water distribution.

We had several advantages in PIS in forming an AP. The users had several years of experience in canal O&M and thus had good knowledge of the system. There was already a common working background between our technicians and the farmers. In the past too, the CIP and the then WUA (though informal) used to co-ordinate with each other in matters relating to O&M. More importantly - local people had faith in the WUA and in its leaders. Farmers said that the Chairman and the Secretary had worked hard for the past several years to keep the system running to its capacity. This was an ideal case for using their skills. However even in this ideal situation, when we completed our survey, we still missed many elements as some of the problems were outside our domain and some were due to a lack of awareness in using this diagnostic tool. The results of this walkthrough were:

- The visible problems were noted down- the canal breach section, the damaged structures, silted canal sections etc. The wider causes of these problems did not come up. For example, everybody in the team pointed to the reservoir silt deposition and its encroachment as a major problem. But the reason for this, and how we could solve it was missing. We also realized that we needed to talk to farmers in the catchment, who were not users of the Panchakanya system.
- We carried out the walkthrough with 'canal closed' conditions assuming that problems would be visible to our eyes. This gave us an idea of structural problems. However, we missed another equally important factor: the hydraulic performance. For example, we noted seepage areas based on farmers' information, but not the intensity of the seepage at different sections.
- We also missed an important person during the walkthrough: the gate operator. When we discussed our data with him, he pointed out many new problems regarding gate operation and canal seepage.

The project team remained highly instrumental in this process. We prepared the technical inventory to find the problems, and prioritized the options for change. The real diagnosis part was missing. For example, we listed down where the seepage was, but not whether the seepage water was lost or used again elsewhere. We did not discuss the why and how of the problems. Another limitation was that we did not discuss any social and legal issues affecting water delivery. At this stage we even did not comprehend this aspect. We were more focused on technical problems and finding the best possible options.

However, we did not limit ourselves to this first attempt, and use the walkthrough only. We decided to carry out several meetings between our joint survey team and local leaders, with farmer groups of different canal reaches, and with other farmers who were not users but farmed adjacent to the reservoir. The walk through was again repeated in canal-running conditions to observe the hydraulic performance. These exercises not only provided the physical condition of the canal and its structures, but gave a broader picture of the system constraints, including the historical changes.

The fundamental technical and physical problems resulting in poor service in Panchakanya were then clear to us. The first major problem, as identified by the WUA was massive seepage from its 4.92km long main canal. This had resulted in a water scarce condition especially in the tail-end areas. Otherwise, the Panchakanya had ample sources to irrigate monsoon rice in its 450 ha area. Another major constraint of PIS was reservoir encroachment by the adjoining farmers, and massive silt deposition of the reservoir at the intake due to lack of a silt-flushing device in the intake weir. We then made a topographic survey and found that more than 40 % of the area was already encroached on by the adjoining farmers and converted into fields. Farmers also claimed that this had also resulted in a decrease in water flow in the stream and hence in the canal itself. All these problems had contributed to the decreasing command area of Panchakanya. Also problematic were water distribution processes because of the poor condition of the gates and the outlets.

Analyzing the constraints setting future targets

When all of these constraints were discussed, the following objectives were set for the future technical improvement work:

- to cover the targeted command are of 450 ha
- to improve the equity and reliability of the water delivery system
- to reduce the operation and maintenance cost of the system

To eliminate these constraints, the WUA set the following priorities for technical intervention: to improve the seepage condition in the main canal; to solve problem of reservoir encroachment and siltation in the headworks; and remodelling the outlets and the gates which were dysfunctional. It was also agreed that no new water control structures would be added in the main canal system. Improvements in the branch canals were given the least priority as the farmers thought these were under their control.

The WUA was then left to decide where to prioritize the improvements and what kind of innovation would be appropriate to solve the problems. As expected, they came up with a shopping list of demands, because they were not given any limitations. Farmers favoured radical changes in the existing technology. They asked to replace the existing canal sections with another cross-section type, the vertical brick wall, over the whole of its length. But this was not only going to be very costly, but was also difficult to justify to the donors, and even to my own seniors in the department. On the other hand these canal sections were structurally safe and stable, but leaking heavily due to poor construction materials used in the past. The WUA's proposal was highly shaped by the project structure: because they thought that most of the cost would be borne by outside funding agencies, they did not focus on finding the appropriate solution under the given situation, but instead favoured an entirely new one, considering it to be better and superior. Tiffin (1987) also documents similar cases where farmers came with an extravagant list of desirable demands for improvement, when not presented with any limitations on the costs and budgetary provisions.

There was no way this change could be justified. We then decided to discuss the matter together, between project technical team and the WUA. In the discussion, I came to realize that it was not only the outside funding that had resulted in the extravagant demand, there were also other reasons:

- They had over-expectations on what technology could do for them. They had observed several canals being constructed in nearby projects utilizing brick lining. They thought this was the best option. They had also a feeling that lined canals were better than unlined canals, and that gated outlets could provide a better service than ungated ones.
- It was also due to the usual trend in our bureaucratic process, which attempts to consider all demands irrational and what we get is always less than what we ask for. So people ask more, even if their need is less. The farmers had also deliberately included extravagant demands knowing that at the time of negotiation there would be reductions in them.

- The system was going to be turned over to them and they did not want to confine their demands, as they do not know when they would get further support.

After the discussion, our technical team and the WUA again inspected the canal sections and discussed the problems. I was not in favour of dismantling the existing canal section, but the WUA insisted on new brick lining and dismantling the old one. Despite several efforts, I could not convince the WUA to change their plan. We were told by the project co-ordinator of the IMTP that the average cost of rehabilitation should not exceed about Rs 14,000 ($200 per ha). Within this limit, it was possible to construct only a 1.2km of new lined section. However, the WUA agreed to continue the discussion on the type of lining, to find better options, if possible during the detailed design work, as discussed in the next chapter.

The experience in Panchakanya shows that it is essential for walkthrough activities to be carried out in both the conditions: canal closed and in running conditions. We found many differences between what we were told by the farmers, and what we observed while the system was running. But this is not really the fault of the farmers, as their knowledge is localized and they cannot usually discuss the situation of the whole system. Another problem is that common farmers generally do not participate in these exercises, they feel that it is the WUA's job, and they are selected for this. Within the WUA too, generally, only the key figures like the chairman and the secretary participate regularly. So discussion with wider groups of farmers (at appropriate intervals) is essential. The evidence here also shows one should not depend on the efficacy of a particular participatory tool to generate information: at the same time one must recognize how the project structure shapes the planning process.

Priorities in institutional development activities

With the technical inventory over, another element required was to prioritize the institutional development activities. However, this did not involve a joint exercise. There were already standard training modules developed in the Irrigation Department for the capacity development of the WUAs. Such training was on both technical and non-technical aspects of irrigation management. It included training on construction quality control, flow measurement, system maintenance, system operation, share system administration (chapter 4), leadership development, and basic training on participatory approaches and methodologies. The same training was proposed here too. The training sessions were to be carried out throughout the implementation period.

The field level project offices were not responsible for most of these training programs. They were to be carried out by the Co-ordinator's office at central level and the consultants were responsible for facilitating the training programs. Beyond training programs, field visit programs to different groups of farmers and WUA were also identified. Such field visit programs were proposed to places where there were successful FMIS, and to areas where farmer could learn about agricultural innovations.

5.4 The Joint Walk Through in Khageri

The management situation was more complex in Khageri than in Panchakanya. Farmers here were less aware of the system problems, as they were not directly involved in canal O&M in the past. The WUA here was formed in 1993. When the walk through started in August 1995, the WUAs had been involved in canal operation for only two irrigation seasons (the monsoon seasons of 1993 and 1994). There was an election of the WUA in January 1995, and as a result about 50% of the representatives in the WUA body were new. The new members were less familiar with the operational problems in the system.

Khageri was a larger system, and the walkthrough activities were to be carried at two different levels: at the main system level and branch canal levels. It was not possible to carry out the activity by a single team, where there was a 23.2 km long main canal and 13 branch canals totalling more than 50 Km length. Furthermore, the farmers in Khageri already had exaggerated expectations of the upcoming project, making their demand based on what the project could offer, rather than actually analyzing their needs. However, we had also some advantages here. We had experience from the Panchakanya case that a walkthrough should be done in both canal operating condition as well as in closed condition. Also that we needed to include the canal operators in the process. Canal operators in Khageri were highly knowledgeable and some of them were very popular among the farmers. Another experience from Panchakanya was that only one walkthrough was not enough in understanding the problem situation: there was a need to discuss it among different groups of farmers as only limited numbers of people participate in the walk through exercise.

Trying different options

An alternative way of joint working was tried in KIS: beginning from the farmers themselves. That is, the concerned BC members were asked to discuss the problems and probable solutions with their farmer groups, and prioritize the necessary changes. This would then be jointly discussed between the WUA and the technical team. This was especially done because of the time limitation. We targeted to complete the walkthrough by December, such that we could enter the Agreement with the WUA by January 1996. There were no fixed targets for the project, but we were told by the project co-ordinator to complete the technical improvement work in three years time. Considering this, we were targeting to complete the technical inventory by the end of December 1995. Beside time limitations, this option had two advantages. First, the problems would be discussed within farmers group themselves at the beginning, so that more farmers would participate in the process. Second was that it would also avoid walking through unnecessary places and detailed investigations could be concentrated on the identified problem areas only.

This approach proved disappointing. About half the BC members were new as a result of the recent election. Many of them had not walked along their canals. They knew about the problems in general, but not in particular. Those who were members in the previous committees had only one year of experience of canal O&M. So when they were asked about what support they needed, their reply was general: they wanted canal lining, widening of canal crossing bridges, concrete pipes for road crossings and construction of tertiary canals. There was a huge list of demands from the branch committees. There was no advantage in going further with this approach, and we started the walkthrough directly as we did in Panchakanya.

The joint team here again included our technicians, including the canal operators and WUA members of the concerned BC. Being a large system, there were two technical teams and I could participate only in some of the canals due to my time limitation. However, at the final priority setting between the concerned WUA and project staff, I was always present. In branch canals, together with the concerned BC members, the member representing the branch in the MC was also assigned for the walkthrough. All the BC members were asked to participate in these joint exercises. However in most cases, only the Chairman and Secretary of the committees were present from the WUA side. This exercise proved useful to both the parties as in most of the cases even the Chairman and Secretary of the branch canals had not studied their system in detail[6]!

The walkthrough in each branch (and also in main canal) was done in three steps. At the first stage, the joint team, used to carry out detailed walkthroughs and prepare the inventory. At the second stage, tentative cost estimates were made, and discussions with the larger group of farmers were carried out. After this discussions, a revisit to the field was made to incorporate the suggested changes. The third stage was the final negotiation stage, where the tentative designs were further discussed and changes made as per the cost available. As the activities in the different branch canals overlap, it usually took a month to complete the walkthrough in four branch canals.

Analyzing the constraints setting the priorities

The Khageri canal network was not in as bad a condition as in Panchakanya. Its major problem was the limited supply at the source. So the major focus here was to increase water availability in the field, especially at the tail-end areas. The major priorities of the farmers were:

- Reuse of seepage water by diverting drainage water back in canal wherever possible.
- Lining the canal sections
- Improvements in the gate configuration
- Development of tertiary canals
- Widening the canal crossing bridges and construction of new bridges.

The farmers' first priority followed the problems in land topography (see chapter 3), where seepage water immediately joins the drainage and was a loss to the system. Farmers had known about this since the construction of the system back in 1967. They had also tried to reuse the water, but with limited success so far. The reason was that this required land acquisition to dig a new canal, which farmers were unable to do because of financial and bureaucratic processes. Reuse of this lost water got immediate attention to farmers who expected to succeed this time through government support. Canal lining was also targeted to reduce the canal seepage, and to reduce the annual maintenance burden of reshaping and remoulding of canal sections.

The Khageri system used to operate on a rotational basis. With their short experience of canal operation and their interaction with the canal operators, farmers in Khageri favoured a strong rotational practice to be put in place in the future. For this they demanded additional cross regulators in the main canal, and changes in the design of existing gate configuration. The present gates were easily tampered with, and the problem was more with fishing by outsiders than water theft by the farmers. In a certain section of canal reach, outside people used to block the gates in the night for fishing, affecting irrigation. So they sought tamper-proof gates. But the farmers' demand for change in water control structures was only at the main canal, not inside the branch canal. They related that inside the branch canal, 'social control' (rules, regulations and social relationships) was enough to regulate the flow. But along the main canal, they needed better technical control as well, to guide the high volume of water as well as to control the vandalism and interference by fishermen.

The problems identified, and the suggested priorities after the joint exercise, were in line with the future management plan of the WUA. The WUA wanted to utilize every available water source inside the command area, control the seepage and have a strong rotational plan. However, we (from the project side) could not agree over demands for canal lining. Farmers demanded almost 50% of their canals be lined. As in Panchakanya, extravagant demands were due to higher expectations generated by the project, but were even higher here, and generated by project activities.

There was high mobility of the consultants and project staff in the field. Farmers had seen consultants (both foreign and local) with white Toyota jeeps in the field more often during the WUA development and training programs. There were also frequent visits by the higher authorities from the IMD, as well as by donor agencies. I also learned that one local consultant involved during the WUA formation had told the WUA that money would not be a problem in future[7]. These activities made farmers expect a big construction project to be launched in the area. There was a strong feeling among the WUA and farmers that the participatory process was meant for the implementation of the construction activities. This feeling existed among our own technical staff too. They were less aware of the management reform, and IMTP was seen more as a construction project, not a part of broader process of management reform. Bruns (2002) notes similar situation in Indonesia, where management reforms has often ended up discussing only issues of technical rehabilitation.

In one of the WUA meetings, I tried to convince the WUA members that the ultimate objective of IMTP was to further accelerate the process of participatory management that begun in 1992. Technical rehabilitation was just to bring the infrastructure up to a level that they could operate and maintain. It was meant for incremental change, to provide them with better working conditions. I told the farmers that we needed to look at better alternatives for the lining, as it could increase the maintenance burden in the future. Farmers thought that lined canal would reduce their maintenance burden (exaggerated expectation of technology). This was only partly true. Lining could reduce immediate maintenance burdens and eliminate the task of canal reshaping, but its maintenance in future would be more cash-intensive.

In Kathmandu, the project co-ordinator and the DDG were not in favour of canal lining. From the experience of previous operators and as well as from the result of walk through, there were advantages of canal lining at certain places. Most of the Khageri branch canals as explained in section 3.3 were constructed with filling sections and there were moderate seepage losses from these canals. There was no measurement of the seepage loss so far, but the drainage flow downstream of the canals indicated that seepage amounts were high. There was no prospect of re-using lost water due to topographic limitations and wherever it was possible, farmers had already taken action. But the scale of demand was high. For me it was essential to address both farmers' concerns and the co-ordinator's.

According to farmers, seepage loss had increased in Khageri since its construction. Farmers themselves knew the reason why: initially the canal embankments were wide (2.0m), and well compacted. Over the years, farmers had encroached on the canal embankment (now less than 1 m) in many places, and converted space into fields which had increased the seepage. I suggested that instead of canal lining, its embankment be re-widened back to its original shape, or slightly wider. I preferred slightly wider embankments than the previous section so they could be used as village roads, besides controlling the seepage. But this had a practical limitation. It required taking back the encroached land, and the WUA feared that these farmers could be hostile towards the WUA.

For many WUA members, this was innovative: they were especially attracted by the idea of the village road, which could control the seepage and also provide local transportation. This had also another value. This involved mostly the earthwork and it would be easier for farmers to contribute to this activity. Farmers agreed with this plan, and agreed to cut their demand, favouring lining at selected places only. With further negotiation, it was finally agreed to line the canals for 6.2 km out of the total length of 50km (considering all the branch canals).

However, the higher authorities in the co-ordinator's office were still not satisfied with the lining proposal, as it involved more cost. Later on, in one of the field visits, one ADB official during his field visit even said that the canals were being 'silver-plated'. However, I now had to defend whatever we had agreed with farmers, and argued that lining was essential as it could save considerable amounts of seepage and provide a better service especially to tail end farmers. I explained that the need for canal lining was also mentioned in the earlier project design report of 1967 (chapter 3). The designers then had assumed that the soil pores would be filled up by the incoming silt and that canal lining may be avoided in future, but this did not happen. There was still heavy seepage loss within the branch canals. With the available data to support my argument, the project co-ordinator was finally convinced for the lining work.

The total amount for the rehabilitation here was NRs. 52.5 million (Rs. 13, 400 per ha) out of which 26% was expected from farmers side. Farmers' contribution was expected to generate out of voluntary contribution. The total cost was also under the limit of Rs. 14,000 per ha cost as suggested by the co-ordinator.

Training and field visit programs

The training and field visits programs here too were similar to Panchakanya. This was already set by the project co-ordinator office in Kathmandu. The WUA here was initiated in 1993, and the members were already supported by training on 'leadership development', 'share system administration', and 'flow measurement activities'. The chairman of the WUA also had the opportunity to visit the Philippines to gain experience in early 1994. This field visit program was funded by the USAID as part of the capacity development program of the WUA, and was participated in by the WUA leaders from Khageri, Panchakanya and West Gandak systems. Additional training on 'construction quality control', 'office administration', 'financial management' was proposed for the future. In addition to the MC, the training was also targeted at the BC. Because of its relatively smaller system, training had not been targeted at the branch canals in Panchakanya.

5.5 Action Plan Preparation in West Gandak.

The West Gandak is an intensive-type development system, with canal networks and associated water control structures up to field level. For farmers, the immediate need was to test its compatibility with their management, rather than addition of the new water control structures. Farmers were more concerned with two major problems, flooding and inundation, and the problem of silt intrusion, which was not resolved so far despite huge investment during the CADP.

Flooding and inundation had been a problem since the construction of the Gandak Barrage and it was especially due to inadequate cross drainage structures, and poor maintenance of the associated drainage canals. The maintenance of the drainage canals however was the responsibility of the Indian Government, which is beyond the authority of Gandak Project Office. These were no silt exclusion mechanisms to control the silt entry in the main canal which used to result in quick sediment build-up in the main canal, drastically reducing its capacity.

The walk through process in West Gandak.

Both the minute book of the SMC, and discussions with the then project manager of the West Gandak show that the process here also began with several rounds of walkthrough activities inside the command area. In the branch and minor canals, first demands from these particular canals were collected for the type of improvement required in their system. They were notified to submit their demands by the West Gandak project office. After the demands from all canals had been collected, they were discussed in the SMC, which then decided to carry out the walkthrough activity on the canals. The branch/ minor committees were then notified about the walkthrough date in their canals. The committee members of the respective canal were asked to join the walkthrough, and show the problems which they had asked to solve. The respective committee was also asked to discuss the problems in their canal networks with local farmers. Any new problems identified during the exercise were also noted down. At the time of the walkthrough, the project manager of the West Gandak, and other technicians, one of the SMC members and the members of the respective branch or minor committee were present. When the Project Manager could not be present, another engineer was present on his behalf. The Project Manager told me that from the WUA side, only key position holders like the Chairman or Secretary were present during the walkthrough activities. The final lists of demands and probable solution were finalized in the field itself.

Once the final lists of the improvement needed was completed, a discussion was again made between the walkthrough team members and farmers of the canal. The date and venue of such meetings were jointly decided by the SMC and the respective committee: common farmers were notified later on by the respective branch/minor committee regarding the date and venue of the meeting. In these meetings details of the demands made were again discussed, and the final checklist for the improvement works was prepared. The finalized items of works were separated into five different headings, namely: Emergency Repair and Maintenance, Essential Structural Maintenance, Catch up maintenance, Rehabilitation and Expansion.

Farmers demands in the branch and minor canals mainly involved the remodelling of old and damaged structures and cleaning, shaping and reshaping of earthen canal sections. At the system level, flood control structures, and construction of a silt ejector[8] to remove silt load from the canal were prioritized.

Considering the intensity of structures the system has and the system constraints, it can be said that very limited improvement works were identified while preparing the AP, especially in the branch canals. There were no debates about the problems regarding water delivery structures or any type of conveyance structures as occurred in both Khageri and Panchakanya. My discussion with the then project manager, SMC members and some branch committee members reveals that

- The whole WUA team was new as a result of recent elections. The team had neither the experience of canal operation, nor had they received knowledge about the system, except around their own locality. They did not know about appropriateness and compatibility of the technology for their management. This resulted in limited participation from the WUA side. In West Gandak, farmers were not involved in day-to-day operation of the canal and thus lacked the knowledge regarding operational constraints.
- Farmers knew that there is abundant water at the source, and their major problem was the heavy sediment build up in the canal. They believed that if the silt intrusion is limited and the canal is regularly cleaned, the system could be efficiently run.
- Very few persons were involved in the problem identification process. For example in branch canals, one or two members of the WUA, technicians from NWGIS and one SMC members were involved in the walkthrough activities. It was thus a group of four to five people involved in the walkthrough and among them, only one or two were from that particular canal. While preparing the initial demand, most often it was the Chairman of the committee who prepared the list and submitted to the project office, without even discussing it with the committee. The BCs were to discuss the operational problems with the farmer groups before joining for walkthrough. Farmers told me that they did not know about these activities. In Khageri and Panchakanya too, it was only the key figures who used to participate in this exercise. But these people used to discuss the problem (both formal and informal) with the fellow farmers in parallel.

- In group discussions (which occurred in the discussion of main canal), and meetings, the process was dominated by one or few influential people. Farmers say they mostly agreed with what these people said.

The CADP had carried out radical changes in the system infrastructure and technology. Construction of additional structures was thus not required in West Gandak. According to the project manager, West Gandak problems, especially the silt and the flooding, were chronic and require continued attention, and one event of rehabilitation had thus limited scope to offer. But one cannot deny that there was very limited discussion and study during the walkthrough. Both the WUA and some of the project technicians agree that if farmers had had more experience of canal operation and maintenance, a wider debate on the type of improvement in technology could have taken place.

Besides the elements of technical change, types of support needed for the institutional development of the WUA were also discussed. The training programs were designed by the consultant involved with the project. As the types of proposed training were similar to KIS and PIS, they are not presented here.

5.6 Signing the Memorandum of Agreement (MOA)

When elements of both technical rehabilitation and institutional development activities were finalized, a MOA to implement the AP was signed between the WUA and concerned project office (on behalf of the government). This was the binding document for both the government and the WUA for the implementation of IMTP in the system. The MOA is a legal document that includes the terms and conditions of the transfer arrangement, the level of transfer (whether it is a full system transfer or joint management) and other specific concerns of the particular system. It also specifies roles and responsibilities of each party involved (the WUA, the SMC and the concerned project office) in the implementation process and type of the support that the system would get after the turnover. The actual turnover would take place after the completion of the technical rehabilitation and institutional development activities identified in the AP.

In Panchakanya, it was not necessary to negotiate with the WUA on the level of the transfer. It was dictated by the Irrigation Policy itself. That is, its command area is less than 2000 ha, and the whole system was to be transferred to the WUA. Farmers had participated in this program knowing this provision (chapter 4). Regarding the condition of the transfer, such as what properties to transfer, what would be government's role and responsibilities after the transfer, we decided that these would be further negotiated after the implementation of the AP. The reason was that so far there were no policy guidelines for this. For the execution of the AP, the following principles were agreed after a meeting between the consultant, the WUA and the project:

- The WUA would mobilize and execute the construction work to be provided as part of its voluntary contribution. The project office would provide necessary technical support for it.
- The SMC would execute remaining work in collaboration with the project office and the WUA. This point was already made clear during the workshop in Kathmandu, that the SMC would be responsible for the execution of the project at field level, and there was no disagreement over it at this stage.
- The WUA and the project office would jointly supervise the construction work.
- The WUA would decide who would implement the construction work (contractor or the WUA itself). As per the financial rule the WUAs are also allowed to carry out the construction work. So a contractor would be employed only if the WUA decided not to carry out the construction work on its own.
- Payment to the contractor would be made after the joint commissioning of the construction work.
- Any disputes between the project office, SMC and the WUA would be resolved by the co-ordinators office in Kathmandu.
- The project office and the co-ordinator office in Kathmandu would carry out all the necessary training and field visit programs as identified in the Action Plan.
- The system would be handed over to the WUA after the implementation of the action plan. prepared.
- It was also agreed that legal issues regarding the transfer would be dealt at the time of handing over after the completion of the AP (see chapter 7).

The AP and the above-mentioned conditions were then discussed and passed in the GA of the WUA. A ceremony was organized to sign the MOA between the WUA and the project office in January 1996. It was held in the headwork of the system. The ceremony was also attended by the DDG of IMD and the co-ordinator of the IMTP. The document was signed by the WUA chairman from the farmers' side (witnessed by two others) and by the project manager (myself) from the government side.

The MOA agreement in Khageri was similar as in Panchakanya. However, since the command area is above 2000 ha, only the branch canals were to be transferred to the WUA, in accordance with the Irrigation Policy. So the signing of the MOA document was done by both the Chairman of the MC and the Chairman of the concerned BC. The ceremony was held in Shivanagar where the MC office is located. It was attended by both MC and BC members. Before the agreement was signed, the AP was approved by the GA of the WUA (for the whole plan, including for main and branch canals) and the GA of the concerned branch committees.

The conditions and processes were similar in the West Gandak too, but with one big difference. The agreement was for the transfer of the whole system. Among the three systems, it is the largest and most complex one with a command area of 8700 ha (chapter 3). The Irrigation Policy specifies that only systems below 2000 ha are to be transferred to the WUA. For larger systems, only the branch canals are to be handed over and the main canal is to be jointly managed by the agency and the WUA. But the policy does not prevent from handing over a larger system, if the WUA demonstrates its technical and financial capacity to manage the systems. How did the WUA, which was only two years old and so far not involved in canal O&M, got interested in taking over the whole system, and why did project office and the DOI agree on complete handover of the system? Project officials say that a few aspiring leaders in the WUA were in favour of taking over the management of the whole system, whereas the key leaders involved at that time say that they were encouraged by the project officials. The WUA here was formed in July 1993, and the MOA for transfer was signed in January 1995. Within this short period, how much maturity can the WUA have earned who still had not establish proper mechanisms of fee collection, and so far was not involved in canal operation in such a complex system? This point leads one to believe that the full transfer of the system was constructed from the government side, because of their aspiration for IMT. However, a few WUA leaders were also attracted to full transfer because of the resources (forest, road tax) the West Gandak could provide (see chapter 7 for details).

5.7 Conclusions

This chapter reviewed the processes of joint problem analysis for the technical improvement work, and capacity building of the WUA. In addition, I described my own involvement in the facilitating process. My intention here was to present the working environment, and the kind of challenge managers face in managing the project process, the continuity of which depends as much on managing these externalities as on actually being committed towards the program itself. Another objective was to show how personal agendas also get embedded into professional life, which ultimately determines people's commitment to be involved in particular problem situation. My commitment to work in the IMTP was as much shaped by my personal belief and personal factors, as by being an engineer of the Irrigation Department.

The chapter shows prescriptive designs of norms for a project is problematic, and how they clash with actors, when external agendas are put to them for implementation. Though considered participatory, the design of the IMTP began in the usual top down fashion, norms of which were set by the actors at higher institutional layers: the project co-ordinator office, the consultant and the donors. The actors at the local level, who were responsible for the project implementation, remained unaware of the implementation framework. The project design also fails to bring different elements of the project environment together in the program process, instead each actor were seen as independent from each other. The actors at central level consider themselves as a controlling or supporting authority and hold the decision making power. Field level project offices were asked to implement the project as designed, and had less authority to accommodate changes in the plans and programs.

The chapter presented the three different cases of Action Plan preparation and agreement over its implementation. It mainly focused on the walkthrough activities to prepare the technical inventory to find options for change. The materials here shows that the outcome of this exercise is highly shaped by the experience of the facilitating group in performing the tasks as well as the understanding of the system features by both facilitators and the users participating the processes. It shows that farmers are knowledgeable actors: however, projects generally raise the level of expectation on the part of local people. This usually limits the scope of self-analysis of problems and probable solutions. People can construct their ideas based on what project can offer (see also Moose 2001), without actually diagnosing the problem situation and probable means of solution. Instead they can be biased towards a set of new technologies, considering it to provide better water delivery. The demand for the technical change in the cases presented was highly shaped by the belief that some outside funding agency would bear most of the improvement cost, without detailed discussions about the problems.

Likewise, unfamiliarity with tools and lack of experience on the part of the technical team can lead to 'blue printing' with no real diagnosis of the problem, as happened in Panchakanya at first trial, despite committed and motivated staff. Problem diagnosis is the crucial element in the walkthrough. Such a diagnosis has to incorporate both hydraulic and structural considerations, and their social dimension, and include the experience of canal operators and others who are familiar with system opportunity and constraints. The participating team should thus be trained on how to diagnose the problems, rather than on what steps to follow in the process.

Participatory methods therefore should not be limited only in consultation over what things are to be included for change, but also in subsequent negotiation for change. They should be practiced iteratively, with detailed diagnosis of the problem and be based on future operational strategy of the local organization, for which understanding of technology and its requirement of use plays a key role. It is essential that the information generated be discussed by broader circles, as well as through group discussions at different fora. At the same time the project activities should not create unrealizable-expectations by the local groups.

A planning exercise shall not limit itself to only one type of methodology, and needs different approaches to show people's needs priorities and preferences regarding future water use. It is essentially a learning process, where people come to learn about the physical environment, the technology they use and the actors within it. The outcome of the process is highly dependent on how these actors learn about their system and themselves. At the same time, the knowledge generated is only the raw material, which has to be refined in due course to transfer it to the actual products for action. The next chapter will explore this.

Notes

[1] When the CIP was dissolved, and the NLIO established, staff were reduced from 250 to 64, a big problem was created in the office: the then project manager was threatened with his life.

[2] In many other cases, an engineer's work in Nepal is based in remote hilly locations, which involves walking even up to 4,5 days depending on location. So I favoured staying here.

[3] As the IMTP was being implemented in different projects, the central project coordinator office termed the different projects at field level as sub-projects and accordingly the term sub-project management committee is used.

[4] Communist parties were (still are) also major political forces in Nepal and farmers are familiar with the word Polit Bureau.

[5] That is I was not always present in this process. I used to get information from the engineer participating the Walkthrough. But I was always present in the discussion afterwards.

[6] Although they were from the same area and had observed the canals for several years, they had not diagnosed problems, as they were not involved in its operation and maintenance.

[7] Once the system was also visited by the then US Ambassador to Nepal as the management transfer was also supported by USAID. During the visit, one local consultant happened to tell the farmers that there would be enough money for the project in future. His intention perhaps was to keep farmers happy, such that farmers would tell the visiting dignitaries only positive aspects of the organizational development on which they were involved.

[8] A silt ejector is a structure constructed at the canal which helps to reduce silt in the canal downstream by diverting the silt-laden bottom layer of water to a flushing channel

6

Joint Action Continues: Participatory Design and Construction

Chapter 5 presented the process of joint analysis to find options to improve technical water control. This chapter further describes the process of design and construction and looks at the key actions and process involved in the PTD: the process of iterative discussions and negotiations, copying, majority priority setting, conflictive negotiation and quality control. It gives much detail about discussions and choices, to show what levels of negotiation, support and patience must go into participatory planning. The first three sections of the chapter review the design processes for new water control structures as selected during the action plan phase for each irrigation systems. The chapter then presents the construction process and reviews the challenges in maintaining construction quality: it concludes with a discussion of the scope, issues, and challenges of PTD in large irrigation systems.

The chapter shows how the project environment guiding the technology development processes shape the outcomes of these actions and processes. The chapter also draws attention that PTD is not only a means of finding appropriate technology what people want, but also building a stable project environment, which is essential not only to facilitate the participatory change process, but also to sustain future water management locally. Likewise, it has to think of building accountability with the WUA for future governance and management.

Another argument in this chapter is that PTD in the context of management transfer should be viewed as a way of establishing service-oriented water control. I argue here that service-oriented design must be based on future operational plans of the users. This requires, together with the users, the involvement of the previous operators and experience of the designers. The design should proceed only after the WUAs are in a position to formulate performance-oriented action plans based on these experiences. This will allow for different operational strategies to be followed in the future rather than freeze the infrastructure into a specific inflexible distribution pattern. This requires that the agency adapt an iterative and interactive process of design, take into account the feedback from canal operators, invest in initial training of the WUA, accept departures from the design standards to meet the farmers' requirement, and allow sufficient time for the process to take place.

6.1 The Design Process in Panchakanya

The Panchakanya case shows how design is constrained when there are already different types of water control in use. It also shows how continuous interaction between the users and designers helped arrive at the most feasible solutions to the local problems in water supply and that participatory design requires a series of innovative actions from both users and the facilitators to make the action situation truly participatory.

The technical rehabilitation work in PIS was targeted to control the seepage from the main canal section, and resolve the silt deposition and encroachment problem at the headwork. The ultimate goal was to increase the command area, and provide better water supply for the farmers. The major areas for improvement identified were:

- Improvement in the existing headwork configuration
- Main canal improvement for 1.2km through new lining works by dismantling the old ones
- Re-configuration of gates and outlets matching with the rotational plan

The same team was involved from both the project and WUA side as in AP preparation. But this time, I was present in every discussion while finalizing the design.

Finding options for headwork improvement

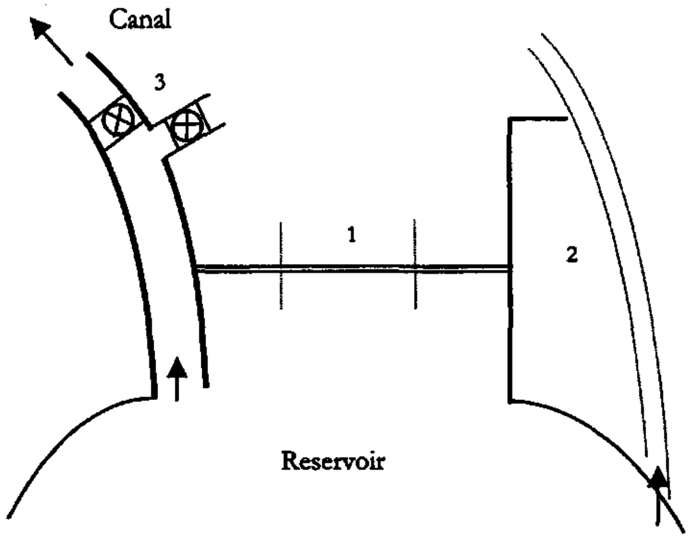
To resolve the problem of reservoir encroachment, non-technical measures were required. It was decided to carry out a survey to find the boundary of the reservoir, and put a fence around it to prevent encroachment in the future. At the same time, it was also decided that the Panchakanya farmers would talk with the farmers of the upstream area, to ask them not to encroach further on the area. The sedimentation problem could be solved, partly by constructing a silt flushing structure. The PIS headwork is a solid-mass concrete weir without any arrangements to flush the silt accumulated upstream. This had resulted in silt deposition in the upstream section. There was thus a need both to stop further siltation and also to clean out existing silt.

There were several discussions (informal) among the WUA themselves and also between the project staff and the WUA about the probable solutions, and there were different solutions put forward by the different parties. A final discussion was held at the headwork itself, to select the appropriate design, in which advantages and disadvantages of different proposals were discussed in detail. The different proposal are presented in Figure 6.2 and discussed below:

Proposal 1: Gate at the middle of the weir dismantling part of the weir. This proposal was put forwarded by the WUA. All of the WUA members and farmers were in favour of this proposal. According to this the middle of the weir body would be dismantled up to the floor of the riverbed and replaced by a gate, such that once the gate is opened, it takes away the silt load. This would also help them in cleaning the reservoir. They demanded this from their experience of Khageri head works, which is near to them, and which they had observed for many years. The Khageri headwork is a gated barrage, without any problem of upstream siltation. From the technical aspect of the headwork, the gates are at the side of the weir with the head regulator of the canal. The farmers' idea of putting gates in the weir body was right from a technical point of view. However, it was abandoned later on because of construction difficulty.

This change required the dismantling of the middle portion of the weir, which could destabilize the weir body. The weir had not created any problems and was stable during the past 23 years. It had no maintenance costs so far! Farmers also thought that dismantling of the weir body could cause cracks in other parts of the weir body, which could cause seepage from the weir. It also required constructing a gate-operating platform above the weir body, to operate the gate. So they agreed not to risk the dismantling of the weir body, which had provided them service for so long.

FIGURE 6.1 Different proposals for headwork improvement



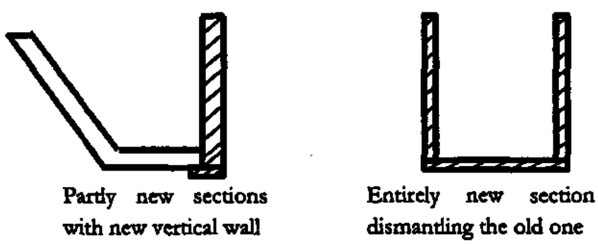
Proposal 2: A side channel. One of the consultants involved had suggested a side channel linking the upstream body of the reservoir to the downstream of the weir, during his past field visits[1]. With this arrangement it was not necessary to alter the existing weir body. This proposal was rejected outright both by WUA and the design team. Farmers could not imagine how this arrangement works. This also required construction of a long flushing channel. The construction burden was greater than the first option but its capacity to flush the silt could be far less.

Proposal 3: An escape structure[2] just at the beginning of the main canal. This was the idea of the design team. It required minimum construction, and no disturbance to the existing weir body. This option was finally agreed upon. It was accepted mainly because it did not involve dismantling the existing weir body. It required construction of two gates one for checking the flow at the main canal, and another to open the escape channel. This was a compromise between the available options. The first option was the best from the functional (to flush silt) point of view. Farmers could also see by its alignment that it was the better option. But its application was constrained by the pre existing conditions.

Designing for change in conveyance structures

This was the most difficult part- to decide how to reduce the massive seepage from the main canal, given that there were already so many different types of canal sections made of different construction materials, as already shown in Figure 3.3. During the AP preparation we had agreed to dismantle existing boulder-lined canal walls and replace them with vertical brick wall sections at seepage-prone sections. Of the two canal banks, the left bank (facing downstream) included a canal service road, and seepage from this bank was relatively less due to the thicker embankment section. On this side, no new wall was proposed, except in high seepage zones with weak service road embankments. The other side was to be dismantled and replaced completely. Hence, two different types of section were proposed as shown in Figure 6.2.

FIGURE 6.2 Proposed canal sections at the time of AP



The idea of a vertical brick wall lining had emerged from what farmers had seen in other systems, including one nearby. When I asked farmers why they preferred lined sections with vertical brick walls, they replied that they see it as more stable as compared to trapezoidal sections and they see the same type of section in most of the systems[3]. At the same time, in Panchakanya, they had a very particular bad experience with boulder lining and concrete works. Contractors can easily create large voids in boulder masonry (due to their irregular geometry) whereas in brick masonry there is less chance of this.

The feasibility study of the IMTP (Gitec, 1992) had proposed a similar types of canal section in its design reports. Under this arrangement, only 1.2km out of a 4.9km canal section was proposed to be lined. The remaining sections were to remain as they were. The proposed 1.2km length was the most seepage-prone zone with cracked canal sections at several locations.

After the signing of the AP there were already discussions among different farmer groups that the remaining sections should not be left in its same condition, as they also displayed seepage, though less than those sections identified for improvement. The gate operator also was of the opinion that entire lengths of canal needed treatment if the seepage was to be controlled. The system was going to be transferred to them and they would not have any government support to carry out these activities in future years, except after natural disasters. Now the WUA asked if more funds could be arranged and new sections to be included. We had allowed an additional 10% of the total cost for likely changes and variations in the AP, but this was not sufficient for this purpose. Changes in design were allowed, but increases in cost were usually not entertained either by project Co-ordinator and donors, except in exceptional circumstances.

So there was no possibility of additional funding. I was not in favour of dismantling the existing canal sections. I insisted on the treatment of existing sections trying different options. Knowing that there would be no increase in funding over the amount agreed in AP, the attention of the WUA then shifted to finding solutions, without dismantling the existing canal sections. There were already different canal sections with different masonry work, as explained in chapter 3. They had been dysfunctional due to the poor quality of the construction work. They were structurally safe, farmers also agreed this. So we decided, instead of dismantling them, to trying find alternatives keeping the existing section. One such alternative was to have a thin layer of concrete lining over the existing canal sections. I was in favour of this approach because of its simplicity and low cost, and proposed it. When the idea was discussed in a wider group meeting, there were differences of opinion. Two difficulties with this proposal were seen. First, it would reduce the flow area, hence reducing the canal capacity. Second, if such thicker masonry sections were not able to control the seepage, how could a thin concrete lining control it?

The first point was valid. Laying concrete over the existing section would reduce the flow area. But it would not create problems. The Panchakanya was designed to carry 1200 lps of water. This design flow assumed that water from the Butter khola would also be diverted to Panchakanya (see Figure 3.2). But after the disputes over water rights on the Butter Khola with the Khageri farmers, no water diversion from the Butter Khola was made. The Panchakanya farmers knew this history. The maximum water flow Panchakanya could accommodate was 1000 lps only. So a reduction in canal cross section would not create problems. Our design calculations also showed that even with this reduction, new lined canals could carry 1000 lps. Farmers' awareness of these historical disputes could help solve these concerns and difference of opinions.

It was difficult to make farmers understand how a thin layer of concrete could control the seepage. Many farmers would not believe this because they had seen seepage from their lined canals. However, the problem with the existing canal sections was with the quality of the work, rather than the work itself. To give an example, I told the farmers that an 8 cm thick concrete slab is used for a roof, which effectively works in protecting the houses from rain. Why can not a similar thing control the seepage here? With this example, they realized that the existing canal sections were structurally sound (strong enough to take care of any likely force or pressure) and the seepage could be controlled by means of thin concrete lining. With these discussions, we finally abandoned the idea of dismantling the existing canal and replacing it with new brick wall sections: in favour of thin (5-7cm thick as required) concrete lining over the existing sections. This shift would give no problems to the higher authorities and the donors, as it would not increase the costs. With this new design, we could improve a 4km long section, instead of 1.2km as identified earlier.

Gates and outlets

It was agreed in the AP that no new control structures would be added, and only reconfiguration of the existing gates and outlets were proposed. There were already three cross regulators in the main canal and according to farmers' experience, these were sufficient to maintain the rotational distribution already practised and to continue it in future. Likewise, there were already gates in the offtake structures in all of the branch canals. However, while there was no need for new control structures, they needed to be rectified. Farmers were asking for a tamper-proof gate. Demand for such a gate was also extensive in Khageri, where we had developed a gate which farmers termed a 'lock system' gate. I shall discuss how this gate came to be designed in the Khageri case. The same design was used here, as demanded by the farmers.

The design of outlet structures posed particular challenge, for various reasons. First, it was the concern of more than one group. Second, the flow variations across the outlets are not linear to their diameter, and is difficult to make farmers understand this. One such case of outlet design is presented in Box 6.1.

The design cases presented here show how the interactive design translate farmers ideas and preferences into practical reality and help to arrive at a desirable solution despite constraints imposed by the existing infrastructure conditions. Farmers are knowledgeable, and share their experience and historical factors in the process of design. When the problem situation is beyond their experience or knowledge, they compare with similar situations, which they have observed and can realize. Scale models and diagrams are also used to explain and discuss the problem situation with farmers in the design (Sheer, 1996) process. However, in large and medium scale irrigation systems, such a possibility does not exist and making comparison with similar phenomenon as well as building their capacity through field visit to similar examples remains only the option.

6.2 The Design Process in Khageri

It would be unwise to assume that farmers have complete knowledge sufficient to shape the design process. As expressed earlier, and again here, farmer's knowledge is based on their experience as well as historical memory. In large systems an overall knowledge of the system is often lacking among farmers, and even if they have this knowledge it is mostly localized. However this does not limit the scope of the PTD, if the design is incrementally carried out to allow learning by both users and designers. This fact draws attention to the need to make a program flexible to allow learning and change. The Khageri case also shows that replication of successful designs of one place to another can be disastrous.

> ***Box 6.1 Outlet design in Panchakanya***
> The branch no 1 of Panchakanya had three piped outlets, of diameter 40 cm and 30 cm and 10 cm each, as offtakes from main canal. When the system was first rehabilitated in 1974, there was only one offtake, the 40-cm diameter pipe. The farmers complained about the water shortage and the CIP had added another pipe of 30 cm. The last 10-cm was added under the influence of particular farmer of the area[1]. The gates of these pipes were also damaged, and the WUA wanted to replace them with a single outlet for easier operation. It was designed to be replaced by a 50-cm diameter pipe. We had discussed the design with the WUA members. But the farmers of the branch objected to it saying that they needed an 80-cm pipe. Their demand was based on simple calculations that they had in total 80 cm pipe openings. Some of the WUA members had understood that flow across an outlet is not linear with the outlet diameter. Together with these members, we tried to convince the farmers of branch 1 telling that the canal discharge is proportional to square of its diameter, ant thus it was not necessary to provide 80-cm diameter pipe. They were not convinced by arguments by the Chairman and Secretary of MC, a dispute started among them. The farmers told us that they would never agree to the 50cm diameter pipe. So we started to bargain, and the final compromise was to put a 65cm diameter pipe, and with a condition that that it would be replaced if proved too small for their canal downstream. Later on, when the construction activity was over, there was full discharge in their canal downstream but the flow depth in pipe outlet was less than 30 cm!

As Khageri was a large system with a large-scale rehabilitation program, we decided in the SMC meeting that design and construction activities would be carried out in a phased manner, so that earlier experience could be utilised in later designs. This approach had several advantages. First, it could allow learning to proceed further. The farmers here did not have a long experience of canal operation as in Panchakanya. Farmers knew problems in and around their tertiaries and outlets, but the problems in the branch and main canal were less known to them. Secondly, most of the branch canal of Khagrei had similar design characteristics so any feasible solution at one place could be replicated. Thirdly, it would provide enough time for planning budgets and their releases. Construction budgets are released annually in Nepal. This requires the submission of budget proposals well in advance to the DOI, which after review passes them to the National Planing Commission for approval and them to MOF for fund release. If design constructions were carried out incrementally, it would provide time for proper planning and implementation.

First phase design and construction

With these ideas, we first began to carry out detailed design and construction on branch canals B_1, B_5 and M_1. This selection was based solely on their geographic location i.e. canals from head, middle and tail-end portions were selected at the first stage (see Figure 3.4) to avoid any conflict among the branch canals. The major priority for change in all the above three branches were similar for:

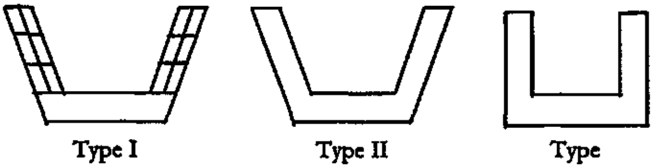
- Canal lining
- Re-design of water control structures to suit rotational pattern.
- Outlet/tertiary canal development
- Widening or new construction of Village Road Bridges (VRBs).

There were several reasons for the demand for lining work. First, it was meant to control seepage. Canals of B_1 and M_1 were constructed by higher earth filling, which was more prone to seepage. In B_1, the land topography is such that the canal seepage water immediately joins the natural drainage. For farmers of B_1, it was a total loss, even though downstream farm areas utilize this. The seepage water exempted many farmers from needing membership of the WUA and paying ISF, as they had free access to this seepage water. Thus farmers demanded canal lining, as they thought lining would control the seepage and those farmers enjoying free water would ultimately join the WUA and pay the ISF. As discussed earlier, they also thought, wrongly, that it would reduce maintenance. Farmers believed that if quality of construction was properly controlled, maintenance requirements would be small even in the lined canals. They said this from their experience of lined canals in their system itself. B_1 had a lined canal section in part of its area. This had no maintenance requirement over the last few years. At the same time, they knew that future rehabilitation would be done by the government. So they favoured a lined branch canal.

Selecting the desired lined canal section

Canal lining can be done in various ways, as shown by the canal sections of the Panchakanya in Figure 3.3. It can be made of concrete; concrete with steel; boulder lining, brick lining or combination of brick and concrete. It can have different geometrical shapes, like trapezoidal or rectangular. However, from a technical view, the choice and type of lining in general is dictated by: existing canal geometry, purpose of the lining availability of materials locally and cost. Considering these factors, we decided to discuss the following canal sections with the WUAs (Figure 6.3): trapezoidal section having bed with concrete and sides with bricks (type I), same section but sides also with concrete (type II) and rectangular section with brick masonry (type III)

FIGURE 6.3 Different lined canal sections discussed with the WUA



B_1 had a narrow canal section with an existing lined section mostly of Type III, and this section was proposed for it. In B_5 and M_1, lining Type I and III were proposed. However, opinions differed in choosing the section in M_1 and B_5. One group of farmers were in favour of Type III, for reasons explained for Panchakanya. Another influence has been the massive construction activity in and around the East Rapti Irrigation Project, where Type III lining was widely used. On the other hand, another group was in favour of Type II, which they had seen in B_{6e} of Khageri where Type II lining had been working satisfactorily for the last 10 years. This site was nearby B_5, so farmers had observed it for many years. Finally it was decided to try with both Type I and II sections. There were two reasons for this. First the existing canal geometry of both B_5

and M_1 were more suitable for type 1or II lining (already in trapezoidal shape). The second was that this was cheaper than the Type III lining. The only danger with these two types was that they were liable to damage (by cracking) if there were any settlement in the embankment. Farmers also asked about this possibility. However, the canal was more than 30 years old (as Khageri was constructed in 1967) and no such problems existed as already shown by in B_6.Considering all these factors, it was decided to proceed with the type II and III type of the lining in B_5 and M_1.

Changes in gate configuration

Khageri farmers wanted to put a rotational water delivery in their system. For this, it was agreed during the preparation of AP that two more cross-regulators would be added in the main canal (downstream of B_4 and B_5) and relocation of one cross regulator which was just downstream of B_7. It was also agreed that no gated control structures would be added inside the branch canals. Inside the branch canals, farmers told that the existing ungated piped outlets had worked well and there was no need to change and adjust them. The two new cross-regulators were added, but the relocation of one cross regulators was not possible due to opposition of B_7 farmers. The farmers of B_7 strongly objected to this as they thought they would lose the control they had if they allowed to shift the cross regulator. The relocation of this cross regulator was then abandoned[4].

Another demand by the farmers was to redesign the gates as tamper-proof, as the existing gates were manually adjustable types and were dysfunctional, for two reasons. First, they wanted more technical control in the main canal. The WUA chairman said it would take several years for farmers to adapt to the new rotational practice and rules and regulations between the branch canals. So until they obtained maximum control in water distribution socially, they needed tamper-proof gates, to achieve control technically. Inside the branch canals, however they told that they could achieve control socially through rules and regulations because of smaller areas, so no such gates were needed. Panchakanya farmers gave a similar answer to the need for tamper-proof gates.

The second reason for tamper-proof gates was to control fishing in the canals. Khageri canal brings in a various varieties of fish, and at night, people come and close the canal gates for fishing. This has been one of the major problems in some of the branch canals: B_8 suffered most from this problem. The B_8 farmers used to guard the canals the whole night to avoid this and once they caught the persons involved in fishing at 3 0'clock in the morning. They brought that person into the project office at 7 in the morning to take legal action. Even the project office had no authority to punish such persons. Later, we thought of a gate that could not easily be dismantled. In conventional gates, the spindle (iron rod attached to lift the gate) is fitted at the top of the gate body and move upward when the gate is lifted. The handle of the gate is attached with the spindle. Instead, we designed the gate such that the spindle does not move upward but sticks with the gate body. The handle of the gate was not fitted with the spindle, and could be separated from the gate body and placed in the WUA office. This gate worked quite well in Khageri and Panchakanya farmers also wanted similar design for their gates. Later, farmers and engineers from other irrigation systems also visited Khageri and Panchakanya systems and favoured this type of gates.

Other design configuration

Changes to the road crossings over canals were of less interest to farmers, as they did not affect the hydraulic performance of the canal flow. Most of these village road bridges (VRBs) had been constructed for bullock carts in the past, which were now unfit for trucks and tractors. They were designed at right angles to the canal and were thus skewed with the road alignment. This made movements of the trucks and tractors difficult. In most cases, widening a bridge on one side could solve this problem and this was agreed without further discussions.

The implementation of these designs provided valuable learning to both our technical team and the WUA and formed base to proceed ahead:

- The brick masonry for lining, Type I was problematic due to doubts over quality (to be discussed in section 6.4). The type III section proved to be costlier than the other two. So its application would be limited in other areas.

- Type II cross sections would be promoted wherever possible, as it was the cheapest among the three. It was also easier in construction[5].
- According to farmers, seepage control was also more effective by Type II lining as compared to other types.
- Farmers found the tamper-proof gate effective in its functioning

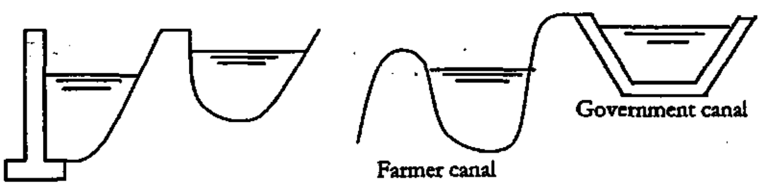
The second phase in Khageri: design and re-design continued.

The learning from the first phase of design formed the base to proceed for the second phase. At this stage, we prepared detailed designs and cost estimates for the remaining nine branch canals and also for the main canal. The same approach was followed in the design of the structures. In all the canal sections, linings were now to be done utilising the Type II section. Gates would be remodelled into lock system gates as in the previous cases.

However, the uniform application of these concept developed earlier did not work here in two of the branch canals M_2 and M_3, due to their different water supply situation and topography. In these canals, there were two parallel canals serving the same part of the command area as (see Figure 6.4). The lower canal was also augmented by the drainage of nearby area. The lower canal was developed by the farmers in response to the water shortage in the area, whereas the upper one was developed by the government. Its objective was to collect seepage from the upper canal and to utilize the drainage water from nearby area. The lower canal was constructed at a lower level than the upper canal, to allow the seepage water from the upper canal to be collected here.

The design team together with the concerned WUAs had proposed canal lining in the upper canal (government) with type II sections. Accordingly tendering and contracting was done for the construction. When the actual construction was about to begin, a group of farmers strongly opposed the proposed development plan. They said that they get more reliable water from the lower canal built by them. They also argued that since seepage from the government canal is automatically collected to the lower canal, which is again used for irrigation, lining in the upper canal would make no sense. So, the farmers proposed an alternative design: construction of a side-wall on the lower canal so that seepage from both the canals is not lost as shown in Figure 6.4. The lower canal had been constructed by farmers buying land from their fellow farmers, with a very narrow embankment. Due to this, there was heavy seepage from the side of the lower canal. The farmers' arguments were reasonable.

FIGURE 6.4 Design change by the farmers



Design change proposal from the farmers

Initial design with type II lining in Government canal

This situation materalized due to a lack of detailed design discussions with the local farmers group. The discussions were limited to technical team and the WUA only. Both were influenced by the success of Type II lining section in other canals. So they simply copied the earlier design without analyzing the field situations and discussing with local farmers[6]. I too was heavily influenced by the previous success and did not explore the conditions! I thus realized the danger behind copying a successful design to another environment without exploring its applicability in detail.

However under prevailing financial rules and regulations, a change in design was not easy, as they were already contracted for construction. According to the rules, costs variation above the 10% of the total cost, as well as quantity variation of any construction items beyond 25% need to be approved by the Director General (DG) of the DOI[7]. That is, even the project co-ordinator and the DDG had no authority to approve such variations. These bureaucratic processes are not only lengthy, but also sometime questionable, especially at the level of Auditor General Office, who finally approves the expenditure. In this case, the design change was not going to increase the cost, but the variation in construction items were beyond 25%.

As the farmers' demand for the change in design was technically reasonable and at the same time it was not going to increase the total project cost, I decided to take the matter to the Project Co-ordinator in Kathmandu and convinced him for the change. He, too, had no authority for this, but assured me to supply the help needed. He was also personally committed to the participatory design process, and visited the site himself during an interaction workshop, and became convinced for the change needed to be made. Back in Kathmandu, he explained to the DOI who had authority to approve such change about the field-level problems and convinced him to approve the design change and the construction proceeded in the field with changed design.

Despite interactive and iterative design cycles, implementation of the design were still constrained due to dynamic nature of institutions. The design interactions were mostly with the WUAs, which changes in every two years (now changed to three years) due to election. The new people often changed the idea of their predecessors, and wanted additional construction works to increase their popularity among the farmers. Likewise, the problem of over designing of the structures, due to lack understanding of hydraulic behaviour by the farmers, also appeared here. However, these should not be seen as a limiting factor of the participatory design, instead, designers need to be aware of these factors, and act upon the problem situation accordingly.

The design cases here show the need to follow an iterative design process together with interactive discussions to allow both experimentation and learning. This help build up knowledge to both the designers and the farmers, on which future actions can be built on. Learning at smaller scale, and expansion over a wider scale has been one of the key approaches in participatory learning process. This works well, but one has to be careful especially in replication of the successful design without detailed understanding of the particular system environment.

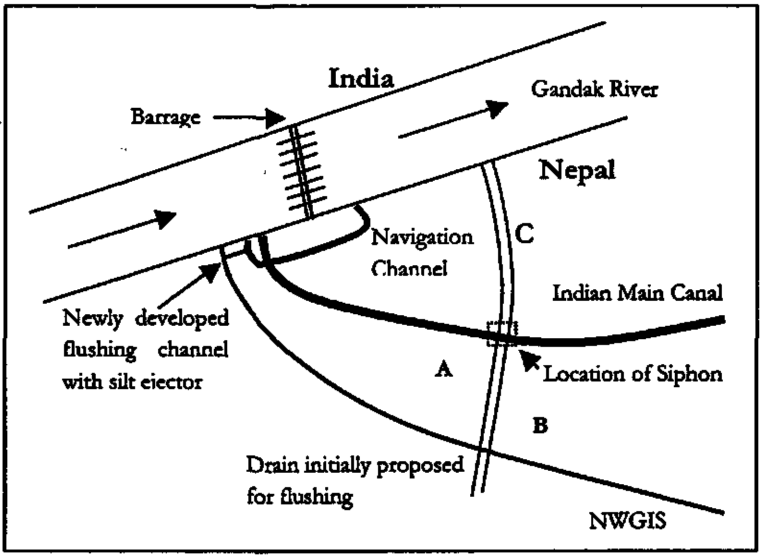
6.3. The Design Case of West Gandak

The design case presented here is quite different to the others because of the nature and scale of the problem dimension. Farmers here had preferred to solve two major problems: to control flooding in the command area and to control silt intrusion in the main canal, by constructing a flood diversion weir and a silt ejector. The design and construction of these are presented below. Due to conflict among different actors involved and difficulty of work across different domains, the final result of the design was very different than planned.

Construction of the silt ejector

As mentioned previously, silt intrusion in the main canal had been a major problem in the efficient management of West Gandak main canal. Farmers were of the opinion that construction of a silt ejector would alleviate much of the problem captured in canal operation. For the government, it would be a great incentive for the farmers to take up the future responsibilities of canal O&M if the silt intrusion could be reduced. A discussion was then made within the SMC for its construction. Later on, an appropriate site was selected after several rounds of site visits by the joint team of SMC, WUA and some interested farmers of the area. It was proposed to construct the silt ejector at 900 m downstream of the intake site (See Figure 6.5). It was an ideal site for the construction of such a structure, as the ejected silt could easily be flushed through the adjacent drain.

FIGURE 6.5 The layout of silt ejector design



However, the idea to construct the silt ejector at this location was bluntly rejected by the farmers adjoining the drain (Farmers from A and B) fearing flooding of their lands. The responsibility of clearing the siphon structure[8] at the Indian main western canal and the drain downstream until it joins the Gandak River lies with the Indian government. But this had not been carried out (or poorly) in the past resulting in occasional inundation in this area. Farmers from A and B believed that flushing the silt here would further choke the siphon and increase the inundation problem. Besides this, farmers of Area A objected as they are not receivers of the irrigation service. After several rounds of discussions with the farmers, the Project Manager and the MC members succeeded in convincing the farmers to allow the construction work. But when the construction was about to start, there was again disturbance, but this time from the farmers of area C.

Both the project office and the WUA had not expected this opposition, as this area had no impact from the construction work. The farmers of area C started their opposition because they had encroached on the drainage area and converted it into farmland. If the silt ejector was constructed, the drainage area would be cleared and they would lose the occupied land. Farmers from C were able to convince the farmers from A and B that maintenance of siphon structure and the drainage downstream had not been carried out in the past by the Indian Government and there was no guarantee that it would be done in the future. The SMC, WUA and the project office were just misleading the people. In the end, all opposed the construction work. The idea to construct the silt ejector at this location was finally abandoned in spite of having several rounds of discussions.

It was then decided to construct the ejector at 400m downstream from the intake, where the implementers did not expect to confront anybody. But it required the construction of a new flushing canal, which had to cross the Indian Main canal before finally discharging the silt into the Gandak River. This also required to pass the navigation canal (see Figure 6.5). Even though both WUA and project office knew that there would be some objection from the Indian authorities, they decided to go ahead with the construction. The ejector was constructed and flushing channel excavated until the point where it meets the navigation channel. At that moment, the Indian authorities complained to the West Gandak project office about the construction. They also complained to the Liaison offices in Balmikinagar and Kathmandu[9].

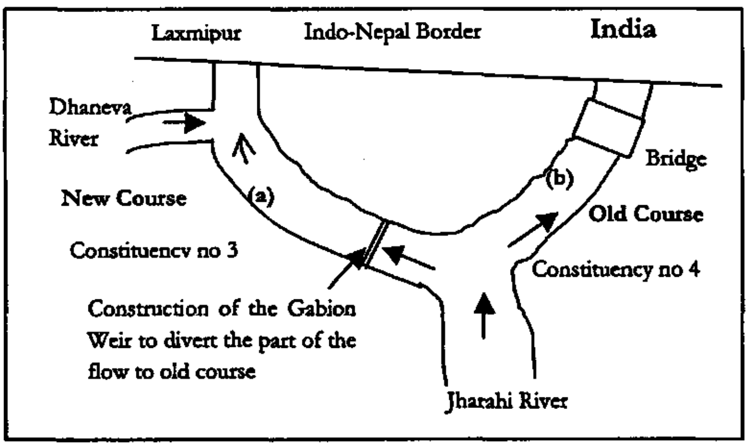
However the construction was already over. Later on, this matter was raised in the Standing Committee meeting in New Delhi[10]. Higher authorities in the Ministry of Water Resources and DOI who attended this meeting were angry about the incident after returning from Delhi. The Project Manager of the West Gandak was questioned by them to justify the construction. The Project Manager justified his intention, saying that he had discussed (verbally) about the construction with the concerned authorities in India. He also argued that it was not going to pose any threat to structures in the Indian Main Canal. The Ministry then sent a high-level team to investigate the matter. They too found that there was no problem with its construction. All the farmers of West Gandak were also behind its construction. Later on, nobody paid any heed to it, as all knew that this would do no damage, and the matter faded away. Even though the construction of the silt ejector has helped reduce the silt problem in the canal, the maintenance burden to the farmers has not reduced much as they have to clean the flushing channel. Another problem is that they have always to be in close coordination with the Indian authorities for its cleaning.

The case of flood diversion weir

The Jharahi river switched its course (b) to a new one (a) (see Figure 6.6) during the flood of 1964. Since then larger portion of flood used to pass along the new course, which is joined by the Dhanewa River further downstream. This new course had damaged both the canal alignments and increased the flood problem in the area. During the command-area intervention in the mid-eighties, the old course (b) was canalized and part of the floodwater from the new course was again diverted back to the old course. This worked quite well for few years but later on the major flow again started to pass into the new course. Farmers adjoining the new course desperately wanted to divert part of the floodwater to the old course again to save the farmland.

In order to do this, a gabion weir was proposed to be built across the new course. However, farmers from the old course opposed the move to divert the flow back to the old course. The two channels lie in two different parliamentary constituencies (3rd and 4th) of the Nawalparasi District and the design proposal quickly caught attention of the politicians. Part of the flood-affected area of the new channel also lies in the constituency no 4. For the MP of Constituency No.4, this was an unfavourable situation and he was interested to solve the problem in an amicable way. Finally a meeting was held between all the parties involved: WUA members, the VDC chief, local politicians including the MP from region 4, and the project staff including the Project Manager. After several rounds of discussions and negotiations, the meeting agreed to construct the weir, but with changes in the original design: reducing the height of the weir from 2.2m to 1.5m. The original design had proposed to divert about 40% of the floodwater, which required 2.2m high weir from the river bed level. The IMTP consultants also favoured the idea to avoid conflict between two groups of farmers. The new course farmers were not satisfied fully with this new proposal, but they compromised with the plan.

FIGURE 6.6 The layout of Jharahi diversion work



Construction started after the agreement. However, the old-course people were still not satisfied to divert the part of the flow. They started to disturb the construction work and sometimes even engaged in throwing stones to the labourers. The contractor stopped the construction work and said he could not continue the work. Now another meeting was called among the relevant stakeholders, as in the first meeting. In this meeting the farmers of the old course made new demands:

- protection of both left and right band of the old course
- increase in the height of the nearby bridge across the old course
- re-excavation of the old course should be done before the weir construction.

These demands were not included in the AP, and the West Gandak Project office had no authority to decide over it. The co-ordinators office in Kathmandu was not in favor of additional demands, and asked the West Gandak project office to further negotiate about these demands. After several rounds of negotiations between the old course farmers, the WUA and the West Gandak project office, it was finally agreed to carry out the protection of only the Right-Bank of the old course. However, left bank protection was rejected by the project office, being deemed unwanted, which the farmers agreed. The demand to increase the bridge height got solved politically. There was a program to upgrade the road by the Department of Roads and the Project Manager told the old course people that he would request them to do that job, which farmers agreed. The MP also supported his idea, and people were convinced by this. Accepting the last demand was not a problem to the West Gandak project office, as they had heavy machines in the office to carryout the excavation work. Agreeing these conditions, the construction work moved again. The MP of constituency No. 4 played crucial role in getting the disputes settled.

However, the disturbance from the old-course people again started. But this time the situation was different, and the MP was not in the area. The new-course people had been very silent so far fearing that construction might stop. But then these people thought that unless they organized and confronted the old course people, the problem was not going to be solved. People across the border in India had also suffered from the floods of the new-course, and wanted the diversion weir to be built. They also joined with the new-course people to confront the old course people. People from the new-course, together with the people across the border, then helped the contractor to finish the construction work. After this, the old-course people did not object to the construction work, as they became smaller in number and only asked to maintain the height of the weir at 1.5m as agreed in the early meeting. When I talked with farmers of old-course, they told me that they had opposed the construction work just to ensure that the height of the weir would not be raised beyond 1.5m.

Later on, some farmers found that the weir was not constructed as designed, and felt corruption had occurred in the construction process. The farmers blamed to all the actors involved in construction supervision: the WUA Main Committee, SMC and the West Gandak Project Office. Local farmers then asked the Director General of the DOI to make an inquiry about this. A two-member investigation team was sent to examine the situation. The team found some alteration in the construction, but no action has been taken to anybody so far. The system was turned over to the users before the investigation. Common farmers criticized both the DOI and WUA for not taking any action against anybody involved in this process. Because of this event, all the actors: the West Gandak project office, the DOI, and the WUA Main committee and the SMC lost their credibility at local level.

Both these cases show that a participatory process is not only about the methodologies and interactive consultation, but also involves conflictive negotiations. Problems generally are highly interconnected, and required to be represented and negotiated in different domains involving different actors and may need forceful actions. The relevant actors are needed to be identified at earlier stage, and then guide the process through negotiations. Both actors and domains can change with the change in the stages of program implementation. As the scale of the system increases, the dimensionality of the problem also increases. Efforts are thus needed to be made to bring different levels of the project environment together, and devise a win-win situation acceptable to all parties involved.

6.4 Ensuring Quality of Construction

I now turn to the construction implementation process of the design. During construction, farmers' input has the function of quality control, cost sharing and gaining of construction knowledge. These are often linked with the empowerment to local users. These are reviewed in turn, with arguments on how these must be conceptualized differently for participatory processes.

User involvement in quality control

The term 'quality control' is most often related with maintaining the design standards through direct user control in supervision of construction work. Beyond this, the quality aspect must also include the quality of the process. This means the process of tendering, contracting and users role in these processes. Both in fact represent dimensions of quality: the first concerns the quality of the materials and their final product, whereas the second is the quality of the process involved. They are not independent, as the quality of the final product depends on the process adopted.

The quality issue has also triggered several questions regarding the efficacy of the participatory design process. It is often argued that even though participatory processes are adopted in making demand requests, and finalizing the action plan through joint problem analysis, the process of tendering, contracting and subsequent construction often has limited participation from farmers.

The reason for this argument is that the implementing agency enjoys control over these processes because of financial rules and regulations and other administrative and institutional requirements of the donors and the Irrigation Department. Farmers usually do not have control over the funds, making them absent in the decision making process regarding tendering and contracting. To avoid this, in IMTP, the SMC (the board made up by four WUA members and the Project Manager) was made responsible for executing these activities. Many of the problems however, can be avoided if transparency of the process is maintained, which also ensures accountability on the part of the project to the WUA.

The process adapted in KIS and PIS

In the SMC meeting of both Khageri and Panchakanya, we first decided that the respective WUAs would be asked whether they would do the construction work by themselves or they preferred to employ a contractor for the purpose. Under the financial rule, whenever a WUA does the contracting job, it has to do the job at 20.75% below the Engineer's estimate. The reason for this is that out of 20.75%, 15% is contractor's profit and 5.75% is the contract tax that the contractor has to pay back to the government. When a

WUA does the job, it is neither given the profit nor does it have to pay tax to the government.

In both the systems, the construction work was to be carried out at different stages and different package of construction contract. The contract jobs were not to a high amount, usually at a range of 0.5 million to 2 million rupees. In both KIS and PIS, the WUA decided to get the job done by the contractor. The WUAs did not want to be involved in direct construction activities mainly for two reasons:

- The job mostly included structural improvement works, which require good managerial skills. Even if they chose to do the construction work, WUAs would have to hire a third person with experience in executing construction work.
- Previous experience had shown that structural works would not provide any profit to them. Usually, a WUA favours to be involved in earth-work only, which is manageable and sometime profitable (see chapter 5). But in this case, all the earthworks were to be done by the farmers as part of their voluntary contribution.

With the approval of WUAs, tender calls were made in National newspapers to carry out the proposed construction work. The interested contractors were asked to visit the construction sites and have discussions with the WUA before bidding for the contract. We had also decided that a meeting between WUA members, interested contractors and our technical team would be proposed and it was mentioned in the tender notice itself. But during the first stage of construction, the meeting could not be held due to difficulties in bringing contractors of different parts of the country together. The association of the contractors in the district liked this idea. They stated that they would make this type of meeting happen in future at their own initiative.

The second attempt however was a great success. At this time, the WUA, our technical personnel and contractors held an open meeting in the office compound. Most of the contractors were from the same district, but some from adjoining districts. The association of contractors also welcomed this approach. Over the past several years, many of the construction works were being done by the WUA and this had decreased jobs for the contractors. They tried to utilize this opportunity to convince the WUA that they would favour good construction quality. The WUAs found this meeting effective because they could clear their concerns at the earlier stage of the construction.

This gathering was welcomed by all those involved in the construction. Meanwhile, we also thought that there should be workshops between the contractors, the WUAs, field technicians and consultants so that problem could be discussed and solved in an amicable way. We had planned at least one such workshop a year. However, again due to difficulty of arranging all the personnel in one forum we were able to organize only one workshop at the middle of the construction activities. At this workshop, the higher authorities of the DOI were also invited to make them understand the field-level problems. The co-ordinator of IMTP, his supporting staff and the consultants, also participated in this meeting. It initiated a dialogue between low -level technicians and the higher authorities, and also provided an opportunity to discuss problems together among the different parties involved - the WUAs, contractor, higher authorities and the field-level technicians. As explained in the case of the Khageri in the previous section, the change in the design configuration were in fact possible due to this workshop, as all became aware of the design problem. These efforts proved very useful in making the project environment stable.

The documents of the tenders were opened in front of the WUA representatives and the SMC members. Under the financial rules and regulation, the lowest bidder was provided the contract[11]. A copy of the contract document was also given to the concerned WUAs. After signing of the contract, a joint committee of WUA and our technical staff was formed to supervise the construction work done by the contractor. From WUA side, there were four members in the supervision team: one from SMC, one from main committee and two from the respective BCs. A summary sheet showing the construction details was also given to the supervision team and to the concerned WUA. An initial construction meeting was also held between the contractor, quality supervision team, WUA and project technicians to discuss the different activities in construction.

After the completion of the construction work, the payments to the contractor were made only after the approval of the SMC and the concerned BC. Upon completion of the construction work, the measurements of proposed works were to be taken in the presence of the concerned WUA members and SMC representative. In

Nepal, previously the joint signature of the WUA Chairman and the Project Manager were also tried in previous projects. But my experience is that these are not going to make farmers feel empowered. The more important thing is to develop a process through which the WUAs feel professionals are accountable to them, which is more related to transparency of functioning. Below I show how failure to maintain transparency caused problems to our team later on.

The construction implementation was transparent to the WUAs as all the activities were jointly carried out. The design was jointly finalized, the construction works were jointly supervised and the awarding contracts were jointly decided. There were also timely discussions on status of the work progress between the concerned WUA the SMC and our technical team. Besides this arrangement, we had developed a format showing details of the construction works, the expenditure and progress, and provided it to the concerned BC, the MC and GA. With this information, we used to hold discussions between the concerned WUA, the MC and our technician. The VDC chiefs were also invited to this type of meeting. In this meeting discussions were held regarding the progress and problems in the implementation process. Altogether four such meetings were held during the construction, though we had targeted six such meetings.

The idea behind these meetings was to provide information and discuss the problem with a larger group of people. In regular work, usually only the executives of the WUAs and SMC members were involved in decision-making process and GA and other members were less aware of the project activities. These meetings were able to provide the necessary information on project progress to the farmers, discuss the problems and get feedback. However, these were highly time-consuming exercises. Details of each and every construction activity including expenditure were to be prepared for separate branch canals. But it was transparent and the WUAs were satisfied with this process.

These types of workshops to discuss project progress and expenditures with the WUIAs, GA and others were not mentioned in the project document. But we had started it at local level to develop trust and confidence with each other. However, at the final stage of the construction, our group lost interest in supporting this activity. This widened our misunderstanding with the Khageri farmers (in Panchakanya the construction was already over) and we were charged with failing to maintain the transparency of the process. The mutual trust and confidence which we enjoyed over the years declined and the WUA Chairman of Khageri criticized me for failure to provide these details, and he raised this issue with me even after I left the project.

The reason for our losing interest was different. Working in participatory projects is challenging, as it requires bringing people with different interests, who are situated at different project environment levels, together in the program process. It takes time and effort. The technicians often have to face angry WUAs and farmers when they fail to meet their expectations. Technicians working in these projects often expect incentives in terms of training (especially abroad), which are generally present in the project proposals. Hope of such higher studies attracts them to work in these projects. In IMTP there were also provisions for this and USAID had allotted US$ 200,000 for the capacity development program. As I mentioned in chapter 4, none of our staff had previous experience of working this kind of project and we were told that training would be provided as the project moved on. But to my surprise, not a single training program aiming to improve the capacity of field-level technicians ever happened.

None of our staff had a chance to participate in a training program or have opportunity of study tours aboard. Once one of our engineers was selected for Indonesia, but he failed his English Examination Test (this is a requirement on the part of USAID) so that he could not attend it. From the West Gandak, one Association Organizer had an opportunity to attend a study tour to Indonesia and its project manager had an opportunity to pursue Master's Study in AIT. Once I was also selected for a study tour on Mexico together with few other engineers. Permission for such tours needs approval of the Minister of Water Resources. At the final moment, our visit was cancelled and the Minister himself with secretary and two high ranking DOI officials made this visit. However, I was unaware of this, and only came to know after it appeared in a local newspaper[12].

The disputes in construction

Despite arrangements made to ensure good construction quality, the outcomes were often otherwise. The problems were different in different construction cases. The events below describe the challenges in maintaining the construction quality, and how we kept on changing the design as we moved forward.

The WUAs were very cautious on the quality of the construction materials, as they had seen poorly constructed structures by the contractors. As soon as the contractor started to bring the construction material, disputes over its quality started. In B_1, the WUA would not accept the brick quality, claiming it to be second class brick. Under standard construction specifications, bricks are divided into three classes: first, second and third class. First class bricks are well burnt, red in colour and produce a metallic sound when clapped against each other. The third class types are over-burnt, black and of irregular shape, and thus easy to notice. The confusion is always between the second class and the first class. Bricks were transported to the construction site in trucks in loads of 4-6 thousands and to guarantee quality of each and every brick was not possible. Immediately, a meeting was held between the contractor, our technical team and the WUA to find a solution of the problem.

In this meeting, we decided that bricks used in the construction of the houses in the area would also be accepted here. The contractor was given a few samples that the meeting decided to be of the first class type and asked to bring the same quality. There were also problems relating to the quality of sand and stone chips, the other two construction materials. For these two, we made a decision that sand from 'Manahari' and stone chips from 'Jharahi would be accepted. These two places are famous for good quality of sand and stone chips in the nearby area. Finally, the major problem was in getting good-quality cement. In our local markets, filling and re-filling cement bags are very common. It was not possible to go for laboratory tests for carrying out small-scale work. There were no such laboratories in the nearby area. So we decided that if the setting was good, we would consider it as good quality cement. If not, we would considered it of poor quality and its use would be restricted[13].

With all these initial confrontations, the construction activity moved smoothly. But as we moved ahead, we came across different problems. While the construction was going on, the Co-ordinator office had arranged a training program on 'construction management and quality control' for the members of the WUA main committee and the SMC. The trainees were taken to the construction site in B_1 to explain about the construction activities. The participants found weak mortar in brick joints in some places. The trainees then started shouting to their fellow friends who were supervising the construction about their failure to maintain the proper quality. Later on, an inquiry was set up by the co-ordinator of the IMTP to find out what actually had happened. The committee found that some of the construction was poorly done! The report further said that there was no ill intention from any party, but negligence on the part of the contractor. The ADB official in its mission visit also raised the issue of poor quality control and gave the report to the higher authorities including the Ministry of Water Resources (MOWR) and National Planning Commission (NPC). It was shocking to see poor outcomes despite sincere efforts.

The problems were not only on the quality issue, there were other problems, which we never thought we would face. In B_5, the contractor did good quality of work and there were no complaints about quality. But he could not complete the work. We came to know that the contractor was bankrupt: he had not enough finance to carry out the job. He ranaway after completing about 80% of the work and had not paid the labours, who were mostly local farmers! The project office had the retention money, but it could not be given to any person without the permission of the contractor himself (according to the rule). There was no legal document stating who were employed by the contractor and whether they were paid or not. There was tremendous pressure from the farmers to solve the problem. But we could do nothing until we found the contractor.[14]

All these successes and failures provided rich experience to the whole team. Based on this experience, we decided the following changes to our approach to carry out future construction activities:

- Brick masonry was controversial so we decided to carry out construction only using concrete lining.
- Design construction would be continued in a phased manner

Even with these efforts, cheating from contractors could not be eliminated. In one case in PIS, the contractor was using two different-sized boxes for measuring cement and sand. The one used to measure sand and stone chip was larger than the standard one. Most often the contractors would be very sincere at first and obtain the trust of the team. It was at a later stage that they started cheating. In another event in PIS, the contractor made a very inferior construction. It was in fact identified by a group of farmers who were not in the supervision team. This event even led to distrust between the WUA Chairman and farmers. The disagreement over quality of materials between two different groups of farmers in canal lining work continued, and also led to verbal fighting between them. Despite sincere efforts of the team to ensure high quality of construction work, the challenges continued ahead.

In irrigation the construction phase is the key of the PTD, as the design gets transferred into the final product, which should be there for a long time to provide service. It needs huge investment and can not be removed or altered easily once placed. Transparency of the construction process is crucial to ensure good quality, which also helps to build up accountability between the WUA and the project.

User's contribution in technology development

User contribution in technology development has always been an important element of participatory initiatives. In the past, 'participation' in Nepal was limited to contributing voluntary labour in the construction process. The objective was to reduce the construction cost employing free labour. The argument for user contribution these days is put differently: to create a sense of ownership among the users. It is also believed that users' contribution to the technology development process makes the implementers more accountable towards the farmers. However, user financial contribution has been both confusing and problematic. Most often the targeted objectives are not met. Why is it so different and does it help to establish accountability between the users and the farmers? Some of these issues are dealt in this section.

In IMTP, a controversy started at the earlier stage of program implementation over the higher percentage of contribution required compared to other projects, as explained in chapter 5. Though a contribution of 26% was required from the farmers, in PIS only 12% could be achieved, whereas in KIS and NWGIS these amount only to 10 %. This again raises several questions: was the construction completed when the farmers' contributions were less than agreed? Yes. The reason was that the items of works included for farmers' contribution mostly included the externalities, that is, the system could functions smoothly even without their being done. For example in all the three cases, the works given to the WUA were canal shaping and reshaping and strengthening of the canal embankments. Farmers in most cases cleaned the canal, but they did not bother to shape and reshape in proper section. This however was not going to decrease the flow. Similarly, except at the points of immediate danger, farmers did not bother to reconstruct the embankments. These factors resulted in a lower percentage of financial participation.

There are many factors why could the expected percentage not be achieved. In the case of IMTP, one major factor was that it was not demand-driven and farmers did not feel that the government would pull out of the program even they did not contribute as planned. They had also stated at the very first interaction meeting held in Kathmandu that contributing 26% percent was beyond their scope. The shorter time span was also another factor in not achieving the desired farmers' contribution. For example in Panchakanya, farmers were to contribute about NRs1.5 million to the system's development. This means a farmer with 1 ha of land had to contribute 56 days of work or equivalent cash, which is normally not achievable within two years' implementation time. TABLE 6.1 presents the contribution to be made in each of the three systems.

TABLE 6.1 Required user voluntary contributions

System	*Contribution Required in NRs*		*Contribution equivalent to manpower*	
	Total in million	*Per ha*	*Total*	*Per ha*
Panchakanya	1.5	3,400	25,000	56
Khageri	12.5	3,200	208,300	54
West Gandak	10	1,200	167,000	20

In the Table, the cost of a labourer is assumed to be NRs. 60 per day. The Table shows that in both Khageri and Panchakanya farmers with 1 ha of land had to provide about two months of voluntary contribution in two years of construction time. To find a month of free time in a year is not easy for a farmer. Another problem is that different farmers have different slots in the year and matching the free time of all farmers is not an easy task. In large systems it is also very difficult to organize large numbers of farmers to provide voluntary contribution continuously. Co-ordinating the voluntary mobilization at this scale also demands sound management on the part of the WUA. Voluntary mobilzation is a slow process and cannot be achieved in a short time span.

Many farmers feel that their voluntary contribution to working in users groups should be included in the users' contribution.[15] These also come to of considerable amount. Table 6.2 presents the person involvement in man-days in the WUA meetings on the three systems in a year. In the Table, a participation efficiency of 60% for the main canal and 50% for the branch canals is assumed in calculating the man-days. The computation is based on the review of WUA meetings between 1994 to 1997. The minute books of the systems show that about 20% of meetings were cancelled, and the same percentage of members were usually absent during the meetings (this percentage is even higher in NWGIS) of the MC. The percentage is lower for the branch canal committees.

TABLE 6.2 Cost involved in the WUA meetings

Systems	*Mandays involved in WUA meetings*					*Cost Equivalent*	
	MC	*BC*	*GA of MC*	*GA of lower canals*	*Total*	*Total NRs.*	*Per ha Rs.*
PIS	108	240	45	500	893	71,440	158
KIS	150	540	85	2000	2775	222,000	57
NWGIS	252	3600	172	-	4024	321,920	37

Source: WUA records.

So if meetings held by the WUA in a year were converted into cash, it would come at substantial figure. For example in Panchakanya, the cost involved in WUA meetings in a year is NRs. 71,440. This is almost about 5% of the total voluntary requirement (see Table 6.1). This cost is involved every year, but it is reflected nowhere. There is also personal involvement in conflict resolution and other WUA activities. A large input also comes from construction supervision work. In Khageri, it usually took 6 months' time to complete construction on each branch canal, and four persons were involved in the supervision process. If this cost is calculated, it comes to Rs.50000. The voluntary contribution in

WUAs administrative activities so far has not been part of the construction contribution, though the amount is substantial.

Despite constraints in achieving the financial contribution from the users, it must be given due attention in the technology development process, as it help to increase bargaining negotiating power to the local users, and can hold designers accountable to the quality of technology on offer.

6.5 Conclusions

The chapter has reviewed the key actions and processes of the PTD and explored how they build up to support future water management locally. It has shown that interactive design process is important, but not sufficient alone: it must be linked to an iterative process where project work uses and feeds back knowledge. Iterative processes allow experimental learning, such that action ahead builds on previous learning. Behind interactive consultation, PTD equally involves conflictive negotiations, where interests of the different parties involved have to be negotiated and translated in the design. As these actions and process involves range of actors situated at different project environment levels, the outcome of the process is highly dependent on how the project environment builds up and facilitates the technology development process.

PTD is mostly seen as a technology development process through interactive design, but its scope is much wider than this. It forms the base for future local governance and management in different ways: providing service oriented water control, building a stable project environment and developing accountability between WUA and irrigation agency.

It involves a series of joint actions for a long period of time bringing actors at different project environment together in the program process, and thus provides an opportunity to build trust and confidence among the key stakeholders. It thus helps to establish a stable project environment, which is essential not only to facilitate the technology development process, but also to sustain future local management. Likewise, transparency in the process helps the irrigation agencies implementing projects to show their accountability with the local organization which is a key factor for future governance and management.

The chapter also showed that PTD faces several constraining factors. At the local level, farmers' knowledge can involve biases. Farmers' knowledge evolves out of different contexts: sociotechical or holistic, experienced-based, historical and dynamic and sensitive to micro-level contextual diversity (Vermillion, 1990). These characteristics are always not positive, for example sensitivity to the micro level context may include vested interests or preclude system-wide perspective (ibid). Engineers often are not trained on how to feed back this knowledge in the design. The dynamic nature of institutions also poses a challenge to maintain participatory design, as ideas and preference changes with change in personnel.

PTD involves actors in different areas of the project environment, facilitators must have a multi-actor perspective, understanding different aspects of representation and different attractions to participation. It needs to link different levels of the project environment into a single system, to allow flexibility and change. However, as the cases show, actors at the higher institutional layers often are not part of the change process, and keep themselves as controlling and supporting actors with decision making power vested to them, limiting flexibility and change at local level.

Another issue lies in the accountability of the designers (Ashby and Spurling 1994) for their design. To my knowledge, there is hardly any mechanism by which designers are held accountable for the quality of the technology on offer. The bureaucratic processes require designers to be more accountable towards their agency than to the users for whom they are designing. There is no recognition on being accountable to farmers and at the same time there is also no punishment for not being accountable to the farmers.

These constraints do not necessarily limit the scope of the participatory design. Actors involved in the change process need to be aware of these factors, and act accordingly so as to achieve the best possible option in the given situation.

Designing with farmers for service-oriented water control

A key conclusion from this chapter has been that a participatory design process should not be seen on its own, but be viewed as a process to develop service-oriented water control. The service concept involved comes from the farmers, not from any external blueprint of appropriate technology or institutions. Users have first to prioritize the type of service delivery pattern that they want to practice in the future. This requires both users and designers to be involved in system operation for a certain period of time, so that they gain knowledge on system constraints and opportunities. This initial knowledge investment can then form the base of the future design. This approach avoids presuming a particular set of institutions and technologies as suitable for farmers' management. Rather it provides an opportunity to test the compatibility of the existing technology and institutions in system management, and seek changes where required.

In Khageri and Panchakanya, farmers familarized themselves with the existing technology, and then sought changes to suit a strong rotational pattern, resulting in only incremental changes in the water delivery technology. In Panchakanya only the gate configuration was changed whereas in Khageri, a few additional cross regulators were added and others re-sited to suit the delivery pattern. The limited discussion in West Gandak reflected the fact that users were not involved in the operation of the system, and lacked any idea of the type of service pattern and institutions feasible in the system.

It is often argued that proportional divisions are more suitable to farmers' management (Pradhan, 1996 and Horst, 1998). The logic is that it is transparent and easy to maintain. But in these cases, farmers preferred to have different types of rotational practice and favoured adjustable tamper-proof gates. But they were also careful to avoid a larger number of gates and preferred this technology in the main canal only. Inside the branch canals, on the other hand, they preferred ungated outlets. Farmers themselves set the criterion: they needed strong technical control in the main canal until they established strong social control among different branch canals. But inside the branch canals, farmers felt that local rules and regulations were enough to distribute water, and check structures needed were constructed temporally during the irrigation season only.

There is also ongoing argument world-wide on whether system improvement should be done before or after the management transfer. There is no single answer to this. This chapter has shown that the important issue, however, is how to put service-oriented water control into practice for future water management. This requires both users and designers be involved in canal operation and maintenance for a couple of irrigation seasons to gain understanding on system opportunities and constraints, before any design innovations are made. At the same time it is essential to adapt iterative and interactive design processes into a project framework linking different actors together in the learning process, that also allows flexibility in technical, institutional and financial norms set down in irrigation development work.

Notes

[1] As mentioned in Chapter 3, the consultants were not involved in the design and construction processes. However, they used to give advice when asked. This particular consultant was not part of regular consulting team, and was hired temporarily. He was based in Kathmandu and visited the field to provide support when needed.

[2] A structure to divert water from the canal to the stream/ or any drainage available

[3] In trapezoidal sections, bricks are laid in parallel with the ground slope and the thickness of the lining is less than a vertical brick wall. This is also the reason why farmers favoured vertical brick walls.

[4] Interestingly, I found it relocated, when I first visited the field in August 1999 as part of this study. Farmers of B_7 later learned that this shift was not going to alter their water delivery, and allowed the relocation.

[5] In general, brick masonry sections (Type 1) are cheaper. But in this case, as huge construction work was going on in East Rapti Irrigation Project using brick masonry, the local brick factory increased the cost of bricks. This led to a situation in which cement concrete lining (Type II) became cheaper than brick masonry.

[6] This was towards the end of the project when all parties had become confident with the previous design and avoided discussing with local farmers. In previous cases, there had been at least one discussion with local farmers' group.

[7] Within this limit, the project manager at the field level can approve variations.

[8] A structure constructed below the canal to pass the drainage water.

[9] Both Nepal and India have Liaison Offices to look after bilateral issues in irrigation and flood control. The Indian liaison office is in Kathmandu and Nepal has its liaison office in Balmikinagar, where the Gandak Barrage is located.

[10] There is a Standing Committee between Nepal and India to look after bilateral issues at policy level. Its members are high-ranking officers of

DOI and Ministry of Water resources of both countries. They generally meet once a year.

[11] However, in large projects funded by the donors, generally contractors are evaluated on the basis of the technical as well as financial proposals.

[12] However, this is not the exception, but the common phenomenon in the Department. Much of the funds are usually spent on the visit of the higher officials and only a little reaches lower or implementing levels. Nobody remonstrates because of the dependence on higher levels on matters relating to transfer and other bureaucratic norms.

[13] This was the only option for us. However, early setting does not necessarily mean good strength. The setting time of cement depends on chemical gypsum and can be reduced by increasing the gypsum content.

[14] He never appeared in the office since then.

[15] WUA members are not paid and work voluntarily. In overall project execution, they also work together in quality control and canal operation activities. They also spend considerable time in WUA meetings and other activities of WUA to decide on matters related to program execution.

7

Shifting to Local Management: Strategies, Actions and Struggles

The handing over of management to a WUA is recognized as a key event in future success giving not only formal stature, but also clarifying institutional rules to steer the future. This chapter looks at how both the project environment and wider social environment shape events and outcomes in the organizational debut of a WUA, and their future actions. While local policies shape the acceptance of WUA, once started the WUA itself can become a political institutions in the ways it involves law and wider government institutions to help it. Project workers committed to supporting change also have to be able to work with these struggles even when they bring greater stress. Farmers and WUAs are also strategic actors: problems and ambitions of wider context can be brought into the local process to express these convictions. A WUA is a new governance space which people will use for their concerns and ambitions. So, project support has to negotiate and mediate in these ambition and strategies. To illustrate these struggles and actor networks shaping WUA transformation, this chapter looks not only at the procedures of change, in each site, but also at key struggles that shaped the WUA and its relation with the project office, the wider political established and their members.

7.1 Preparing for Transfer: Establishing the New Management

Irrigation management handover is an important event and should be formally recognized (Smout, 1990), as it represents the end of project support and beginning of the farmer-managed or jointly managed operation. This event provides opportunities to both the government agency and the WUA to negotiate the support needed to sustain future local management, and help avoid the likely second generation problems (Svendsen, 1997). Likewise, it also helps to clarify roles and responsibilities of irrigation agency, the WUA and local farmers, and minimize the disputes in future water management.

Transfers can involve transfer of 'ownership' or of 'use right' over irrigation infrastructure and water. In most cases, the ownership lies with the state for both water and infrastructure, and only 'water use rights' and infrastructure are transferred to the WUA (as in Mexico and Turkey, see Svendsen, 1998). In many cases, farmers themselves resist ownership transfer (for example in USA and in Columbia, see Vermillion and Sagardoy, 1999) fearing that this will entail unwanted liabilities like financing the cost of rehabilitation and modernization, property damage and property taxes.

In Nepal, it was not clear what the management transfer would entail, though it was allowed by the law (Chapter 2). Even near the end of 1997, When the Action plans were fully implemented the status of ownership of the transferred infrastructure, and terms and conditions of the transfer were still not clear to both WUAs and the project office. This was because the Water Resources Act (1992) and the Water Resources Regulation (1993) were also not clear on the status of ownership of the transferred systems.

The Water Resources Acts and the Regulation failed to clarify these elements, as they were more concentrated on attracting private sector investment in hydropower, and paid less attention to the irrigation sector reform. Thus there were no guidelines regarding the type of documents to be prepared, and what rights and responsibilities were to be transferred to the WUAs. Moreover, as already agreed during the MOA signing (Chapter 5), in Khageri only the branch canals were to be handed over whereas in both West Gandak and Panchakanya, the transfer was to take place at system level. It was not clear how to proceed in these different situations involving full or partial transfer of the system management.

Having reached the end of the project and there being no possibility to form new regulations to clarify the constraints of the existing rules and regulations, we decided to discuss it among the relevant parties: the DDG in charge of the IMD, the co-ordinator of the IMTP, the consultants and the WUAs of the concerned irrigation systems. The consultant (who was previously with DOI) was then asked[1] to prepare the transfer document through discussions with the above stakeholders. Ultimately, the following criteria were set for the transfer of the systems after detailed discussions and negotiations.

Ownership status and conditions of the transfer

The status of the transfer would be 'right to use' infrastructure only. That is, the WUAs were restricted from pledging the transferred structure, or from transfer of its ownership to others by way of sale, donation, exchange, or agreement otherwise. Damage, spoiling or change of structures that could lower the quantity and quality of water was also prohibited. However, changes in the structures and canal network could be made for the purpose of necessary maintenance and expansion. It was also decided that the WUA could not transfer the system again to another person or to any other organization.

Together with the irrigation system, the transfer would include the property that was part of it: the lands, natural resources like forests along the canal, canal service roads and any other structures that previously belonged to the Irrigation Office responsible for the system. However, the forest resources along the embankment of the canals were the property of the Department of Forest (DOF), and the DOI had no authority to hand it over to the WUA. For the systems going under joint management like Khageri, only the resources under the concerned branch canal to be handed over would be transferred to the concerned WUA.

Post turnover support

The WUAs considered the issue of post-turnover support more important than the ownership issue. Kloezen (2002) documents a similar situation in Mexico. It was needed to boost the confidence of the WUAs to manage the system ahead. Two types of support needed to be clarified: the support for emergencies and the support for future development and expansion.

The WUAs were especially concerned about the damage of the structures due to natural calamities, which could run far beyond the farmers' capacity. In most cases, damage needs to be repaired within a few days, so as to avoid crop failure, which requires sound financial conditions and intense management input. This cannot be expected from newly established WUAs. In all of the three systems, there were fears among farmers as well as within the WUA on whether the government was going to abandon the system. To boost the confidence of the WUAs, the DOI needed to assure the WUA that it would help them at the time of need, and at the same time the WUA were required to assure the farmers that government would help in problems beyond their capacity.

At first it was mentioned that any damages due to natural calamities beyond the capacity of the farmers would be repaired by the government, but with participation from the WUAs as specified in the Irrigation Policy. However, the problem here was - what were the criteria to decide whether damage is beyond the capacity of the farmers? Farmers wanted specific criteria. The final solution was that if damages in the main and branch canal are greater than as mentioned below, the government would provide support in the reconstruction, but with the necessary contribution from the WUAs:

- If unlined canals are damaged beyond 250-m length and lined canals are damaged beyond 50 m length
- If the cross-drainage structures[2] of branch and main canals are damaged such that they are unable to deliver the service
- If the head works of the systems are washed away

These conditions were in fact put forwarded by the Panchakanya farmers. They had came to this criteria considering the technical and financial constraints in carrying out the works mentioned above.

Another fear of the farmers was future government support for system development and expansion, including extension of command area and increase in the water supply situation. This was not mentioned in the Irrigation Policy or other documents. Farmers wanted this clear before transfer arrangements were made. They argued that they should have these opportunities and government must provide support for them.

There were now conflicting views between the government and the WUA. The government wanted to avoid any support to the WUA in the near future as their systems had been recently improved, but the farmers wanted to be allowed to seek support even immediately after the handover. I tried to convince the WUAs that the government would not agree finance in near future as the systems had been supported recently, and suggested a longer time frame before they ask for such help. The WUA leaders replied that they knew it, but they needed a shorter period to assure their farmers that the government would help in any future development. Ultimately, the WUA agreed a time period of five years, before which they would not seek government help for system development and expansion.

The responsibility for future rehabilitation was not spelled out, and was assumed to be the government's responsibility. The reason was that in the Irrigation Policy the FMISs are also allowed to ask for government support and the DOI's major activity involves the rehabilitation and expansion of the FMISs. Once the systems are handed over to the WUAs, their status would also be that of the FMISs and they cannot be restricted from seeking support from the government for future rehabilitation.

Another support to be cleared was about providing technical services to the farmers by the concerned irrigation offices. In Nepal, most operation and maintenance activities are carried out by the direct participation of users through voluntary contribution from the member farmers. They generally do not hire any outside technicians or contractors to supervise in technical affairs. Continued government support in this direction was thus needed. It was agreed that in case the WUA requires technical advice during repair and maintenance of the structures the user association may request the concerned Irrigation Office, who shall provide the necessary technical advice requested.

WUA responsibility and authority

The responsibilities of the WUA towards the farmer members are mentioned in their by-laws and constitution, and there was no need to repeat them in the transfer document. The WUAs major concern was that - they felt they were not empowered enough for resolving conflicts and raising funds from the users. In many instances their laws, by-laws, rules and regulations were not effective, and required support from wider political and administrative institutions where they felt unrecognized.

When WUA rules and regulations were insufficient to resolve disputes, they had to take them to the VDCs, DDC and the District Administration Office (DAO) depending on the nature of disputes. However, they found that they were not well recognized by these institutions and so demanded provisions in government Acts and Regulations to make these local offices provide immediate help to them in solving these problems.

They were also concerned about the evasion of Irrigation Service Fee (ISF) by many farmers, and wanted to have strong rules and regulations to check this. There were two problems relating to collection of ISF. First, in all the three systems farmers with large land holdings were not paying the ISF, and WUAs were helpless to take any action against them. This problem was greater in West Gandak than in Khageri and Panchakanya, where the percentage of farmers with larger land holding is much higher, and high monsoon rainfall and land characteristics made it easier to evade paying the ISF.

The WUAs were already empowered to set up their own rules and regulations, set up own operation and maintenance fee and collect it. Those who failed to pay the ISF were supposed to be sanctioned from the irrigation services. However, in practice, sanctioning a particular farmer or group of farmers from the service is difficult in irrigation because of its specific characteristics:

- In unlined canals, where seepage and leakage are common, sanctioned farmers can have access to this water
- Field to field irrigation is practiced in rice cultivation, and control of flow from one field to another is usually absent
- Small farm plots, due to which water moves quickly from one plot to another belonging to different farmers.
- Specific features of the land topography as explained in chapter 2, due to which water applied to one field automatically reaches to adjoining field at lower levels.

All three systems were also facing this dilemma, and fee collection had remained poor in these systems (will see in chapter 9). The WUAs themselves put forward some innovative proposals to solve this problems aiming to bring the other institutions together in the process.

The farmers' view was that the ISF, or any form of fee or fines imposed by the WUA, should also be linked with the other service sectors. They felt that the VDC, DDC, DAO, ADBN and the Agriculture Development Office (ADO) should also be brought into the process of building WUA authority. The idea of involving these institutions was also being discussed within the Irrigation Department as they were directly related with farmers' affairs. The ADBN provides loans and credit to the farmers and the loan request (may) need to be certified by the ADO. The ADO is responsible for overall agriculture development in the district helping farmers in providing the necessary agriculture extension services. The VDC is the lowest political unit in Nepal - without its recommendation, one can not obtain a national identity card or any facility or services that the government provides to its citizens. The VDC is the unit where people register deaths, births and marriages. Land taxes are also paid in the VDC, and without paying the land tax, one cannot use the land for economic activities like in selling, taking loans or building houses.

If services from these institutions were restricted after reporting of a fee violations by a WUA, one could not escape from paying the service fee. This required changes in the existing law, which was not possible at that moment. However, it was agreed to work in this direction in the coming years. Vos (2002) documents a similar situation in Peru, where the WUA considered the linkages between the different institutions, which provided an 'obligatory passage' as a key in fee collection.

A need for a separate Irrigation Regulation was then realized, for two factors that were clearly lacking in the current acts and regulations. First, the terms and conditions of the transfer and second, to empower WUAs to collect the ISF and resolve conflict through wider political and administrative linkages. This regulation came only in 2000, but still failed to address the issues relating to ISF, though it clarified the terms and conditions of the transfer:

- It failed to address whether government property like land, buildings and machinery could be transferred to the WUA or not (though these were already felt needed and done in the West Gandak in 1997). However, it granted the forest to the WUA, so that there is no need to contact the forestry department onwards
- It failed to link the issue of ISF to other political institutions. Instead, it formed a committee under the chairmanship of concerned District Irrigation Office to decide and collect the ISF. The committee also consisted of WUA chairperson and the Chief of the Agriculture Office. It was also unclear whether this provision was applicable to the fully transferred systems.

- Instead of empowering the WUA, this kept power within the irrigation agency.

The agreement over the terms and conditions discussed in above paragraphs prepared the base for management transfer to the respective WUAs. However, the transfer process faced further problems from the system and project environment, as discussed below.

7.2 Handing over the System Management in Panchakanya

After agreements over technical improvement and institutional development activities in the AP were over, the system was to be handed over to the WUA as per the MOU signed in 1995. The decision to take over the system from the government was made in July 1997 by the General Assembly of the WUA. However, before the formal agreement was signed with the government, farmers wanted some improvements in the branch canals too, which were not initially mentioned in the AP. An additional 0.8 million rupees was sanctioned by the government to carry out these improvements. With the completion of these work, the WUA organized a ceremony for the turnover of the system from the government.

The ceremony for handover was held in the headworks of the system in January 1998. The handover document was signed by the WUA chairman from the farmers' side and by myself from the government side. The handover document included the system details, the length of main and branch canals, the map of the irrigated area, structures in the system and the property transferred. The PIS did not have any other properties like trees and land owned by the government, but only a small house at the headworks. The house was of no use to the farmers as it was quite remote from the farming community - the WUA later provided this house to a local NGO. The other conditions regarding post-turnover support, and duties and obligation of the WUA as identified and agreed earlier, were also included in this document.

The ceremony was chaired by the WUA Chairman and the Director General of the Department was the chief guest. All district-level politicians including the mayor of the municipality, were present in the ceremony. The Chairman and Secretary of all other irrigation systems under the IMTP were also invited.

However, Members of the Parliament from Chittwan were not invited to this ceremony, since the WUA wanted to keep the ceremony at local level only. Later on, one local MP complained to me about this, but the WUA had organized the ceremony and I was not involved in deciding whom to invite.

I kept away from organizing this ceremony for fear that people might think I was influencing the WUA to takeover management responsibility. As an implementer, I always tried to convince farmers that the system would operate better under farmers' management while reassuring them that the government was not going to abandon the system after the turnover. But I never tried to influence their decisions.

One group of farmers dissatisfied with the idea of turnover of the system to the WUA registered their opposition to the visiting dignitaries (the mayor, DG of DOI). They demanded continued government support in the system and wanted further structural improvement works. I was already involved in Panchakanya facilitating the transfer process for more than two years, but had not faced any opposition from these people earlier. When I asked these people about their opposition, they had no satisfactory answer to this. However, they were calm when other farmers and WUA members attending the ceremony started confronting them. Later I came to know that this opposition was more directed at the secretary of the WUA because of their political differences[3].

Once the agitation was over, the program began. The certificate of the handover together with the transfer document was handed over to the WUA Chairman by the DG. The WUA Secretary first briefed the gathering about the history of system, its expansion and participation in the IMTP and the achievements made so far. Other dignitaries including the Mayor, the coordinator of the IMTP and USAID representative, also addressed to the program. Many of them highlighted the successful end of IMTP in Panchakanya. I was not convinced with the words 'end' and 'success' being used. In my turn, I argued that it was not an end but the beginning. The aim of participation in this case goes beyond project execution. The way farmers would manage the system in future and get returns from it were yet to be seen. Of course, project execution was completed without many problems here, for which, one had to go back to its history of development and the past interface between the government and farmers.

The handing over ceremony increased recognition of the WUA at local level, and increased its confidence for future water management.

7.3 Handing over System Management in Khageri

In Khageri, only the branch canals were to be transferred to the WUAs. There were 9 branch canals and 4 minors together. As mentioned in chapter 5, the implementation of the action plan for different branches happened at different stages. Hence the transfer of the branch canals was also done in stages. As happened in the Panchakanya, more demands for improvement were asked by the WUA here also. It was agreed that if any major problems had been left out during implementation resulting decreased flow in the canal or if flow could be increased, would be considered even after the transfer of the system. However, most of the new demands were again for the lining of the canal, so no additional works was carried out at this late stage.

The branch canals in Khageri had no property to be handed over except the canal networks. The date and venue of the handing over ceremony were fixed by the respective WUAs. Before the ceremony, the GA of the concerned branch committee gave approval for signing of the transfer protocol. In all these GA meetings, farmers were asking about future support and made additional demands for construction. Regarding additional construction, my reply was same - only if there were money left at the end out of the previously agreed AP, as there was no possibility of increasing the cost beyond that. Because of these detailed discussions and stepwise approach, the progress of management transfer process was slow. The department was pushing me to move quickly, but I resisted. The slow stepwise approach was productive, because all the confusions in roles and responsibility were cleared with the farmers. However, my assurance for system improvement if there was remaining budget, increased farmers' expectations. At the end, these expectations were not met for which I had to face criticism from several WUA leaders.

The handing-over ceremony was usually performed inside the command area of the concerned branch canals. It was usually a school building so that large numbers of farmers could gather. Besides the branch committee members and the farmers of the concerned branch, the Chairman, Vice Chairman and Secretary of the Main Committee were also present on the occasion. No outsiders, including the higher authorities from the DOI, were invited to attend the ceremony except VDC chiefs and DDC members, as it involved only the transfer of the branch canals management and their presence was not thought important. As a result, only the field-level technicians including myself were present from the government side. The transfer document was signed by the Chairman of the concerned branch committee on behalf of the farmers and by myself on behalf of the government.

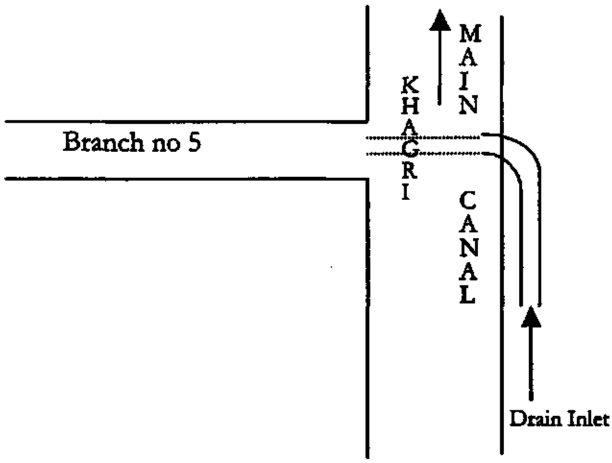
However, the handover process was retarded due to the multiplicity of the problems outside the framework of the project. There were conflicts between different farmers groups as well as between the government and the WUA: these made our efforts to transfer the management to the farmers collapsed almost at once. The events here show that problems are not necessarily inside the framework of project control but still affect the outcome of the process. Efforts to solve it require the bringing together of different institutions with different strategic actions in the program process. Two such events are explained below.

Conflicts in branch no 5

As mentioned in chapter 6, branch canal 5 (B_5) was under the first stage of implementing the AP. This branch also had access to drainage water from adjoining higher land (see Figure 7.1). In Khageri, drainage water was used at several places to complement water sources to alleviate scarcity conditions. While developing the AP for technical improvement work, there were more proposals to bring the drainage water back in the canal and farmers gave it first priority (chapter 5). B_5 was also receiving drainage water since 1992. There was a drainage channel and a canal crossing structure constructed to divert drainage water in the B_5 canal as shown in Figure 7.1.

When the technical improvement activity in B_5 was over, farmers had their first experience of improved canal operation. Meanwhile in July 1996, a few farmers group (here after called opponent farmers), not belonging to Khageri system, blocked the drain inlet of B_5. This drain was very helpful to B_5 farmers, as they received water even when there was no supply from the main canal. It put B_5 relatively at an advantage over other branch canal farmers. This drainage was important for main system management too, as the water saved in B_5 could be utilized in other branch canals. This blockage of drainage was politically motivated.

FIGURE 7.1 Drain inlet arrangement to branch no 5



The drainage source lies outside the command area of the Khageri canal (the Khageri is a contour canal irrigating only left of its canal alignment), and the farmers who had blocked the drainage were not members of the Khageri WUA. The B_5 farmers, together with branch committee members requested the farmers to unblock the drain and allow free flow of water. In reply, the opponent farmers said that the land with the drainage channel belonged to them and they would no longer allow the drainage canal from their land. The drain had been there since 1992: several such drains were constructed in Khageri and their legality was never challenged. No one knew why this issue was being raised now.

The farmers of B_5 made several requests with the opponent farmers to open the drain but without success. When the local community failed to solve the problem, it was brought to the attention of the MC, who also failed to convince the opponent farmers, so the matter was brought to our office. We had developed an understanding with the WUA for this procedure, so problems only come to our office after internal actions have been tried. The irrigation offices in Nepal have no authority regarding the conflicts over such issues and we (the MC and project office) decided to take the matter to District Administration Office. A meeting was arranged between MC, Chief District Officer (CDO)[4], Police Superintendent (SP) and the opponent farmers. Despite several requests by these higher authorities, the farmers did not agree to open the drain. They insisted that the land with the drain belonged to them, and argued that neither the government nor the Khageri farmers had the right to construct the drainage channel from their land. There was no way left after this, except to go in the court.

It was already time for rice transplantation. Farmers were pressing to solve the problem quickly. Local farmers were asking questions like: if the WUA cannot solve a problem like this, what is the use of ongoing IMT? How can the WUA manage the system in future? I realized that going to court was not helpful at that moment, as a court case takes a long time. Farmers of B_5 were pressing me that they would open the canal if I supported them. . So, I decided to talk again with District Administration and higher authorities in my own department.

Both these authorities told me that if WUA and farmers favoured to open the drain, even forcefully, the administration would support their initiatives. So I told the farmers they could open the canal. However, the B_5 farmers asked to do it in our presence only, as they were afraid of future legal consequences. We agreed to be present, and farmers and WUA members from B_5, and the WUA main committee, in the presence of our technicians, finally opened the drain inlet. The opponent farmers were there, but instead of opposing our move, they were busy taking photographs. A few days later I learned that the farmers had filed a case in the District Court citing that their land had been forcefully occupied by the farmers of the B_5.

Interestingly, the farmers had not charged any of our office staff but only the members of the Branch Committee and some farmers. The drain was opened under the supervision of our technician, so I was surprised that they did not charge us. It turned out that those farmers who were charged were politically active in the area. I then sensed that this problem was not linked with drainage canal. The farmers did not charge us because if we were charged, the District Attorney would be involved from our side and there would be no need to hire a private lawyer[5]. It was clear that some farmers and members of B_5 committee were the target of opponent farmers.

The members of the B_5 branch committee and some other farmer members were then asked to be present in the District Court. Farmers in Khageri were now very much disappointed. Everybody questioning why they should support and participate in a program which was going to end in court cases for nothing. The ISF collection decreased rapidly and WUA could not function properly after this event. Farmers from other branch canals were also disappointed. I felt that the effort of 4 years was going to collapse at this stage.

However, I was confident that the court would order the blockage to be opened. As per the customary law Act 1963 (*Muluki Ain*, 1964), nobody can block natural drainage or canals, irrespective of land ownership. The problem was that the court case would take a long time. So I decided to talk about the matter with the District Judge directly. My intention was not to influence the court process, but to request an early judgement because of the sensitivity of the case. In one of the court proceedings, I requested all the parties including the lawyers from both sides and a representative from the court, to visit the site and see the problem physically. The judge agreed to visit the site himself together with both the lawyers[6]. In the next court proceeding, the judge declared that the drain cannot be closed and farmers of B_5 have rights over the water. This was a great relief for all of us. Had we not won the case, the process might have collapsed at this stage.

The Padampur resettlement program

Another challenge that emerged pertains to resettlement of flood victims of the Rapti River in the catchment of Khageri River. In 1992, just at the beginning of the IMTP, the Government made a decision to resettle the flood victims of Padampur village to Saguntole clearing about 540 ha of partially forested land there: this involved 10,200 people belonging to 1700 families (Source: Padumpur resettlement committee). Saguntole lies in the catchment of the Khageri River, and Khageri system farmers were concerned about the effects of this resettlement. At the beginning, Khageri farmers took no action, thinking it would not happen. However, the Government formed a high-level committee and started the resettlement program and there was a great concern among the Khageri farmers. They believed the program would destroy the river catchment and affect the water supply regime of the Khageri River. They also feared upstream diversion by the new settlers. Padumpur village and the Saguntole are shown in Figure 3.1.

The WUA members first tried to solve this problem through local political leaders, asking them to request the government to stop the resettlement program. But the DDC had already approved the resettlement program. The Chairman of the DDC was also a farmer from the Khageri command area. He stated that the DDC had approved it after reviewing the environmental impact report prepared by the Ministry of Local Development, which showed no serious impact from this resettlement program. When the problem could not be solved at district level, they took the problem to national level politicians. They even talked with two successive Prime Ministers, but that gave no solution. The government repeatedly told the farmers that an environmental impact study about the resettlement program showed no adverse affect on Khageri water supply.

Finally the Khageri WUA filed a case in the Supreme Court of Nepal in March 1995 to stop the resettlement plan on environmental grounds, the first of its kind in the country. They charged that the resettlement would lead to the destruction of the catchment of the Khageri River and lower the water availability downstream. It now became a national issue. The politicians were then desperately seeking to settle the problem out of court as the verdict of the court to any side would have led to a lose-lose situation for the politicians. I was only the observer now, as the case was with national level politicians and in the Supreme Court. Farmers' attention now shifted to this issue, and the progress of IMTP rapidly slowed down and farmers no longer showed interest for management transfer.

The politicians finally succeeded in convincing the WUA leaders to withdraw the case from the Court. But before that the Khageri WUA wanted a guarantee from the government that they would be provided with additional water supply. Now the ball again came to my court: I had to find a means by which Khageri could be provided with additional water. I was asked by the Minister of Water Resources to find possibilities within a week. Through the farmers, I came to know about a nearby stream, the Budhi Rapti (see Figure 3.1) from which we could augment to Khageri canal. Budhi Rapti was 2.2 Km away from the Khageri canal. We explored that possibility, but unfortunately, Khageri Canal was almost about 15m higher than the Budhi Rapti River, needing another lift scheme.

I was never in favour of constructing a new lift scheme, as I had the bitter experience of running one. It demands both skills and resources and is not favourable to farmers' management. I shared my view with the department in Kathmandu and with the Water Resources Minister, who was also not in favour of constructing new lift scheme. However, the Prime Minister wanted this problem to be solved quickly, and the Water Resource Minister later agreed to go ahead with the proposal of the lift scheme.

I prepared a pre-feasibility study report of the proposed scheme, listing several problems relating to environment - it had to be constructed inside the National Park as well as having likely problems in operation and maintenance. But I had no choice but to move ahead with the proposal, as without this, there would be no agreement between the government and the WUA and the Cabinet itself was in hurry to solve the issue. An agreement to this was made between the WUA and the government, in which the Minister of Water Resources, the Minister of Local Development, the State Minister of Water Resources and another Minister on Behalf of Prime Minister's Office signed from the government side. The WUA Chairman and Vice Chairman, the Chairman of DDC of Chittwan and the MPs representing the Chittwan signed on behalf of the Khageri.

This politically settled negotiation however had a big impact on common farmers who believed that they were cheated by the government. The WUA also had no alternative except to compromise with the government, because it was equally difficult to prove in court that the resettlement would decrease the available flow in the Khageri River. Many times, during the field visits, common farmers used to ask me about the effect of this resettlement program on water availability in Khageri in the long run. As USAID was also involved in the IMTP, it carried out an EIA of the resettlement program through a private consultant, who could not provide any concrete details on the impact of the resettlement. It again carried another study on the impact of the resettlement program on the water supply regime, which also failed to quantify the impact.

The root of the problem was in fact a lack of discussion about the resettlement program with Khageri farmers. Khageri farmers knew the suffering of the Padumpur farmers and they also knew that in Chittwan District there was no land available other than at Saguntole. The Khageri farmers' fear was not so much for the upstream diversion, as for the destruction of the forest-land after resettlement. A topographic survey of the area later showed that there was no possibility of water diversion from the Khageri and its tributary to the planned resettlement area. The fear was that the newly resettled people could inflict massive destruction of forests for their livelihoods, which could affect the water supply regime of the river. If the Khageri people had been consulted, and participated in an action plan for resettlement program and catchment area, there could have been an amicable solution of the problem.

The dilemma was that the Khageri farmers never knew what was going on in this resettlement program and what effect it would have, and how they could minimize the effect of the resettlement. The Ministry of Local Development was implementing the resettlement program through a high-level resettlement committee which included members from the local land revenue office, District Administration, DDC, and Forest Department. Neither the Irrigation Department nor the WUA of KIS were represented in the committee and never knew what was going on. The government advocates participatory policies in all development fields, but in this, the affected people never knew what was happening.

The ADB also showed concern over the situation in Khageri, as it was the major funding agency in the IMTP. In its successive mission visits during 1996/1997, ADB representatives asked the government to prepare an action plan for the resettlement program and guarantee that it was not going to have any negative impact in the functioning of the Khageri. It even suspended all the reimbursement of the expenditure made in IMTP unless the action plan for resettlement was presented to them. The ADB was particularly concerned over the process of the resettlement programme, which was going on without any detailed plan. There were only maps showing the division of the land. The ADB mission raised the issue with the NPC and MOWR[7].

After strong opposition from the ADB, a meeting was held between the Ministry of Water Resources, Irrigation Department, Ministry of Forestry, Ministry of Local Development, the high level committee for resettlement and our project office. The meeting was organized by the NPC to discuss about the preparation of a detailed plan for the resettlement and to discuss how to minimize the degradation of the Khageri River catchment. It also discussed on how Khageri WUA could be involved in the future catchment protection and the resettlement program. However, there was no budget available to prepare such a plan and a lack of co-ordination between the different ministries. The Local Development Ministry implementing the program did not pay attention in preparing the action plan for resettlement, as it thought that the irrigation department only needed it to satisfy the ADB. The Forestry Ministry had already provided land and took no further interest. There were no further meetings of this kind. However, such a lack of co-ordination is not uncommon in Nepali bureaucracy.

The resettlement program was still continuing during my last visit in November 2001. It was originally planned to be completed in five years, but was slowed by a lack of funds. The total cost of the resettlement program is Rs. 300 million, but only around RS.10 million was allocated per year. The settlers were given marginal land in Saguntole, and were to be compensated for their lands in Padumpur. Since the Committee had insufficient funds at its disposal, it tried to compensate by giving more land. This led the Committee to demand 300 ha additional land from the government, which the government later approved.

Every farmer in Khageri feels insecure about their future and are expecting the lift system to be constructed as agreed by the government. But there has been little progress in this direction too: It is still at the detailed study level. On the other hand, the resettlement program is moving slowly, and is not being done in planned way. The DOI has its own problems of getting reimbursement from ADB. Therefore it became rather a tragic incident. These events reduced farmers' interests towards the joint management activities. However, all the branch canals had already been transferred to the WUA. As will be seen, the WUA have been maintaining the system without any deterioration, but there is no progressive achievement either.

7.4 Handing over in West Gandak

The dynamics of the transfer process was much wider here as it involved transfer of the entire large system. The case here also shows how problems are interconnected, and involve a range of actors at different project environment levels with different strategies and interests in participating in water management, and come to shape the management transfer process.

In the West Gandak the handover was to occur at two levels: at lower level, which would involve transfer of the branch and minor canals; and at the main canal level. This section first reviews the handing over of the lower order canals, and then the dynamics of main system management transfer.

Handing over of branch and minor canals.

Available documents and interviews with WUA and the project office technicians show that the handing over of the branch canals were overshadowed by the concentration at the main system level. There are no documents or protocols signed showing that particular canal system (branch or minor) had been handed over to the WUA. Documents of the West Gandak project office show that the handover of these branches was done by means of a letter from the project office only. First, upon completion of the construction works as agreed in the AP, the concerned BC used to forward a letter mentioning that the construction activities were over and they were ready to take over the system management. The project office then used to issue a letter notifying the committee that responsibility of operation, maintenance and resource mobilization had been handed over to them with no details attached. This means that only the committee members of concerned canals knew about the handover of the canals. For example there were 23 members in the Mangharia Toli committee. There are more than 1200 farmers in the Mangharia minor and only 23 farmers made the decisions and knew about the handover decision.

There were two reasons for this limited discussion regarding branch canal transfer. The first is that the branch canals had no GA (see Chapter 4), so there was no discussion with wider groups of people. The joint planning process had a similar dilemma. Second, all the other actors - the co-ordinator, the local project office and the consultant - paid attention to the main system only. Elsewhere, upon handover, the WUA was also to be provided with the details of the system, its functional status, canal operational rules, their right and duties, and post-turnover support that they could receive from the government. Such documents were missing there.

The IMTP was being co-ordinated by the same unit in the DOI and was being supervised by the same consultant group, but they did not pay attention to this in the West Gandak. After signing of the MOA in 1996, meant for the transfer of the whole system, no real focus was given on what was happening inside the branch canals.

However, the branch and minor canal WUAs also never asked for these documents. Many farmers in the area say that the WUA members themselves were involved in the construction activities, and never asked for the documents: instead were in hurry to recommend that construction had been done to their satisfaction. The payments to the contractor were to be made only after the recommendation of the WUA. In this way, all the branch and minor canals were handed over upon the interest of few members engaged in construction.

The IMTP was being co-ordinated by the same unit in the Irrigation Department and was being supervised by the same consultant group, but they did not pay attention to this in the West Gandak. After signing of the MOA in 1996, meant for the transfer of the whole system, no real focus was given on what was happening inside the branch canals. Yet many of the Gandak branch canals are larger than the Panchakanya system, or branch canals of the Khageri: the largest has the command area of 1300 ha (see Table 3.9).

Handing over of the main system to the WUA

At the main canal level, however, the decision to take over the management from the government had to be approved in the 172-member GA. Before this, the MC had to make the decision first and draw up the agenda in the GA meeting for approval. Only then could the WUA enter into the agreement with the government to take over management responsibility. At the MC level, two opinions were put forward regarding the taking over of the management responsibility from the government. One group was not in favour of taking the responsibility, feeling it was too early to do this. People had just begun to learn about the management activities, ISF collection was still below than 30% and its rate was five times lower than required (see chapter 9). Their idea was thus to stay with joint management and take up the responsibility of main canal management gradually over a period of few years.

The other group favoured takeover of the full system responsibility. They thought the system had enough resources to meet the operation and maintenance cost. They were talking about the forest resources, road tax collection and the land property of the West Gandak. There was an understanding with the government that these properties would be handed over to the WUA together with system handover.

Many WUA members told me that the consultants and project authority also encouraged this group to takeover the main canal. Some farmers even claimed that the project office told the WUA that if the main canal was handed over, some WUA members would be given the opportunities to visit a foreign country as in the past[8]. However, the consultants and project officials of the time told me that they never made this type of commitment.

However, it cannot be denied that the project authority - including the central co-ordinating office in Kathmandu - were interested to hand over the system. This could provide advantages in dealing with the donor community to show that they managed to handover a system of this scale. The interest of the project authority, and ambition of key leaders in the WUA, finally won the battle and the MC decided in favour of taking over full responsibility. Later on, the GA also approved the takeover, as decisions in the GA were usually dominated by the MC members.

When the MC made the decision, the chairman was not present and the meeting was presided over by the Vice-Chairman (according to the rules). The chairman told me that he was on a private visit. However, other people told that he intentionally avoided the meeting so that he could escape the controversy regarding whether to takeover the system or not.

After the GA approval, the MC organized a ceremony on January 1998 for the transfer of the system from agency to WUA. The Director General of the DOI was chief guest of this ceremony. The Chairman of the MC himself presided over the ceremony, although absent during the decision on takeover. The Director General handed over the certificate of transfer to the chairman. Interestingly, the document specifying the terms and conditions of the transfer was not present at the ceremony.

The hand over arrangement

The management transfer certificate was handed-over to the WUA, but as mentioned, necessary documents were not prepared at the time of transfer. According to project officials and consultants of the time, it was agreed with the WUA that the terms and conditions of the transfer would be decided later on.

The WUA made several visits to Kathmandu to finalize the conditions of the transfer. They had to come to Kathmandu as the West Gandak Project Office in the field was not in a position to settle issues regarding the transfer of government owned properties. The following conditions were finally agreed between the DOI and the WUA:

- Transfer of both management and right to use of main canal and the associated structures
- Right to use the land under the main, branch, tertiary, and field channels and some of the buildings owned by the government. There were about 50 ha land in total.
- Operation and maintenance and right to use the bulldozer, loader, dump trucks, and vehicles.
- A sum of Rs. 8.5 million for the period of three years to assist in operation and maintenance activities and during which the WUA had to gradually increase its resources.
- Control of forests including those in the canal embankment and flood protection dykes.
- Right to collect tax from the canal service roads and houses built among the canal embankments.
- A small unit office to support the WUA in technical affairs.

However, handing over the canal forests and authority to collect the tax from the canal service roads and houses, was beyond the authority of the Department of Irrigation. There were more than 126,000 trees (according to the inventory made at the time of the forest transfer) along the canal alignment. The WUA expected to raise part of the maintenance cost out of the forest resources. The canal service road is also one of the major road links with the national highway and the District-headquarters. There was high potential for collecting a service tax out of this road through a toll arrangement with a manned barrier. Likewise along the side of the canal and service road, people had occupied the land and started business. Housing construction on canal banks was illegal, but removing them was impossible for political reasons. Instead of removing them, the WUA planned to raise funds out of this.

Many of the issues were resolved over time. The transfer of forests was made possible due to the influence of the MP of the area. Forest resources were with the Department of the Forestry (DOF) and handing this to the Gandak WUA required DOF's approval. The DOI requested the DOF to hand over the forest resources to the WUA. Incidentally, the Forest Minister then happened to be a close friend of one of the MPs of the Gandak area. The MP himself was in a powerful position, as chief of the Public Accounts Committee of the Parliament[9]. It was through his influence that the forest was handed over to the WUA, rather than the DOI.

The issue of authority over the road tax collection was resolved through the effort of the project office and the WUA themselves. When the WUA started collecting tax from roads and houses along the canal embankment, residents and public transporters complained to the District Administration Office. The DAO questioned the WUA and the Gandak project office regarding their authority to raise such taxes. The WUA and the project office explained to the District Administration about the ongoing management transfer policy and that a law allowing collection of such taxes was in the making. Finally the District Administration decided not to object and WUA started collecting such taxes.

Other issues were inside the domain of the DOI. The Government allotted the budget as agreed. A small unit office consisting of an engineer and an overseer was kept to help the WUA in technical affairs. Otherwise, the Gandak Project office was to be merged with the District Irrigation Office of the Nawalparasi District (finally merged in 1999). However, the transfer protocol was still not signed because of the conflict between the DOI and the WUA regarding the transfer of the heavy machinery, which the government had promised to hand over to the WUA (see Chapter 8).

Because of the disagreement over the transfer of heavy machinery, the document specifying the conditions of handover was never signed between the WUA and the DOI. On the other hand, WUA has received other support as agreed.

With all these dynamics going on in the system, how has the NWGIS matured under the new management? The results so far are disappointing, and party politics are now blamed for the failure of the new management. But, is it party politics only that restricted the development of new management? In the following chapters, I argue that the DOI itself was key actor in the wider politics that occurred the West Gandak: its interest to get a quick success without realizing the technical and organizational complexity, has been a root cause of the management collapse.

7.5 Conclusion

Handing over irrigation management creates new forms of local governance and not just local task management, in which both social rivalries and resource management problems will be areas of struggle. Political rivalries will often surface in struggles for new governance, which are not easily addressed by simple consultative methods. Often actions are strategically timed, without word of problems in earlier stages of change. Without recognition of the scope of political action, the structured and supposedly democratic procedures of consultative irrigation management transfer may be little more than paper. By negotiating the weakness and gaps in policy, WUAs first developed by struggling against factors (and not being dominated by them) that helped give WUAs power for further action when the project could not immediately help – as in Khageri – they lose relations and WUAs struggle further for action. If a project pushes to hard and fast without proper negotiation – as in West Gandak then other weaknesses emerged. WUAs as new form of local governance, became entwined in politics because from their creation they are shaped by political systems of government – and need their wider support (but not domination).

The chapter also showed that how process of policy implementation were driven by local negotiations and decisions. The relative success or failure of these local process also were shaped by the wider politics of other local struggles with the Government or the preferences of the project actors.

Notes

[1] He was in regular contact with all the system managers as well as the higher officials in the department and the WUAs of the different irrigation systems, and was thus assigned this job.

[2] Cross-drainage structures comprise aqueducts, siphons, culverts and other related structures

[3] I came to know that they were from two different rival political parties, including one opposed to the government who organised this protest, and this difference was reflected in this ceremony. The demonstrating group wanted to show the public that the WUA was unnecessarily taking the burden from the government.

[4] CDO is the chief administrative officer in the district and heads the DAO.

[5] In Nepal, when government offices are charged for their action, the district attorney fights the case on behalf of the government office.

[6] I have never come across a case where the judge has visited the problem site in person before deciding the case. He told me that he was interested to see the problem himself because he was involved in several conflicts in water issues in the past.

[7] The issue of resettlement and displacement has been of growing concern for donors (see Dwvedi, 1999; Cernea, 1988 and Cernea and McDowell, 2000).

[8] As mentioned in Chapter 4, in 1994 a few WUA leaders from systems where joint management was being implemented, were given the opportunity to visit Philippines: two of the them were from West Gandak.

[9] It is considered to be the most powerful committee in Parliament, which oversees government expenditure.

8

Organizational Change and Evolution

The policies and projects for transferring irrigation management in Nepal were aimed at creating new local organisations to manage irrigation. This thesis has argued that such functionality first depends on their wider evolution and recognition as a new form of local governance, in which their political capabilities will also evolve. This chapter reviews the evolution of the new organisations after their handing over. It reviews how elections and new committees were used to bring change in functioning of the WUA, but also how WUA representatives networked in wider politics and told actions that both defended their systems and built their recognition. It also examines how internal personal agendas and power politics stifled some new management options, rather than creating a new management force. The relation between technology and institutions is partly seen here in the forces shaping institutional evolution, but the everyday interactions in water management and the new institutions is studied in the next chapter.

The chapter shows that local governance needs actions beyond the local level (but see Ostorm, 1992) and political accountability[1] of the actors (Kloezen, 2002). Organization needs legitimacy and power for local credibility and acceptance. These build up through visionary leadership that allow local rules to expand and develop future visions, and with recognition from wider administrative and political institutions (Chapter 7). These are often related in political action, and organization will continue to seek resources and legitimacy externally for their survival. The WUAs thus acts as a platform to increase local social and political power, and people use their social status and political power to be elected in the WUAs and use this status further to expand their economic and political networks for the system sustainability (ibid). However, chosen structure and administration and processes involved make a difference to their evolution, in which project support plays a role. The participatory processes of IMTP did influence initial conditions and options to build functional and representative institutions, and project failures in the IMTP did shape initial weaknesses in new local management.

8.1 Changes and Evolution in Panchakanya

The Panchakanya WUA evolved as a two-tier organization: the MC at system level and the BC at the branch canal level. The GA, the policy-making body of the WUA consisted of 45 members elected from the constituent branches and outlets on the basis of area under irrigation – one member to represent in the GA from 15 *bighas* (10 ha of land) under irrigation. The MC constituted of 13 members including the Chairman, Vice Chairman, Secretary and the Treasurer. These four executives were to be elected from among the GA members whereas the 9 chairpersons of the constituent BCs were to be ex-officio member in the MC.

The second election of the WUA was held in May 1996. As in the first election members in the MC and BC, including the four executives of the MC were selected by consensus. One of the engineers from the project office was the election officer during this election. However, the WUA used to prepare all the necessary documents to hold an election, like preparation of the voter list and time and venue of the election.

The same persons were re-elected in executive posts, as farmers found this group most balanced in terms of power sharing, and were satisfied with them for their negotiations with the government. All the executive members in the WUA were active in other parts of local social and political life. The Chairman was well respected as he negotiated with the government during rehabilitation and expansion in 1974 and 1988. He had been in leadership from the beginning of the (informal) WUA formation in 1988. He had been Chairman of the District Farmers Association in the past, and a supporter of the major political party, the Nepali Congress. Farmers wanted to keep him as Chairman because of his significant involvement in many arenas of power.

The Secretary was from the United Marxist and Leninist (UML) party, another major political party in Nepal. He was equally active locally in other social affairs. He was trained by the project in maintaining the accounts and other administrative jobs, and was equally knowledgeable in water distribution and the constraints of the system. The Chairman and the Secretary are the two most vital posts in any WUA. Here, they were from two large but rival political parties and farmers saw this as a strength of the WUA.

The Vice-Chairman was selected from the native *Tharu* Community and had a strong base within that community. The treasurer was a schoolteacher and well respected locally. Local farmers appreciated the balance between political and ethnic groups and that all members were active in several areas of local social life. Farmers also found the WUA successful in negotiating the Action Plan and subsequent rehabilitation.

Changing WUA configuration

Before the third election, there were several changes in the WUA structure. The changes were made immediately after the system was handed over to them in December 1997. There were two reasons behind these changes. First, to match the WUA with the changes in the structural attributes and operational plan brought through the IMTP intervention. Second, to increase women's involvement in the WUA.

The changes in operations (see chapter 9) brought new management requirements to the organization. The increased water availability, as a result of improvement work which controlled the massive seepage led to a gradual increase in the irrigated area, especially during the spring season. This required more management input on the part of WUA, especially in co-ordinating the water distribution inside the branch canals (will be discussed in section 9.1). This necessitated the formation of outlet groups below the branch canals. The increased water supply also made the eighth branch canal, abandoned before, interested to join the WUA and so it had to be included in the system.

The WUA also found a problem in co-ordinating water distribution among the 10 direct outlets, which receive water directly from the main canal, which did not have their own committees to look after the water management[2]. The outlets were at different locations in the main canal and their committees (the two BCs looking after these outlets) had failed to maintain the water distribution inside the outlets. Instead of two BCs representing the 10 outlets, the WUA realized that it would be better for each outlet to have its own outlet committee to distribute the water below the outlet.

The WUA took the initiative to have a greater role for the women in the WUA for three reasons: time, donor requests and women themselves. The ADB, the USAID and the government wanted a wider role for the women in the WUA. Local women groups were interested to join the WUA, because of the recognition of the Panchakanya WUA locally.

The Panchakanya WUA office was established in January 1996 and since then its local recognition increased. Since its establishment, its executives (or representatives) were invitees in the local or district level functions like the Municipal Assembly meetings, Ward meetings, and other public forums. The local Municipal office also later on negotiated (finally agreed in February 2001 only) with the WUA to rent its land on the headwork to start the weekly market. Some locals were also contacting with the WUA to start a fish hatchery in the reservoir upstream of the headwork (final agreement made in March 2001). The DAO also started targeting its training activities at the WUA.

In Chittwan, women groups were very effective in controlling alcohol abuse, and in creating awareness among villagers about the importance of primary education and personal health care. It is the district with the highest women literacy rate in the country and recently, a study (published in a local newspaper) shows more girls attending primary school than boys. Women riding bicycles, both young and old, is common in Chittwan, a rare phenomenon in rest of the country. As the WUA became an established institution, women also wanted a wider role in it.

The new WUA structure and elections

Because of these new requirements, the constitution of the WUA was changed in December 1997 by a general Assembly meeting immediately after the system hand over. I was also invitee in this GA meeting.

This new structure was intended to bring as many persons as possible under the umbrella of the organization so that people would know about the WUA and pay the ISF. The number of GA members was increased to 110 up from 45. Besides one representative per 10 ha area, executives (Chairman and Secretary) of the concerned branch, outlet groups were also made GA members. Women representatives were allotted 20% of the GA seats. Details of the debate on how to increase female membership are given in Box. 8.1. The numbers of MC members were increased from 13 to 16. Separate outlet groups were formed for the 10 outlets taking off from the main canal. Their representation in the MC was kept at two, as in the past. Out of the 16 members in the MC, 10 were from the eight branch canals, with one extra seat each for branch canals 1 and 5 because of their larger command area. Two members were from the 10 outlet committees and one women representative was to be elected by the GA. The remaining three were the executives of the WUA: the Chairman, vice Chairman and Secretary and were also to be elected by the GA. The post of the treasurer was removed, and the job was transferred to the WUA Secretary.

The third WUA election was held after this amendment in October 1998. The same persons were again elected as Chairman and Secretary of the WUA, and 50% of the members were the same as in the old committee. The Chairman, who was elected by consensus, wanted to be relieved this time, as he thought he was too old for the post in his mid- seventies, and had been Chairman for so long. But later, he agreed to retain the post as all farmers wanted him to stay because of his earlier contribution. The Chairman told me that he also decided to stay because this post has given him social and political status: everybody in society respects him. He is also known among the DOI authorities, the NGOS and INGOS working in the Nepal irrigation sector. Though too old to expand his political career, this post has provided him an opportunity to retain his symbolic value within the society.

There was however balloting for the post of the Secretary. A supporter to the Nepali Congress Party (the same party as the Chairman) stood against the then Secretary, who was from the Communist party. But the sitting Secretary won the election. People favored him again because the same pair (the Chairman and Secretary) had worked for the last years to the satisfaction of the farmers. Farmers see this combination as the strength of the WUA, and that it works effectively because of the dynamic leadership of these two persons, belonging to rival political parties. Shukla *et al.* (2000) also cast a doubt whether the WUA could work if these two people left the WUA.

Box 8.1 The GA meeting to change WUA structure

The meeting was held in front of the WUA office. At the beginning, the Secretary explained about the need to change the WUA configuration. He explained that as the system is just handed over, they needed to bring more people into the GA so that they would know about the WUA activities and pay for the system. He also explained why they needed to form the outlet committees to help implement the strong rotational pattern. The members knew the Secretary as the man involved in system operation as well as in fee collection from users. So the members accepted his explanations, and his proposal for the new structure with outlet committees was passed without much discussion.

Then a debate began in how to increase the women members in the WUA. It was interesting to observe that all were in favor for increasing roles of the women in the WUA, but nobody was clear on how to do this. Everybody knew the obstacle: the membership was based on land ownership which was attached to men. One of the GA members said that they should transfer part of their lands to their wives and encourage them to become members. But this was not practical, everybody laughed at him for being too emotional. Another option, tabled by another member was to let the male and female decide who would be member from the house. The discussions continued up to the evening with no solution to the issue.

The meeting continued on the second day, although I was not present. I learned from the Secretary that they made a provision such that the member can transfer part or whole of his share (in Panchakanya 1 ha equals to 60 shares) to anyone and recipient could then be a member to the WUA. This opened the door for women to be member s of the WUA without owning land in their name, but it still requires to get concession of the share from their husband.

However, the structure prepared at the time of the third election proved cumbersome, as there were too many members involved in different tiers of the organization. Hardly any meetings were held in lower order committees. The numbers of members were thus lowered after another amendment in 2000, although the structure has remained the same. The change in the membership numbers of the WUA in successive election is shown in Table 8.1

TABLE 8.1 The changing WUA membership arrangement

Committee	*1st election May 1994*	*2nd election May 1996*	*Third election Oct 1998*			*Fourth election Jan, 2001*		
			M	*F*	*Total*	*M*	*F*	*Total*
MC	13	13	15	1	16	14	1	15
BC	45	45	32	8	40	35	21	56
Outlet canals	-	-	40	10	50	8	20	28
Outlet groups	-	-	105	30	135	0	78	78
GA	45	45	72	38	110	22	67	89

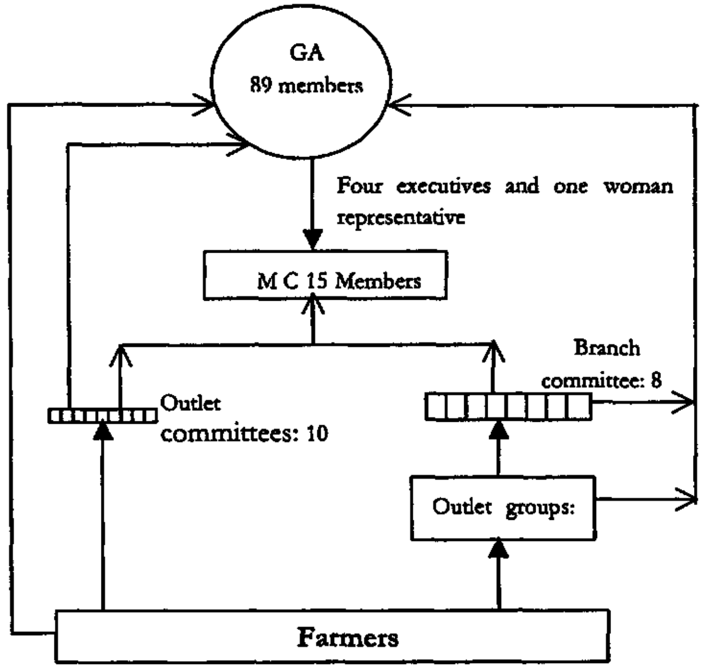
Source: WUA Records. M: male, F: Female

The table shows that lower order committee members are now dominated by women representatives. According to the WUA, the women members were more effective in convincing the farmers to pay the ISF and creating awareness among the farmers to keep the canal clean and not to encroach the canal. The present structure of the WUA is shown in the Figure 8.1.

The composition of the WUA as a result of the changes are summarized below:

- The WUA now has three tiers of organization: the MC at system level; BC or outlet committee at the next lower level; and outlet groups below the branch committee. However, ISF collection is done by the MC only and branch and outlet committees only carry out water operations within the branch or outlets.
- The MC members are formed from representatives of the eight branches and 10 outlet committees. The executives of the MC are to be elected by the GA. Besides, a woman member would also be elected by the GA as a MC member.
- Each BC and outlets has 5 members with one compulsory woman member
- The GA includes executives of branch and outlet committee besides, the elected members.

FIGURE 8.1 The present WUA in panchakanya



The fourth WUA election was held in January 2001, after the second amendment in its constitution. The Chairman and the Secretary were again the same persons, showing continued support from the farmers. The secretary is now paid (Rs.1500 per month) for performing the administrative and finical management of the WUA.

The Panchakanya WUA has expanded its administration and structure, for which the project support played a crucial bringing better water delivery and operational preferred by the farmers. The changing structure has allowed institution to reform itself as seems best for the organization and its members. The PIS had already a visionary leadership in place, shaped by the existing local social norms, that was accountable to its members addressing local concerns and needs, which further added legitimacy and power to the WUA. The next chapter will further show how this was able to deliver positive changes in water management.

Increasing roles for women in Panchakanya WUA

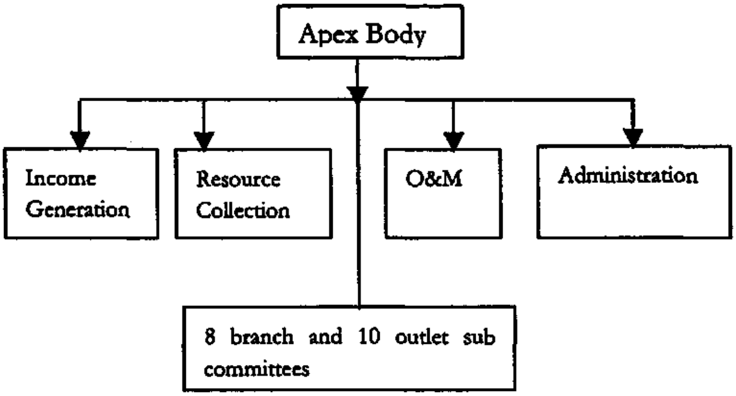
The reasons for the initial lack of women's involvement in the WUA processes is that there was no guidelines and framework for this in the project. Of course, there were sentences like 'women involvement would be given due attention' and 'they would be encouraged to involve in the WUA' in project papers and documents. The Irrigation Policy also states that at least 20 % women representation was required in the WUA. But in practice, this was not being done at the beginning, when no system had a single woman in the MC.

But implementers like me have a different dilemma. I was hardly aware of the issue at first because of my technocratic background and bureaucratic orientation. Once two USAID officials, on a mission to the project, asked me why there were no women in the WUA. I had never thought about the question nor had an answer. But from my own perception, I told them that activities like water distribution and system maintenance are likely to be a male job. I continued to believe this until I read Zwartveen, 1995 and realised that all activities of irrigation could be shared by men and women).

It was only during the GA meeting in PIS (se Box 8.1) that I could understand the problem behind women's' participation in the WUA, in that a water right is attached to land right mostly owned by the male head of the family. There were several recommendations for women involvement by the consultant, donors and also policy papers by the government, but removing this major hurdle has been nowhere mentioned[3].

In Panchakanya, the change in constitution made it possible to increase the numbers of women representation in the WUA, as seen from Table 8.1. But the real change in their activity came only after the involvement of an NGO in helping the women to form a group and move ahead. In October 2000, the NGO formed a committee called the 'Women Helping Group' to help women members take an active role in irrigation management activities. According to the Secretary of the WUA, the group was formed through the joint effort of the WUA and an NGO called 'Women Plus'. I came to know later on that the ADB had supported the NGO for promoting women's role in Panchakanya. The structure of this group is shown in Figure 8.2.

FIGURE 8.2 The structure of the Women Helping Group in Panchakanya



In the Figure, the function of the training and income generation group is to increase the income of members through capacity development in agriculture by means of training and credit facilities. To start the credit program, the group has already opened a bank account. The function of the resource mobilization committee is to help the WUA in collecting the ISF by raising the awareness among farmers to pay for the system. The subcommittee for operation and maintenance was created so that the operation and maintenance activities below the main canal would be gradually taken over by these groups. The administration sub committee was meant to carry out the daily administration of the helping group.

According to the WUA, this group has been effective in convincing the users to be members of the WUA and pay ISF as well as creating awareness among the farmers about the importance of canal cleaning and maintenance activities. I observed an active involvement of this group during the fourth election in Jan 2001. The 60% representation in the present WUA (considering all the tiers, see Table 8.1) would not have been possible without the involvement of them.

The WUA report prepared by the Secretary of the WUA in December 2001, mentioned that the increase in the membership of the WUA, ISF collection and the maintenance fee in the years 1999/2000 and 2000/2001 (see section 9.2) have been due to effort of the women's helping group. I also saw a 500m long tertiary canal constructed with the initiation of this group. The WUA say that 61 new members joined the system after this construction. I had also two more opportunities to observe for myself the activities of this group in the Panchakanya.

The WHG is now getting support from the other government institutions and NGOs especially in training and capacity development activities. Immediately after their formation, they were given seven-days training on canal management, leadership development, office administration by the NGO. As part of the training and awareness program, the group also organized an awareness program inside the command area for keeping the canal in proper condition. There were about 500 women in this campaign, and they travelled from head to tail of the main canal telling the farmers not to encroach the canal embankment, nor to throw remains of dead animals, broken glass, plastics and other wastage in the canal. Local farmers feel that this awareness program has helped to keep the canal clean. When I visited the system later on, I did not find much change in the condition of the canal, but for two visible changes: nobody now put his buffalo into the canal and encroachment of the canal embankment had reduced.

On April 2001, the women's group asked the WUA to call for a GA meeting of the WUA. The reason was that part of the springs in the catchment were diverted by the adjoining farmers which had caused the decreasing water supply at the source. This was peak season for the early paddy transplantation and I was there to see the canal operation in this season. Due to ongoing training and capacity development activities the women members were in regular contact with each other and they able to call the meeting quickly. The recently completed awareness campaign had also encouraged the groups to call the GA meeting where they decided they would visit the field and took necessary action. Two days after the GA meeting, the WHG organized themselves and together with the WUA, moved to the catchment and dismantled the diversion made by the farmers to divert the springs. The farmers said that they would not repeat this in future.

The problem of land ownership is not going to be solved in the near future. Talks are ongoing in Nepal regarding women's rights over the property of their parents. The newly changed legislation has made it clear that daughters would also share property with the sons, but has to be returned once she is married. Further discussion about this is beyond the scope of this book. But it seems unlikely that the majority of women will have land ownership in the near future. That means WUA will continue to be dominated by men unless they intentionally enable female representation.

The Panchkanya arrangement for transferring share concessions is one step ahead in resolving the problem. But the head of the family has still to transfer the concession. This has worked in Panchakanya because of a relatively aware and educated society. Formation of a separate Women's Group and taking part in irrigation can also be another approach. This group can involve itself to other income generating activities besides involving themselves in the irrigation activities, or encouraging the women to involve in the WUA.

8.2 Changes and Evolution in Khageri.

Khageri has not seen the level of changes in structure and responsibility as Panchakanya. There has not been much change in water availability scenario to drive change, nor demands for water users for different representation. Indeed, there has been ongoing concern over water scarcity, especially given the resettlement struggle.

By January 1999 there had already been four elections in the Khageri since its first in 1993. I had just become involved with the Khageri at the time of second election in January 1995. The representatives at all the levels of WUA, the MC and BC were chosen by consensus this time: previously, the three executives were selected through balloting. The same persons were again selected for the executives of the MC.

The GA members who elect the executive posts cited three main reasons for the selection of the same group of people as executives. The first was that these people had two years' of experience in the WUA. It was time to negotiate with the government for the management transfer arrangement and the presence of the same group was considered essential so that they could put into practice what they had learned and experienced in the first term. The two-year term was realized as a very short period to gain experience.

Also farmers were satisfied with the way the WUA had co-ordinated with the agency in system operation and maintenance. They gave the example of how the WUA saved Rs. 365,000 rupees out of the contract with the government and kept in the bank account (chapter 4). Thirdly, farmers felt that the committee was able to maintain the equitable water distribution and were accountable to the farmers. Just after the formation, the MC took control over the operation of the system from the government. The WUA had decided to do so thinking that unless they had control over the main system operation, equitable distribution among the branches would not be possible. According to local farmers, the MC worked hard to maintain the equitable water distribution in the system[4].

Though elected by consensus, all of the executives and the members had political attachments with either the Nepali Congress or the Communist party. The six members from the Branch Canal B_1 to B_{6e} were from the Communist party whereas the remaining six members were from the Nepali Congress party. The three executives were all from the Nepali Congress party, as this party had majority support in the WUA. Likewise, almost all the members were already attached to other organizations and were visible in wider society. Usually, they were members of the primary school board, the forest group, the local political party or their affiliated institutions[5], or the local Red Cross society.

However, I never found any single incident of (party) political domination in the Khageri during my stay in the years ahead. The decisions in the MC and in GA were always unanimous despite their political differences, though it required several rounds of discussions and negotiations. From the beginning of the action plan preparation (chapter 5) to the different Court cases described in Chapter 7, the WUA was always united.

I was present at the third election in January 1997 as an observer from the project office. The administrative support for holding the election was also provided by our office as in Panchakanya. This time there was no consensus for the posts of Chairman, Vice Chairman and the Secretary and election (by ballot) was held. In the past elections, these posts were held by the Nepali Congress party whereas the 12 MC members were equally divided between the Congress and Communist party. In this election, the sitting Vice-Chairman showed his desire for the post of Chairman. A well-educated man and owner of a boarding school, he claimed to provide better leadership in the WUA. However, the existing Chairman was also interested to continue the post. Since both of them were from the same political party, the Vice-Chairman abandoned his idea to run for Chairman at the very last moment of the election. Besides this, many farmers opined that the Vice-Chairman had insufficient time for the WUA if he became the Chairman, as he also runs the boarding school. This forced him to abandon his plan to run for the post of Chairman.

But this time, the Communist party decided to fight for the posts of the executives as these were always taken by the Nepali Congress. Because of this, there was no consensus and election (through ballot box) was held for these posts. The previous group again won the election. Farmers already knew that the old group would win because the GA was dominated by supporters of the Nepali Congress party. One member of the WUA who was supposed to be a Communist party supporter told that they knew they would lose the election, but still they nominated their candidates to boost their identity in the society.

In the fourth election, in January 1999 the same persons were elected as Chairman and Vice Chairman, but the Secretary was changed this time[6]. He however, belongs to the same political party. Since the last election, the tenure of the members of the WUA members has been also increased from two to four years. The need to change the tenure had already been felt by the WUA since the time of second election, as a two-year tenure was found too short to build plans and programs and a vision for the future. However, it was not changed then as many farmers thought that the initial phase provided an opportunity to a wider group of people to be represented in the WUA, and learn about the participatory process and the irrigation system. Only after the third election was the constitution of the WUA changed to a four-year tenure.

Here also the same persons are elected in the executives post of the WUA in successive elections. But there are sign of change in that the secretary is replaced now. It is interesting to observe why the same group is re-elected over and over again. There are two factors explaining this. First, why do farmers keep on choosing the same persons and the second is that why do leaders seek to retain their posts?

About the first question, farmers in Khageri believe that the leadership in the WUA have been working well. They give the example of the way the leadership pressed the government on the resettlement issue. The WUA was also able to establish a network with the National Park (the first few kilometres of the Khageri canal lie in the National Park) and other government offices in the district. The national park authority has already supported the Khageri system with more than a million rupees. As the main canal was not transferred to the WUA in Khageri, the canal embankment forest was also not handed over to the WUA. But the WUA convinced the District Forest Office, and took control over the forest resources since 2000. The WUA also regularly organizes workshops inviting all the district level offices to establish network for future co-operation.

In parallel, farmers are also satisfied with the current water allocation practices, which will be dealt in next chapter. The survey by Wallingford (2001) shows that there is strong support for the WUA in Khageri as shown in Table 8.2. A 72% of the farmers agree that the committee does a good job and 80% of the farmers agree that there is a good co-operation between the committee and the farmers. Likewise, the agency personnel are also supportive of the WUA: 87% say that there is good co-operation between the DOI and the WUA and 84% say that WUA gets advice from the agency as needed by them. This suggests that all parties are accountable to each other in their functioning.

People want to stay in the WUA is because of the social recognition and opportunities it provides them for further career opportunity. The WUAs in Chittwan are recognized as separate organization with their own identity. Once, when the Prime Minister was in Chittwan to address a function (can not recall the date), the WUA Chairman of the Khageri was also invited on to the stage to sit near the Prime Minister.

The Chairman of this WUA was also elected the president of the Nepal Federation of Irrigation Water Users Association (NFIWUAN). He is now Vice-President of the INPIM Nepal chapter. The Vice-Chairman is a graduate, and owner of a boarding school. For him too, it has been a place for the development of leadership. With the Chairman now engaged in the NFIWUAN, the Vice Chairman has been responsible for the running of the WUA. Local people believe that he wants to continue in the WUA because he has also bright political career ahead.

Changing WUA configuration

As in Panchakanya, the two-tier organization here is also now gradually changing into a three-tier organization, adding the outlet committee below the BC. The need to form the outlet committee here is also guided by the new management requirement and the process of outlet committee formation has been on the farmers' own initiative. Besides, the problem in holding the GA meeting inside the branch canals has also necessitated the formation of the outlet committee.

TABLE 8.2 Farmers perception on their WUA in KIS and NWGIS

		KIS	*NWGIS*
Is There a WUA	Yes	94	92
	No	0	8
	Don't Know	4	0
Are you a member of the WUA	Yes	53	19
	No	41	78
	Don't Know	4	4
Is There a GA meeting	Yes	57	38
	No	37	62
	Don't Know	4	0
Does the committee do a good Job	Yes	72	20
	No	16	80
	Don't Know	10	0
Is there good co-operation between farmers and the committee	Yes	80	23
	No	7	77
	Don't Know	11	0
Is there good co-operation between WUA and DOI	Yes	87	25
	No	4	75
	Don't Know	7	0
Does the WUA get advice from the DOI if necessary	Yes	84	30
	No	3	68
	Don't Know	11	2
How Active is the WUA	Most members	42	27
	Only a few members	45	16
	Only committee	0	0
	Only Chairman	0	5
	Don't Know	11	52

Source: Wallingford 2001

The WUA here also gradually shifted towards the implementation of strong rotational practices (see chapter 9). With this, the branch canals always receive the full discharge within it: the duration however, depends upon the type of delivery whether it is weekly rotation or the sectional rotation. Delivery from the branch to the outlets also accordingly shifted towards the sectional rotation. However, the outlets did not have any committee, and the BC members had difficulty in co-ordinating the water distribution among the outlets.

On the other hand, the farmers below the outlets had also two problems. First, they lacked the information on when their irrigation turn came. Second, they were also having difficulty in co-ordinating water distribution inside the outlets. So the outlets of the branch canals formed outlet groups to co-ordinate water distribution among the farmers as well as to co-ordinate with the branch committee.

Another reason for the formation of the outlet committee has been the administrative one. In Khageri, each branch canal has their own GA to form policies regarding the system management within the concerned branch canal. The GA members of the branch canals are the farmer members of that particular branch. According to the constitution of the WUA, at least 50% of the member farmers must be present to hold the GA meeting in the branch canals (it is the same for all the branch canals). For example in branch canal 1, there are 860 households and at least 481 members are required to be present to hold the GA meeting. Organizing a meeting with such a large group of farmers and arriving at conclusions was found practically impossible. This problem has been there since the formation of the WUA. During my stay between 1995 to 1998, I remember, only in few instances that the GA meeting of the branch canal could be held[7] at the first call of the meeting and the same trend has been continued. Most often it was cancelled for lack of a quorum.

So BCs tried to change this arrangement through the development of the Outlet Committees, such that only the executives of the outlet committee are made members of the GA of the BC. During my fieldwork, many branch canals were forming the outlet committee and it was over in B_2 B_{6e}, B_{6w} and B_7. However, these outlet committees are so far are not included officially inside the structure of the WUA, and the process for this is still being discussed in the MC. The other structure of the organization has remained the same so far.

The MC of the WUA has its office at Shivanagar and employs a regular office secretary and a peon[8]. The responsibility of the office Secretary is to look after day to day administration and record keeping. The MC meets regularly on the first day of each (Nepali) month. Informal meetings are also arranged depending on the need.

The Khageri WUA has also matured to its administration and structure. A WUA can not be designed as an apolitical body, party politics often enter in the leadership selection, as it increases social recognition to both leaders and the political party. However, these are not necessarily problematic, the main issue is how the leadership maintain accountability to the farmers and to the agency and vice-versa. The Khageri also shows how external support and networking play role in the evolution of the WUA.

8.3. Changes and Evolution in West Gandak

In Chapter 4, I explained how the first election in the West Gandak was dominated by the party politics, and this has continued in the NWGIS since then. People in the area say that the second election of WUA was more dominated by the party politics than the first. One JT (Junior Technician) of the NWGIS, who was directly involved in the election told me that most of the local political figures including the Member of Parliament were present during the election to influence the voters in favour of their concerned political parties.

The candidates for the post of Chairman of the MC also used loudspeakers, printed pamphlets and hired vehicles to campaign on their behalf. On the day of the election, the GA members (who were the voters) were provided with transportation facilities by each candidate. There were three candidates for the post of the Chairman and only one of them used motorbikes: the others hired jeeps. Local people said that each of the candidates for the post of the Chairman spent more than fifty thousand rupees in the campaign. It is also said that there was a large crowd inside the West Gandak office compound where the election was being held. The police were called in to maintain (likely) violence at the time of election. Local people recall that it was like an election for a Member of Parliament.

New persons were elected in the post of executives of the MC including the Chairman. Local people say that all the executives were from the Sadhvabana party, which had a stronghold in the area and a majority in the GA of the WUA. However, by the constitution itself, the GA members were not allowed to contest for the posts of the four executives. They were to be selected from the 35 member representatives of the MC: as this was also dominated by only 19% of the command area, the selected key figures could easily capture the posts.

The increased influence of the party politics at this second election was due to two reasons. The first is that the rehabilitation activities were about to begin. That means the Chairman would have access to resources and being the Chairman one could influence the priorities in the improvement work. Another reason is that the WUA was also looked at as a platform to build a political career. To be a president of the WUA in the West Gandak is to be farmers representative for the 22 VDCs and it cover 2 parliamentary constituencies. There was no organization of the scale in the area that could provide opportunity of leadership for such a large group of people. This made the Gandak a WUA very attractive venue to aspire for the future political career.

Change in WUA configuration

By the time of the third election (February 1998), the WUA themselves realized that the WUA structure was ineffective. The lower-order committees, that is the *Tolis* and *Upatolis* were almost non-existent. Shukla *et al* (2000) notes that people aspired to be elected in the upper tiers of the WUA only, nobody was willing to work in the lower tiers. Because of its unitary configuration (chapter 4), representation in the lower committee was acquired to fight for the upper-tier post or support the candidate belonging to his party.

Another problem was that mostly the MC meetings used to be cancelled for lack of a quorum and even when held, only a slim majority was present. This was mainly because of its unequal representation. As explained, about 19% area covers more than 68.5% of the MC membership. This area hardly had any problems of water availability and even in difficult years, they managed to get water as they are small canals directly drawing water from the main canal. Table 8.3 presents the WUA attendance and the type of decisions made by them.

The Table shows that there has been very low attendance in the WUA meeting. That is to say, only few individuals were making the decisions in the WUA. Another point the Table shows is that the WUA has not seen itself as an organization responsible for water management, as there are hardly any discussions on canal operation and water distribution.

TABLE 8.3 Members attendance in the main committee meeting

Meetings Held against the target	*Average attendance in the meeting*	*Presence of key personals*	*events when more than 85% were present*	*Type of discussions*		
				O&M	*Financial matters*	*Conflicts/others*
60%	55%	60%	20%	20%	50%	30%

Source WUA minutes books.

Meantime, with the handing over of the system management, a new water delivery pattern was designed in the West Gandak (see Chapter 9). According to this plan, the main canal was divided into four sections to co-ordinate the water distribution in each of these regions areas. Accordingly it was also necessary to form regional committees of the WUA. Because of all these new requirements, the structure of the West Gandak was also changed before the third election was held.

The first and most important change made in the WUA was the formation of a 'Management Committee'. The committee would be formed out of the members of the MC representing all four different canal regions, and would look after the system O&M. In this new model, the MC members would be called a 'board of directors' and the Management Committee members were to be selected by them. The concept of the Management Committee was generated by the consultant, as it was found impossible to move ahead with the large number of MC members (now called the board of directors). This new structure was aimed at changing the WUA towards a management model similar to the American Model (Freeman, 1989) and practice in Mexico (Kloezen, 2002) in which the board hires managers and technicians to carry out the daily activities of the canal O&M. However, the difference here was that they were again from within the WUA body and thus could not escape from wider politics within the WUA. At the same time they too lacked knowledge of canal O&M.

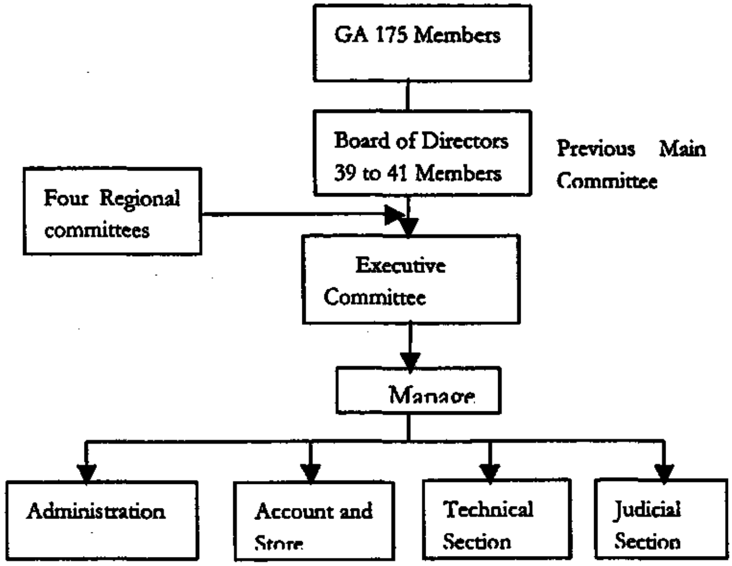
The Management Committee was designed to look after the daily management tasks of the WUA. It would contain five members among which one would be appointed as manager. The others would look into legal, financial administrative and technical matters of the WUA. With the formation of this committee, it was also decided that the regular meeting of the WUA (or the board of directors as now called) would be called only once in two months instead of a regular monthly meeting.

Another major change was made from then on: the GA members were also allowed to stand for the posts of Chairman and Vice-Chairman, previously restricted. This had been the weakest point in this WUA and had resulted in limited participation in the leadership. With the executive committee assuming the daily management of the WUA, the post of the Secretary was removed from the WUA. The MC members (now called Board of Directors) was increased to 39, adding four women representatives[9] and the total number of Board of Directors may increase to 41, if the Chairman and the Vice Chairman are elected from within the GA members. Another change made was the addition of the four regional committees to look after the water distribution inside the four regions. The new arrangements of the WUA is shown in Figure 8.3.

The third election of the WUA was held in February 1998. The election this time too was shaped by Party politics. However, Shukla *et al.* (2000) note that the influence of political leaders were less this time as compared to past. The reason, according to local people was the completion of the system improvement activities. Yet the money spent and the type of campaign using printed pamphlets and loudspeakers were same as in the previous election. The lower tiers of the organization have remained the same as presented in chapter 4, and are not shown in Figure 8.3.

Both Chairman and Vice-Chairman again changed, and both of them were high-level political leaders in the district. The Chairman was from the Sadvabhana party, as was the past Chairman. Local people say that the past Chairman was not favoured by his party because of two reasons. First, he had already been elected to the post of the Chairman of the VDC. Second, the current Chairman had recently shifted to this party from another rival political party. He had no public post and so he was favoured for the post of the Chairman in the WUA.

FIGURE 8.3 The New WUA structure in West Gandak



The Vice-Chairman was from the Communist Party. He had stood for MP in the last Parliamentary election and lost. This shows that even national level politicians prefer to be in the WUA of West Gandak. As the post of the Chairman and Vice-Chairman were now to be elected out of GA (after the change in constitution), we can also see how power is divided between two rival political parties, which used to be limited to particular political parties in the previous elections.

From this time, the WUA board was to hand over its responsibility to the five members Management Committee which was to be selected by the Board of Directors. The person selected for the post of Manager of the Management Committee was the first Chairman of the WUA. It is interesting to see a past Chairman assuming the post of the Manager. But he shared his view that the Manager would be now the most important person, visible to the farmers and because of this he accepted the post. But this Manager was from different political party, from both Chairman and Vice-Chairman who did not transfer the power to the Manager. He left the job after few months, as he did not receive the support from the key figures in the WUA.

A new Management Committee with a new Manager was then selected from the board of directors. In my fieldwork in West Gandak, I found this manager very committed to his work and was interested to improve the situation in the West Gandak. He tried to implement the new water distribution practices and timely repair and maintenance of the canals and structures. But he too could not work. The WUA Board of Directors were supposed to give the necessary authority to the Management Committee regarding finance and administration, which they never handed over. They feared loss of power. The major problem to the manager was that there was no money with the WUA, as there was no mechanism to collect the ISF from the farmers (se Chapter 9). The situation was such that he was blamed by the farmers for not being able to run the canal, whereas he had neither the authority nor the resources to perform management activities. So after about a year, he also quit the job.

The first Chairman, who was made Manager of the WUA first time was again made the manager. The same person was requested this time to work as Manager as he had the experience of the system more than others. For him, it was again an opportunity to establish his position in the WUA and society.

The new structure however, could not bring any change in the service but increased the complexity of management. The reasons were: first the Board of Directors never handed over the authority to the Management Committee, fearing loss of power. Papers relating to past expenditures and income and other administrative processes were never given to this Management Committee. Secondly, the Management Committee had no resources to carryout O&M activities except the fund provided by the government, which was not enough. They were also not able to use this money due to lack of authority. Thirdly, they were again from within the Board of Directors, not professionals having knowledge manage the system.

In next chapter, I will show that the attempt to improve the irrigation management through WUA development and the system improvement could not bring change in West Gandak, for which Party politics has often been blamed. However, I disagree: despite the influence of the party politics, there was considerable strength inside the WUA. Except the present Chairman, the past two Chairman were common farmers with marginal land holdings. The present Vice-Chairman is also from a lower caste group and a subsistence farmer. Though the socially and politically active people were in the WUA, they were not landlords and a local elite

Because of the scale of the project as compared to Khageri and Panchakanya, a wider political influence in the WUA is not unexpected here: a comparatively rural society and lower political awareness, divisions in caste and ethnicity further helped political influence in the WUA. But its failure I argue, is due to poor project structure and lack of accountability and policy gap of the government as explained below:

According to the government, they had handed over the system because of the strong demand from the WUA. But I found no reason to justify belief that the WUA could operate and maintain the system. At the time of handing over, only 29% of the farmers were the members in the WUA (according to the Audit report 1997/1998). Poudal (1998) reports 35% membership in the WUA at the time of handing over. That means a majority of the people were still not members in the organization. The data in Table 8.2 also supports this, as only 19% said they were members of the organization. The Table also shows the low recognition of the WUA in the society.

The WUA, who was supposed to takeover the management responsibility had so far (until at the time of handing over) no experience of system O&M. So far it was only involved in construction supervision activities. Besides, the WUA here was constantly changing, and no one had knowledge about the system. It was only at the time of handing over that a need to form a Management Committee to look after the operation and maintenance was realized. But this too, was from within the MC, and could not function.

Since its formation in 1993, there was no increase in ISF rate and its collection efficiency. As it will be seen in chapter 9, the collection efficiency was about 21% and the rate of ISF was eight times less than what was required to operate and maintain the system. There was no planning on how the system O&M cost would be generated. For the WUA, this is the most conflictive role which they definitely wanted to avoid.

In this situation, what led the government to believe the WUA was capable to manage the system? The organizational and managerial requirement to govern and manage water in such a complex system environment was overlooked, and this led to the collapse of new governance.

8.4 Exploring Future Prospects: the Development of the WUA Federation

Despite the different dynamics of IMTP in irrigation systems, the creation of the WUAs and handing over of the system management also gave these WUAs an opportunity to develop into a National Federation. The Irrigation Policy mentioned that the government would promote a federation of the WUA at the national level: this turned into reality with the implementation of the IMT in large irrigation systems. The federation of the water users association was born in 1999 during a national level INPIM[10] seminar.

The INPIM Nepal Chapter organized a three-day seminar to review the status of IMT in the country in November 1999. The meeting was inaugurated by the then Deputy Prime Minister (who was also looking after the Ministry of Water Resource) and participated by professionals from DOI, officials from Ministry of Water Resources (MOW), professionals, academicians and consultants involved in irrigation development in the country. I was also present in this meeting and was partly responsible for arranging it as it was held in Chittwan. The WUA leaders from different irrigation systems where the joint management program was being implemented were also participants of the program, as were key INPIM representatives[11]. This was the first occasion in which large numbers of WUA leaders of many irrigation projects were together. They utilized this opportunity to form a federation of the WUAs at National level. During the workshop itself, they formed an *adhoc* Committee of the federation which was chaired by the Chairman of the Khageri[12].

The Federation later got support from Ford Foundation through a local NGO, which arranged a workshop in Rajapur to discuss the future course for the federation. The constitution of the federation was completed by 2000 and got registered under the name of 'National Federation of Irrigation Water User's Association, Nepal' in March 2000. The federation held its first election in April 2000 during a national level conference of its members. By that time there were already 37 district level committees as its members. The federation is also supported by the DOI in its capacity development programs. The federation has taken part in INPIM seminars and other international conferences

However the objectives of the federation are not fully clear. In Colombia, for example, a WUA federation emerged with a clear vision to prepare the WUA to take over management of the irrigation district from the government (FAO). The federation is financed by the member WUAs and it hires lawyers to assist with transfer negotiations and engineers for technical problems. The objectives here are clear: the federation would increase the ability of farmers to lobby more effectively for their interest before the government agencies and in political fora. The Federation in Nepal immediately came under NGO funding and its own resource collection mechanism has not evolved yet. There is a provision that each district committee of the federation would pay the fee, but it has not been effective. Likewise, how and where it would represent farmers has not become clear.

A further drawback, pointed out by many professionals is that the federation, by its constitution itself, originally restricted many of the WUAs to become the members. The constitution originally allows that only those WUAs who are registered with the government (registered under the Water Resources Act) to become members. This provision has been changed now allowing any WUA to become member in the Federation.

8.4 Conclusions

The chapter has shown that institutions are dynamic, that changes in one water control areas bring change in another: this brings new management requirements. Project support makes a difference in facilitating the change and supporting the administration structure for organizational expansion. Project support can ensure that new organisations have clear information on their systems, and clear responsibilities at the time of transfer need to present at all system levels. Projects need realistic expectations of the WUAs they work with, and projects should be valued for their response to the WUA, rather than the targets of donors.

Both local social structure and wider external support play a key role in shaping the local governance, which been often overlooked in institutional design principles. While local social dynamics shapes the pattern of leadership and its recognition, the wider support from external political and administration help execute decisions and get support for water management, that also adds to local credibility and acceptance. The WUA therefore will continue to develop economic and political network among the different WUAs themselves and among the WUA and other political institutions. Farmers' effort to develop the Federation of the WUAs was in search on this direction. Because of these wider political activities embedded in organizational evolution both at local and external level, people use their already earned social and political status to be represented in the WUA and use this position to expand their social and political network. As we saw in all the cases how farmers used their social status to be elected in the WUA and how they used it to get wider recognition. The Khageri chairman got elected president of the federation because of being a chairman of the Khageri. On the other hand, Khageri is recognized to wider society because its president is chairman of the federation.

There is a need to change the official view on the WUAs as non-political, non-partisan bodies looking after the water management activities. They are delegated governance roles, and to be effective in organizational development and water management, they need to evolve local governance and execute decisions not only on water, but on production and through this, livelihood and welfare. It must thus be looked as an organization that provides power to bargain and negotiate with the government and with other agencies and provide an opportunity to build up social and political career. Because of these opportunities, party politics also often enter in the WUA development process. However, they may not be always dominant in all affairs as shown by both Khageri and Panchakanya. The dominant role of party politics can be problematic too, as shown in the Case of West Gandak, especially when there is lack of accountability between the key actors involved: the irrigation agency, local users and the WUA. The political activity needed to sustain local governance have to be accepted, rather than ignored in program design.

Notes

[1] Political accountability here is seen as how providers of irrigation service are liable to show that they have followed agreed upon arrangements for decision making, user representation, leadership selection and equity and democratization targets (kloezen, 2002).

[2] In the previous WUA structure, the 10 direct outlets from the main canal were divided into two different BC (one committee for outlets 1 to 5 and another for outlets 6 to 10) to represent them in the MC.

[3] There are few discussions in the DOI regarding women's role in the WUA, and only occasional seminars and workshops. To carry out research on women's involvement in irrigation, the USAID hired a foreign and a local consultant, who were based in the project office in Chittwan. In one of the training programs, I requested the team to come up with some recommendation to represent women better in irrigation design under prevailing socio-economic conditions, and find what legal, institutional or other actions are required for this. Their report gave the same recommendations on better representation and involvement in decision making, but no practical means to achieve this! To my knowledge, there are rare cases in which both male and female of the household are given membership in the WUA.

[4] The Khageri was under joint management, but canal operation was carried out by the WUA themselves, but with financial support from the DOI.

[5] Each political party has their own sister organizations representing farmers groups, youth groups, women groups, student groups etc.

[6] The secretary was very gentle, older than others, but less dynamic compared to chairman and vice chairman and he was intentionally removed.

[7] I was always invited to the GA meetings of the branch canals, I personally attended many of them and when I was out of the office, one of our engineers used to participate in the meeting.

[8] A lower clerk employed for cleaning and maintaining the office as well as to carry notices and deliver letters.

[9] Here too, the women members were included to address the donor concerns

[10] INPIM stands for International Network for Participatory Irrigation Management, originally based at the World Bank.

[11] These included Geert Diemer from central INPIM unit and Raymond Peter, Additional Secretary at the Irrigation Ministry in Andhra Pradesh Sate of India (now executive secretary of the INPIM)

[12] The federation quickly got attention in the meeting, and donors quickly showed their interest to support it ahead.

9

Changing Irrigation Management Practices

After turnover, the WUA had to face the various challenges that their system environment brought to irrigation management. The changed practices were partly a reflection of the skills and knowledge they took care to develop technical water control and operational and financial accountability. However, they also depended on the political accountability, and credibility, that the WUAs built up with their members, and with the DOI. Project support through action around technology, tried to translate concerns over the system environment in practical design for improved water delivery and operation acceptable to farmers, and to build the skills, resources and accountability needed to sustain water management. However, poorly executed programs without due understanding of system environment, undermined change, resulting in failures costly to users needs and the program process.

The chapter describes the changes in water supply and operation, changes in maintenance status and financial sufficiency. These three are studied here as they help explain the different water control elements (Mollinga, 1998) and financial accountability (Kloezeon, 2002) that shape local water management.

9.1 Water Supply and Canal Operation

Panchakanya

Canal operation in Panchakanya was jointly done even before the initiation of the IMTP. A *Dhalpa* was assigned by the government to look after gate operation and water distribution from the main canal. He was supported by the then informal WUA in carrying out his activities, especially in the monsoon paddy season. There was no allocation schedule for the monsoon paddy, but during winter seasons they used to rotate water among the branch canals. There were no written rules and the Chairman used to decide the time of rotation.

A new principle for water distribution has been put in practice since 1998 considering the possible water available at the sources and the cropping pattern in the command area. The operational rule is *ad hoc*, developed from the experience of the WUA. However after the system transfer, water measurement and calibration activities were performed to make the WUA and the work force, which is called the *Karyadal*, to understand the water availability at the canal intake. The rule is as follows:

- If the discharge at the main canal entry is above 1000 litres, all the branches and outlets gates are open and all will get continuous flow.
- If discharge falls to between 500 to 1000 litres, the command area will be divided into two sections and rotation is applied
- If the discharge falls to 300 to 500 litres, the water will be rotated between three sections
- If the discharge is less than 300 litres, hourly schedules are implemented for each branch canal. The time depends on the size of the canal and may vary between 9 to 24 hours.

The first two rules are only applicable in the monsoon season, whereas the last rule applies in spring. The third rule is applicable to both spring and monsoon season (depending on rainfall). If the water availability is above 1000 litres, nobody worries about water and all the gates are opened. In the second scenario, the rotation period is kept at four days whereas in the third situation, the rotation period is reduced to two or three days. The fourth option is only for early (spring) paddy and spring maize as water availability is usually below 300 litres during this period.

In all the distribution patterns mentioned above, we can see that an effort is made to concentrate water to a particular canal reach when the discharge decreases. The concerned canal reach is always provided with full discharge, but the time of its allocation varies with canal flow. This shows that farmers prefer to have a higher discharge within a short time period, rather then a lower discharge for a longer duration. Farmers say that this increases water use efficiency for several reasons. First, as the water flow is concentrated in a limited area only, seepage loss is low compared to distribution over wider areas. Second, when the canal runs with higher discharge intensity, flow velocity is also higher compared to conditions of low flow. This again reduces the total seepage volume. Thirdly, farmers have to work for a shorter duration to obtain the same volume of water.

This distribution pattern tends to be similar to the *Warabandi* system of water distribution in the design of protective irrigation in India (Narain, 2003) and Pakistan where outlets are operated in 'either or' conditions. That is: either they have full discharge or none, with a fixed rotational interval. However, the difference here is that it is attempted to keep the discharge the same with varying time allocation. This makes the management task more challenging here than the *Warabandi* distribution pattern, as it involves adjustment of the schedule in accordance with the flow availability.

The time of rotation is decided by the MC, on recommendation from the workforce called the *Karyadal*. The *Karyadal* records the discharge at the intake and reports it to the MC. Depending on water availability, the MC decides which pattern to follow. The *Karyadal* consists of two members who are selected by the WUA from the farming community. They were trained in canal operation and discharge measurement by CADI after the handing-over of the system management. They are paid (Rs. 1500 a month) by the WUA and report directly to the Secretary of the MC, who supervises the *Karyadal*.

The real challenge for canal operation in Panchakanya is the spring season. In monsoon, there is no water shortage in the command area at present and the WUA also say that they have no complaints about water shortage. In winter, Panchakanya farmers hardly care for water. Wheat is not popular here and lentil is the most preferred crop in winter. According to farmers, field moisture is enough to grow lentils and irrigation is harmful. In spring, maize and paddy are the predominant crops and farmers prefer to cultivate paddy. Because of the limited flow at this time, they plan the irrigation schedule in advance for the spring in which each farmer has to announce which crop he wants to grow to the outlet groups concerned, which pass the information on to the Branch Committee (BC). The BC submits it to the MC. Once the demand from the all networks have been collected, the MC decides which branch can cultivate what area with what crop, where restrictions are put in the area under early paddy. But the division is made in proportion to the command area of the branch canals.

This mode of canal operation is working, but the WUA faces the problem that more farmers are now interested to grow early paddy. The water discharge at the source varies from 250 to 400 lps between March and May, the period when early paddy is grown. Their experience shows that they cannot increase the early paddy beyond 100 ha with this flow. For spring maize and vegetables they put no restriction on the area, as their irrigation requirement is quite low. Therefore they are now thinking of a new strategy. Instead of transplanting early paddy in different branch canals, they now plan for yearly distribution (only for early paddy), such that the upper half command area would receive water for the first year and lower half the second year. This again is targeted to minimise the water loss in the process of conveyance and distribution.

The implementation of this new rotational plan has been made possible due to the increase in the discharge in the main canal and the matching of water distribution technology to implement the rotational schedule. The presence of three check regulators in the main canal and the gated structure at the head of the branch canals make it possible to practice this type of delivery from the main canal to the branch canals. The reason for the match of technology and the delivery pattern is that, as explained earlier in chapter 5 and 6, the users in the Panchakanya system with their prior experience of canal operation, had similar ideas on water distribution and the rehabilitation was based on considerations of these rotational ideas.

Farmers say that water availability for the system has increased more than two-fold. To find out the impact of the lining improvement, I measured discharge during July and August 1999 at the same point where I had carried out measurement in 1994 (chapter 3). This location is 1.2km downstream of the intake. Comparison of flow at this point and flow entering the headwork (there is already a flow measuring gauge at the intake) showed that there was no seepage from this zone, where there used to be a 50% seepage loss prior to canal improvement work. Canal discharge at this location was now always higher than 1000 lps for these periods. My previous experience is that during the month of July, discharge at this location was never above 465 lps. I did not check the discharge in spring, but more than seven-fold increase in spring paddy area (Box 9.1) is clearly an indication that there has been a substantial increase in springtime water availability.

Farmers perception regarding water supply and system operation

Farmers' perceptions regarding the present supply condition and operational pattern are shown in Table 9.1. 81% of the farmers believe that water is adequate in the monsoon seasons. The percentage saying water is adequate in winter is greater, 85%, as irrigation is not important because of lentil cultivation. Only 40% of the farmers say that water is adequate in spring, saying water at the source as the constraint for this.

TABLE 9.1 Farmers perceptions of water supply and system operation

Item		*PIS*	*KIS*	*NWGIS*
Percentage judging supply to be adequate during	Monsoon	81	48	55
	Winter	85	8	30
	Spring	40	15	0
Percentage judging distribution to be fair	Between branches	85	66	13
	Along Branches	75	60	18
Main constraints in different seasons	Monsoon		Water shortage	Operation
	Winter		Water shortage	Operation
	Spring	Water shortage	Water shortage	Operation
Percentage judging supply/operation of main system to be	Acceptable	86	83	21
	Poor	10	10	74
Percentage judging supply/operation to be better compared with five years ago		72	10	5
Percentage judging supply/operation to be same compared with five years ago		22	68	21
Percentage judging supply/ operation to be worse compared with five years ago		3	15	74

Source: Field Survey and Wallingford, 2001.

A majority of the farmers believe that the distribution is fair among the branch canals (81%) and a little lower percentage (75%) feels it is fair inside the branch canals. This shows that the present practice of canal operation is satisfactory to the farmers. At the same time almost all the farmers in the command area agree that present operation is far better than it was under government management (before 1994). The rapid increase in the collection of service fees and farmers willingness to contribute to the increasing service fees also indicate that the allocation is satisfactory to the farmers.

The operational plan in Khageri

The Khageri system requires intensive management input during monsoon paddy cultivation, running from July to October, due to high fluctuation in the river source. Prior to the joint management program in the system (before 1993), water allocation and distribution was the responsibility of the CIP. The engineers and overseers used to prepare the water distribution schedule in the office and the gate operators were responsible for gate operation. The gate operators say that there were informal farmer groups in branch canals, who used to help implement the designed schedule of water distribution. The CIP personnel used to consult these groups about the schedule, but large numbers of farmers never knew about the distribution schedule. According to farmers, water distribution was unequal, those at the head receiving more water than the tail-enders. Owing to water shortage, a weekly rotational schedule was in practice.

After the formation of the WUA in 1993, it took control over the canal operation from the government. I found this the most interesting feature of the IMT activities in the Khageri when I joined the NLIO in 1994 and got involved in canal operation supervision in July 1995: what encouraged the WUA to take over the operational responsibility of the main canal at a time when they had hardly any knowledge of the system? The MC members later on told me that they saw two advantages. First, if they were not involved in the main system operation, the MC had hardly any other job to do, as the activities inside the branch canals were the responsibility of the branch canals. Second, it would give them full control over water delivery and there would be no conflict between the agency and themselves in matters of water distribution. So, they decided that they would make the operational decisions themselves, and the CIP gate operators would implement it. Although no agreement was made over it, it became practice for the decisions on canal operation to be made by the WUA, while the government continued to pay for the cost of operating the main canal.

The WUA used to base their decision regarding water distribution on the recommendation of the canal operators. When I became involved in July 1995 - my first involvement in the process of joint supervision of canal operation - I was struck by the experience of some WUA members. They talked in terms of 'litres', 'cusecs', and 'centimetre' to denote canal discharge. They told me that they developed their knowledge by sharing the experience with the gate operators, and from the water measurement training the DOI gave to them in 1993.

There were nine gate operators in the system, six of them from within the farming community itself and four who were from outside the district, and had been there already for more than twenty years. Because the operators were locals and familiar with the WUA, it was easier for the WUA to work together with them. Four of the operators used to work inside the command area while the rest worked in the main canal and in headwork operation. Eight of the gate operators were permanent whereas one was on contract with the government. In the monsoon season, about equal numbers of labourers were hired to support the gate operators.

In 1996/1997, the WUA formed a canal supervision committee to look after canal operation in the main canal. It was co-ordinated by the Secretary of the MC and there were three other WUA members from three canal sections (the main canal is divided into three sections for the purpose of water distribution) and one technician from NLIO. The supervision team was converted into the main canal work force, the *Karyadal*, in 1998 and were trained to carry out canal operation activities. In Panchakanya, the *Karyadal* were different from the WUA committee members, but here they were from within the WUA. The reason was that the three members had good knowledge of the system, its constraints and the operational rules. They were directly involved in canal operation for the last five years. So the MC was interested to continue with the same group of people as a work force. They were also interested to stay, as the *Karyadal* were to be paid from the government O&M fund of the main canal.

Present allocation and distribution

Presently, the MC decides the water distribution schedule for the main canal and the *Karyadal* implements it. The *Karyadal* supervise the gate operators and the labourers, and are fully responsible for the operation of main canal. They visit the different canal sections and listen to complaints from the farmers and from the branch canal representatives. Any changes in the distribution schedule are done upon the recommendation of the *Karyadal*. They decide the type of delivery by measuring the flow depth at Devnagar, which is at 9km downstream from the headwork and from which the command area starts. The distribution pattern in the Khageri is based on the flow available at this section, with three types of schedules:

- *Continuous delivery:* When the water level is more than 1.8 m at the escape structure in Devnagar the cross regulator gates are lifted to avoid any obstruction in the canal flow. All the branch canal gates are also opened to allow water to entry freely into the branch canals. Inside the branches water is rotated among the outlets at a seven-day interval.
- *Rotational delivery:* When the water level at Devenagar is between 1.4 to 1.8m, a weekly rotational schedule is practiced on the branch canal forming two different groups, each receiving supply for seven days. Inside the branch canals, the distribution pattern is a section rotation, in which the branch is divided into two or three sections depending upon canal length and water is rotated accordingly.
- *Section rotational schedule:* When water level reduces below 1.4 m at Devnagar, sectional rotation is enforced among the branch canals. Under this schedule, the main canal is divided into three divisions. The first division receives water for four days, the second section for five days and the last section for six days. Higher days for tail-end areas are meant to compensate for more conveyance loss and travel time. Whenever there is section rotation, a branch canals also practices section rotation inside the branches. The rotational schedule now practiced in Khageri is given in Table 9.2

From the Table 9.2 it can be seen that as the discharge drops in the main canal, the delivery pattern also changes. The principle is to concentrate the available flow at particular canal section by varying the time, as we saw earlier in Panchakanya. In the first pattern, water is plentiful and allowed flowing freely in the canal network. In the second pattern, water is rotated between different canals within a seven-day interval. As the water availability falls further, sectional rotation is applied. In this type of rotation, the canals at the first section receive water only after an 11-day interval, the middle section receives it at a 10-day interval and those at the tail receive after a 9-day interval.

TABLE 9.2 The changed water distribution schedule in Khageri

Flow regime	*Type of schedule in MC*	*Details of schedule*	*Schedule inside the branch canals*
h>1.8 or Q>8	Continuous flow to branch canals	All branch canal gates are opened and no checks provided in the X regulators	rotation among the outlets
1.4<h<1.8 or 4<Q<6	Weekly rotation among the branch canals	7-day rotation among the branch group 1: B_1,B_3,B_5,D_{6e}, B7,B_8,M_1 group 2: B_1,B_2,B_4,B_{6w}, M_2, M_3,M_4	Sectional rotation among different canal reaches.
h<1.4 or Q<4	Sectional rotation among the branch canals	Group 1: B_1,B_2,B_3 for 4 days Group 2: B_4,B_5,B_{6e},B_7 for 5 days Group 3: B_{6w},B_8,M_1,M_2,M_3, M_4 for 6 days	Sectional rotation among the outlets

h is water level expressed in meters and Q is discharge expressed in m^3/sec

The MC functionaries said that they have found the schedule effective in ensuring equitable water distribution. Because of the uncertainty of water supply at the intake, the MC functionaries meet frequently to work out the irrigation schedule matching the supply situation at the source with an irrigation schedule based on recommendation of the *Karyadal*. Only the *Karyadal* has the right to adjust the gates (both cross-regular and head regulator).

The canal operation inside the branch canal is entirely carried out by the concerned BCs. They hire labour for water distribution for four months, who are assisted by either the Secretary or Chairman of the BC (depends on who is active in that particular branch). The distribution among the outlets of the branch canals is made according to their allocation from the main canal. Inside the outlets, farmer themselves decide on how to divide the water among them. Now many branch canals are in the process of forming outlet committees for water distribution inside the outlets.

Only two permanent gate operators remain in the system at present, as many took retirement after 2000. The gate operators were to be relieved earlier together with the management transfer. But the problem was that they were permanent employees and there was no provision to relieve them unless they retired by the age limit. In 2000, the government brought an early retirement program with financial incentives, which the gate operators took[1]. The additional labour requirement to operate the main canal is now filled temporarily.

Farmers' perception on canal operation

The farmers' perception of canal operation and water availability is presented in Table 9.1. It shows that the majority of the farmers share the view that water is not adequate, identifying the limiting supply at the source. The percentages agreeing water to be adequate are only 48%, 8% and 15% for monsoon, winter and spring season. In chapter 3, I explained that Khageri has a major supply problem at the source. As there were no additional sources to augment the flow, attempts were made to improve the situation through canal lining (chapter 4, 5). The new lining and the introduction of the rotational schedule has increased the total irrigated area for both main paddy and spring paddy, but the changes do not attain the level seen in Panchakanya.

About 66% of farmers consider distribution to be fair along the main canal and 60 % share the same view within the branch canals. The higher percentage of farmers agreeing fair distribution along the branch compared to those within the branch indicates that the MC, through the *Karyadal*, has been able to maintain a fair distribution among the branch canals. The MC had tried several options to make branch distribution fair, whereas the branch committee are now implementing strong rotation through the newly formed outlet committees and are still to arrive at an acceptable delivery pattern.

At the same time 68% share the view that supply and operation has been the same over the last five years. The majority, 83% say that the present supply and operation plan is acceptable to them. The figures here suggest that operational performance has not declined over the years and farmers consider the present allocation satisfactory. On the other hand, there are no significant improvements in the water availability situation.

West Gandak

The Gandak system was designed to provide continuous flow up to the tertiary blocks and rotation among the farm ditches. However, as explained in chapter 2, it used to run on an *ad hoc* basis mostly upon the experience of the canal operators. With the handing-over of the system in 1997, a new water distribution pattern was developed for the system by the consultancy firm involved. The main canal was divided into four divisions and each division was allocated a fixed water share, as shown in Table 9.3

TABLE 9.3 Water share for different canal regions in NWGIS

Region	*Work force*	*Area in ha*	*Main Canal Offtakes*				*Water Share lps*
			MC	*Minor*	*Branch*	*SFD*	
1	1	1577	7	1	1	4	2016
2	1	2883	5	2	1	-	2883
3	1	1733	9	1	1	1	2242
4	1	1159	5	4	-	1	1300
Total	4	7352[2]					8441

Source: Neupane (1998)

Water measuring gauge stations were established at the beginning of each region to measure the flow, such that a fair share of water goes downstream in accordance with the above plan. All branch and minor canals inside each region were then supposed to have their separate water scheduling arrangement. But according to Poudel (1998), water measurement activities were confined to only the first two regions. The WUA say that the operational plan was developed only for a few selected canals, and was unclear to them.

Another proposal by the consultant was to test different rotation schedules among the regions when the water shortage occurs as shown in Table 9.4. According to this two different types of rotation schedule are proposed. In the first arrangement, region 1 and 3 get water for few days, after which supply is shifted to region 2 and 4 for the same duration. The rotation cycle is then repeated. Upon the second arrangement, region 1 is grouped with region 2, and region 3 with 4 for rotation purposes. The period of the rotation as well as the type of arrangement (out of two different groupings) were to be selected by the farmers testing different alternatives and adopting their preferred schedule.

This Table does not say anything about the conditions under which the rotation has to be followed and the delivery plan for different branch canals under the rotation. It only says: if the discharge is less, test the rotation and adapt the feasible one suitable to them. The system thus did not have any delivery pattern at the time of handing over, and appropriate delivery patterns had to be developed by the WUA over time.

TABLE 9.4 Typical proposed rotational schedule

Region	*1*	*2*	*3*	*4*
First Arrangement				
First turn	O	C	O	C
Second turn	C	O	C	O
Second Arrangement				
First turn	O	O	C	C
Second turn	C	C	O	O

O: open; C: Close

A five-member *Karyadal* was formed to look after the operation of the main canal. The four divisions were made after discussing with MC, considering 8km length as the most appropriate for one *Karyadal* member. The main duty of the *Karyadal* was to carry out water distribution activities from the main canal to the branches in accordance with the schedule inside their region. The members of the *Karyadal* were selected from among the farming community representing each region. A co-ordinator was selected to co-ordinate the water distribution activities across the regions. The

Karyadal were trained on basic rules and regulations of the canal operation. They were provided with a bicycle and supposed to be supported with additional labourers as required (during busy canal operation like in monsoon) in performing their duties.

For the branch canals, distribution schedules were proposed for selected branch canals only and the rest had to rely on their judgement and find suitable delivery patterns over time. The branch canals were also asked to form a *Karyadal* to distribute water inside the branch canal. According to the WUA, a total of 219 farmers were trained to work as *Karyadal* from branch canals.

But the reality turned out differently. No new management regime could get established in the system, which ran under 'no management'. The *Karyadal* quit the job after few months as they were not paid by the WUA. The *Karyadal* were supposed to be paid NRs. 1500 (US$ 22) per month but were not paid by the WUA due to lack of funds. As explained in section 9.4, the WUA could not establish mechanisms to collect the fees from the farmers and was totally dependent on the Government funds provided as part of the post turnover support. Part of the funds provided by the Government were utilized for paying staff other than the *Karyadal* like - peons, drivers, mechanics, operators and office watchmen. Any remaining money after paying these staff was used for cleaning the canal. This staff previously worked with the West Gandak project office and were now retained for operating the machines. They were mostly from the same area and could influence the WUA for their job continuity. On the other hand, the project officials also wanted them to continue as they had sympathy for them. So neither the WUA could generate money from the farmers nor were they able to utilize the government fund to pay for the *Karyadal*, who refused to work for the WUA. Once the *Karyadal* left, nobody was responsible for canal operation in the main canal.

I spoke to all of these *Karyadal* members including the co-ordinator. They had good knowledge of canal networks and operational methods, and were very angry with the Board of Directors (the previous MC) for not being accountable to the farmers. They had even agreed to work for half the amount agreed previously, but the Board of Directors did not pay any attention. The 'Management Committee' formed later also could not bring any change due to lacking funds. The 'Management Committee' were regularly paid, but no attention was given to paying the Karyadal. They blamed both the Board of Directors and

Management Committee for the poor functioning of the main canal. Inside the branch canal, there was no single person for water distribution as branch *Karyadal* also quit their jobs.

Another problem with the system's operation was that the system maintenance was completely neglected after handing over, for lack of a repair and maintenance fund. This resulted in the main canal capacity being reduced by sediment build up. According to an overseer, the canal discharge in the monsoon paddy season (June-September) after the first year of transfer itself never exceeded 5 m^3/s. The de-silting in the main canal was carried out just before the main paddy season and only part of the head reach section was cleaned. The de-silting was done out of the money provided by the government as post turnover support.

The situation deteriorated further in subsequent years. When I first arrived into West Gandak in August 1999, I was amazed to see the main canal almost filled up with silt. One technician told me that the discharge in the main canal was only about 3000 litres per second. There was not a single person - except a gate operator at the intake of the main canal - to look after water distribution in such a large canal network. Whoever wanted water used to organize in groups, come to the main canal to divert water into their respective branch canals The same situation continued throughout my field-work period.

To establish the volume of flow in the main canal, I carried out measurements at the head reach from June to October 2000. The maximum discharge in this period never exceeded $2.3m^3/$ s against the design discharge of $8.5m^3/$ s. This gives an indication of the silt deposition in the main canal. Because of the low flow in the main canal, the tail-end areas hardly receive any water. The Germi Minor at the tail received water only eight times during the whole canal operation period in 2000. Confrontations between the head-end and tail-end farmers over the distribution of water were common in the absence of authority over the water control, with one example outlined in Box 9.1.

Farmers perception on canal operation

Table 9.1 shows that about 55% of farmers feel water is adequate for them during monsoon, and 30% during the winter. Farmers think that sediment build up is the main problem. Despite no management arrangements for water control the number of farmers considering water to be adequate is high, as the monthly water requirement of West Gandak is quite low as compared to its design discharge as shown in Table 9.5, which clearly shows why this sense of adequacy is possible.

> ***Box 9. 1 Confrontation in Water Distribution***
>
> Once I observed a daily confrontation between the farmers of Germi tailend minor and the Nandapur head-end minor. It was during the wheat irrigation season (March 2000), and there was no water flowing in the tail portion of the command area. The Nandapur farmers, who were at upstream usually blocked the cross-regulator gates to stop water flowing downstream and downstream farmers from the Germi Minor used to come once the water was blocked to open the gates. As soon as these downstream farmers returned back, the Nandapur farmers used to close the check gate again. Sometimes there were verbal confrontations between these two groups.
>
> Once the Nandapur farmers lowered down the cross gate and dismantled the gate structure such that it became impossible for the downstream farmers to lift it again. Farmers from Nandapur made several efforts to lift the gate but failed. In the field, I could see that if the Germi farmers did not get water within the next few days, the crop could die. One day, we were returning from the Germi minor and saw hundreds of farmers to trying to lift the gate, but without any success. This time we could not stand back. I knew that the project office has equipment to lift the heavy gate. I talked with the technicians there, and succeeded in getting the lifting device at the site. The check gate was lifted and fixed at the top. After five days, the Nandapur farmers had again succeeded in moving the gate down, blocking the water again. The crop was saved but the problem remained the same.
>
> Such incident were frequent in the area. There was neither rule nor the person to carryout the water distribution. Farmers used to describe the situation as " who has the stick owns the buffalo.

As can be seen from the Table 9.5, the monthly water requirement is far less as compared to its capacity of 8500 lps. The discharge of 2300 lps in the monsoon period and that of 1400 lps in winter season can still meet about 50% of the water demand for these seasons. The balance can be provided from groundwater. In spring, nobody says that they have adequate water. The reason is that in

April, the barrage is closed for operation by the Indian Authorities for about a month for the purpose of maintenance. My experience in Khageri and Panchakanya was that farmers were very sensitive in water distribution arrangements. But here nobody - the farmers, WUA or the technicians - were concerned in the delivery schedule and operational plan.

TABLE 9.5 Water requirement in $m^{3/s}$ in West Gandak

J	*F*	*M*	*A*	*M*	*Ju*	*Jl*	*Ag*	*S*	*O*	*N*	*D*
2.0	3.0	3.1	4.5	3.1	5.8	5.8	2.3	5.3	6.0	1.4	2.0

Source: Silt Consult (1989), Neupane (1998)

From the Table 9.1 it is also seen that only 13% of the farmers see distribution from the main canal and 18% from the branch canal as fair. This low percentage despite the other higher percentage agreeing that water is adequate, shows the lack of a distribution mechanism in the system. A majority of the farmers say that the supply and operation is worse than five years ago when the system was Government-run.

9.2 Canal Maintenance

Panchakanya

Maintenance in the PIS involves cleaning out canals and reservoirs, greasing and fixing gates and the maintenance and repair of damaged structures. The cleaning of the reservoir is not a regular activity: the WUA cleaned it once after the handover using the heavy machine provided by the DOI in an operation worth NRs 170,000 raised by the WUA itself. According to the WUA, the construction of the silt flushing escapes during the previous rehabilitation has stopped further siltation of the reservoir.

The MC prepares the annual plan for maintenance activities. Before such planning, the main committee inspects the whole command area and discusses with the concerned BC about the maintenance requirement. The MC then prepares the maintenance plan and puts it before the GA for the approval. Usually the plan prepared by the MC is approved by the GA. The review of the WUA maintenance plan since the handing-over shows that the maintenance activities only include cleaning of the main and branch canals. Since the canal lining and gates are newly rehabilitated, there has been no maintenance cost involved in maintaining them so far. Instead, much of the expenditure has been on the expansion of the command area by constructing new canals and structures. The expenditure and activities carried out in each fiscal year are shown in Table 9.6. The activities included here are only those beyond the regular canal cleaning activities.

TABLE 9.6 WUA expenditure in maintenance and expansion

FY	*Activities*	*WUA Expenditure*
1997/1998	2km new canal construction, repair of 500 m canal section,	Rs.52,297
1998/1999	Reservoir cleaning, new RCC lining10m	Rs.103,514
1999/2000	10 numbers of additional gates in main canal outlets, reservoir cleaning,	Rs216,016
2000/2001	Pipes for Road crossing, change of gate configuration	Rs86,392

Source WUA records

The high expenditure in 2001 is due to the greater outlay in cleaning the reservoir. The Table shows that additional construction activities are still going on. During my field-work, I was struck when I saw several new gates being installed by the WUA. During the previous rehabilitation, we had not provided gates in the 10 outlets considering them to be small, and able to be closed when needed by the farmers using mud. But the WUA found it necessary to put the gates to maintain the rotational schedule, as they found water theft when closed the outlets by the mud and grass.

The current maintenance status and farmers' perception

The result of the asset survey (Table 9.7) shows that the system has been maintained well after the transfer. About 10% of structures have minor defects requiring maintenance, and about 8% of the main canal was found defective requiring cleaning. The defect in the structure was a joint crack in the under-ground pipe section. Inside the branch canals, the percentage of defective structures is higher: 22%. This shows that maintenance in the branch canals is neglected more than at the main level. The reason is that maintenance responsibility of the branch canal also lies with the MC, which is more focused on the main system. The farmers inside the branch are also said to give priority to main system maintenance, as problems insides the branch canals are considered not serious enough to affect the flow in the canal. This level of maintenance requirement can be expected, as the asset survey was done in August, by which the canal had already been running for more than six months continuously.

TABLE 9.7 Summary of infrastructure condition (from Asset Survey)

Schemes	*System Level*	*Structures defective (%)*	*Structures requiring Maintenance (%)*	*Structures requiring Improvement (%)*	*Canal length defective (%)*
PIS	Main	10	10	0	8
	Branch	22	22	0	12
KIS	Main	23	21	2	13
	Branch	14	11	3	23
NWGIS	Main	36	16	20	52
	Branch	40	23	17	54

Source: Wallingford (2001) and field survey

Interviews with the farmers also gave similar results regarding the system condition, and their perception about system maintenance is presented in Table 9.8. About 88% of the farmers consider main canal condition good or reasonable, where as only 68% consider the condition of the branch canal good or reasonable. Farmers agree that there has been significant improvement in the main canal maintenance status over the years, where as farmers agreeing the improvement in the branch canal has been less as compared to the main canal.

Khageri

The responsibility for branch canal maintenance lies with the concerned WUA, and that for main canal lies jointly with the NLIO and MC. According to the MC, they share 15% of the cost of main canal maintenance with the NLIO. This mostly involves cleaning out the main canal, greasing and fixing of the gates and structure protection works. In the branch canal, the maintenance mostly involves cleaning the canal as the newly lined canals have been in any need of maintenance so far.

TABLE 9.8 Farmers perception on canal conditions

Assessment of condition	*PIS*	*KIS*	*NWGIS*
Percentage of farmers considering current condition good or reasonable			
Main	88	69	28
Branch/Secondary	72	88	26
Field Channels	90	68	38
Conditions compared with five years ago. Percentage considering current condition better			
Main	82	7	0
Branch/secondary	43	14	0
Field channels	14	9	0
Conditions compared with five years ago. Percentage considering current condition same			
Main	14	63	24
Branch/Secondary	50	72	19
Field Channels	80	68	30
Conditions compared with five years ago. Percentage considering current condition worse			
Main	4	25	76
Branch/Secondary	7	8	81
Field Channels	6	7	52
Maintenance status			
Maintenance is not well done	20	50	81
Better or same as compared to five years	75	44	34
Work now is worse	0	50	65

Source: Wallingford (2001) and field survey

The asset survey (Table 9.7) shows that about 23% of the canal structures and 13% of the canal section in the main canal are defective. However, out of 23% defective structures, only 2% require improvement and the rest require maintenance. Likewise inside the branch canals, 14% of the structures are found defective, out of which 11% require maintenance and 3% require improvement. The defective canal length in the branch canal is

23%, higher than in the main canal. The structural defects both in the main canal and branch canals mostly involve scour around structures. As this situation does not affect the flow in the canal, it has been neglected by the WUA. The high percentage of defective structures in the main canal compared to the canal condition reflects that Government funds provided for maintenance are insufficient.

The problem in the canal sections is mostly weaker bank sections and weed growth at the banks in both main and branch canals. These defects were not affecting the hydraulic performance (no obstruction to the flow of water) and thus have been ignored by the farmers. At the time the survey was carried out, the canals had already been running for about 2 months and minor problems were bound to occur as the period is the main rainy season.

The survey was carried out in B_1, B_5 and M_1 in which improvements were completed by June 1996. The survey shows that over the 4 years period, the condition of the canal and structures has not deteriorated. This is also reflected by farmers' perceptions (Table 9.8). In Khageri, 69% of the farmers consider the present condition of the main canal good, the percentage for the branch canal is 88%. A majority of the farmers also feels that system condition has remained the same over the years. However, while 50% of farmers share the view that maintenance is not done properly, the same percentage say it is done properly. A majority of farmers say that they help to clean the branch and field canals (75% and 67%). However only 39% of the farmers feel that maintenance was adequate last year.

There are no major constraint in the system presently. Wallingford (2001) notes that maintenance (by farmers) does not constraint operations at present, nor is likely to do so for the next few years. But maintenance has been deferred, especially at the main canal.

West Gandak

Maintenance tasks in West Gandak are challenging, requiring both financial and technical resources. The major maintenance activity is the de-silting of the main canal and of branch canal systems. As explained in chapter 6, a silt ejector was constructed to control silt entry in the canal system. But it could not work as designed due to poor location of the structure. The requirement for canal desilting has thus remained same.

All of the farmers interviewed agreed if the silt in the canal were cleared properly, more than 50% of the problem in the West Gandak system would be solved. It is estimated that about 800,000 rupees are required annually to clean up the main canal. Likewise, cleaning of branch canals also requires same amount of money in total. The cleaning activity requires heavy equipment like excavators and dump trucks, but available machines in the systems are old and require maintenance regularly. Under the agreement with the government, the equipments were supposed to be transferred to the WUA which was not done, due to agency concerns explained in chapter 7. But use of the machinery have been provided to the WUA.

Another major problem with the system is flooding, which occasionally causes heavy damage to canal networks. The magnitude of flood damage is often beyond the WUA capacity. For the smooth operation of the systems, the repair of canal breaches needs immediate action. On average, it requires about Rs.1 million annually to solve this problem. Under the Indo-Nepal Agreement, the drainage channels and associated structures are to be maintained by the Indian Authority looking after the barrage. However, the quality of their maintenance has been poor, they only remove weeds from the channels.

Beyond these two problems, it is also required to maintain a large numbers of structures like canal siphons and other water delivery structures. These also require about 1.5 million rupees annually. These figures suggest that the system needs more than 3.5 million rupees annually, or about Rs. 400 per ha for O&M (see annex 3). The cost does not involve cost for future rehabilitation (which is supposed to be carried out by the government with a fixed percentage of farmers' contribution). After the hand-over, it was agreed that part of the cost would be provided by the government as a post turnover support, and part of it would be generated by WUA through ISF and other resources. However, WUA resource generation did not take place and Government funds were insufficient to maintain the system. This resulted in continuous system deterioration.

The only maintenance activity carried out since the handover in the West Gandak is maintenance of the service road and desilting of part of the head reach of the main canal. These are also performed out of the fund provided by the government. The rest of the maintenance activities in the main canal and inside the branch canal are overlooked. The maintenance activity is so neglected that even minor problems have now become major problem in the system. One such incident is described in Box 9.2.

> ***Box 9.2 Neglect of maintenance***
>
> Once I observed a small breach in the Bishnuganj branch canal. It was in February, the winter irrigation season. The location of the breach was about 1.3km downstream from its intake point with the main canal. The canal was drawing a small discharge (about 200 lps) at the time and if the flowing water were not stopped, it could induce larger damage. I was thinking that it would be solved by evening. When I came to the place the next day, I was surprised to see that the canal was not closed and the section had breached many times more than the day before. Back in office, I told the situation to the WUA manager. He told me that he had no money to get it repaired. I thought that the whole section could collapse next day if the canal is not closed. I again visited the place next day. This time, the whole canal section had collapsed!
>
> This branch is the largest branch in the system and the MC Chairman is also from this branch. In the following rainy season, the section was further damaged and this time the canal service road was also washed out blocking any movement along the canal. The canal section is not repaired yet. The service area below this point, about 1000 ha, has not received irrigation water since then.
>
> The repair of the canal section now requires about a million rupees. If the water in the canal had been stopped on the first day it would have needed only two labourers to repair the bund. There are several places where the clean-up and repair of the canal and bunds have not been done. The WUA simply have no funds to do it. problem. The accountability of WUA towards the farmers does not exist here.

The present maintenance status

One can estimate the situation in West Gandak on the basis of the above discussions. The result of the asset survey (Table 9.7) shows 36% of the structures in the main canal and 40% in the branch canal to be defective. Of the defective structures in the main canal, 16% require maintenance and 20% require improvement. In the branch canal, 23% require maintenance and 17% require improvement. The identified problems with the structures both in the main canal and branch canal concern scour around structures, damage of protection works and cracks in structures. The damage is mostly due to floods, rather than ageing. However, the structures are still in a position to deliver water. But failure to correct the defects will inevitably bring failure to the structures in the future.

The asset survey also shows that the condition of the canals is worse as compared to the structures. The percentages of defective length in the main and canal and branch canal are 52% and 54% respectively. The problems identified are sediment build up and slippage of the canal embankment. These problems have arisen due to lack of routine maintenance. This indicates that problems inside the branch canals can still be improved with farmers' own effort: but unless conditions in the main system are improved, it will be meaningless for the farmers to initiate improvement inside the branch canal.

Farmers' perception on maintenance (Table 9.8) also shows similar results. Percentages of farmers agreeing the present condition of the canal is reasonable are 28%, 26%, and 38% for main, branch and tertiary channels respectively. Nobody agrees that the system condition is better than before and a majority (76%, 81% and 52% for main branch and tertiary canals) say the situation has worsened compared to five years ago.

9.3 Financial Sustainability

A major objective of irrigation management reform in Nepal is to develop financially viable local organization to finance future system operation and maintenance. This section studies practices and mechanisms in achieving financial sustainability, and shows how they are shaped by accountability of the WUAs in delivering water services and in financial administration, and legal and policy support from the government.

Panchakanya

The collection of the ISF in Panchakanya was started in 1995, immediately after the formation of the WUA. The rate of the ISF was Rs. 60 per ha per year, which was the Water Tax rate of the Government. Prior to this, there was no collection of the ISF but farmers used to provide voluntary contribution of 3 labour days per ha to clean the main canal once in a year, with minimum of 1day contribution for those having less than 0.35 ha of land. Cleaning and maintaining the branch canals and tertiary canals was again carried by the concerned BCs mobilizing voluntary labour.

The ISF was increased to Rs. 90 per ha per year in Sept 1996 by the WUA. There were two reasons for this. First, most of the canal sections were lined and repairing and maintaining them would require cash. Likewise, the gates were to receive greasing from time to time for their smooth operation. From their experience, the ISF of Rs. 60 per ha was not going to be enough. Second, many farmers used to send aged persons or children t to clean the main canal, as working age groups were out in search of jobs or education. Mobilizing people was another problem. The Chairman told me once that some farmers work only three to four hours a day and he had to shout and run after them all the day. Many farmers raised concerns that the voluntary contribution was not equal, some working more than others

Immediately after handing over the system in December 1997, the ISF rate was again increased and another service fee, the canal maintenance fee, was introduced. The ISF was increased to Rs. 150 per ha for rice and Rs. 75 for other crops. The maintenance fee was separated from the ISF such that it would be used only for the cleaning and maintenance of the main canal. This fee of Rs. 300 per ha per year was collected against the three labour contributions to be made by the farmers. The canal maintenance fee was introduced so that the WUA could clean and maintain the main canal employing hired labourers expecting better quality of work. However, the WUA decided that the labourers would be hired only from among the member farmers. This provision was done so that money would remain within the farming community and needy farmers would benefit by this policy. Outside labours were to be hired only if the local farmers were not available.

According to local farmers, the quality of maintenance work in the main canal improved a lot after this new arrangement. With the improved quality of the work at the main canal, the branch canal users also preferred to do the same. Instead of cleaning the branch canals through voluntary labour, they also decided to clean up the branch canals by collecting money at the rate of Rs.150 per ha: this started from 1999. A farmer with 1 ha of land in Panchakanya now pays Rs. 600 ($ 8.0, at 2001 prices) per ha if he cultivates two rice crops (300 for the maintenance and another Rs 300 as ISF) or Rs 525 if he cultivates rice and one other crop (Rs 300 as maintenance fee and 225 as ISF).

The different types of fees and their collection over time in Panchakanya are shown in the Table 9.9. The membership fee is Rs.10 and has to be renewed annually where as the share fee is Rs 90 per ha and is to be paid only once and does not need to be renewed. The other sources include grants if any provided by the NGO, fees paid by researchers[3] and any other incomes. It also includes the entry fee paid by newcomers. The high amount of other sources in FY 1997/1998 and 1998/1999 have been due to the entry of large numbers of new farmers, who were charged of Rs. 500 for entry in the WUA. They were charged high amount of entry fees as they were not involved in paying contributions in the system rehabilitation program.

TABLE 9.9 Fee collection in NRs 000 in the Panchakanya.

Types of Fee	*1995/ 1996*	*1996/ 1997*	*1997/ 1998*	*1998/ 1999*	*1999/ 2000*	*2000/ 2001*
Membership/ Share fee	5.45	27.89	15.27	13.43	10.26	10.49
ISF	12.87	22.07	42.87	51.25	63.09	75.98
Canal MT			82.98	74.68	85.08	119.28
Fines/ Penalties	4.62				15.70	6.17
Other sources	10.71	16.33	47.88	67.37	8.00	5.59
Total	33.65	66.29	189.01	206.74	182.14	217.53

Source: WUA records (as per October 2001). * system handed over

From the Table 9.9 it can be seen that total income of the WUA has increased almost six fold in 2000/2001 since the beginning of the collection in 1995/1996. Of the different fees, the ISF and the maintenance fees are the two permanent sources of the WUA. The Table also shows that there has been an increase by almost 15 times in the total collection of these fees combined together.

The WUA now claims that 450 ha are under irrigation in monsoon paddy. However, only 360 ha (80%) has obtained the share and membership of the WUA, and of this, only 259 ha paid

ISF for the monsoon rice in 2000/2001. That is, the collection efficiency is only 59% for monsoon rice. The WUA say that many farmers in the monsoon paddy evade paying ISF saying that they do not use the canal water. Because of the excess rainfall and land characteristics described in chapter 3, evading ISF in monsoon rice is possible. The WUA demands that unless the government brings a new law attaching the ISF with other fees, it is not possible to increase the collection efficiency of the ISF. According to the WUA, collection for winter and the dry crops has never been a problem, as the irrigated fields are visible to the eye. Upon failure to pay the ISF, the WUA can easily apply sanctions to the farmer as spring crops, especially paddy, can not grow without irrigation. The collection efficiency for winter and dry crops has always been 100%.

Despite the problems of collection in the monsoon season, the changes in fee collection are encouraging. The question now is what makes the Panchakanya farmers agree to pay more for irrigation? There are three reasons for this. The main reason is the increase in the irrigated area in spring season (see Box 9.3) especially paddy. Earlier they used to grow spring maize under rain-fed conditions instead of early paddy. Second, the canal maintenance activities are carried out by hiring the labourers from within the member community. Thus the needy farmers can work and take back the money they paid earlier and can even earn more. The third reason is the transparency maintained by the WUA. The income and expenditure of the WUA are always presented and discussed in the GA meeting once in a year. Likewise the annual maintenance plans are also discussed and passed by the GA meeting. Though there is not much discussion or questions on the agenda prepared by the MC, this process has made farmers believe that things are going well within the WUA. There is also annual auditing by an external auditor whose report is made open in the GA meeting[4].

Another question is whether the Panchakanya is financially self-sustaining to carry out future O&M activities. My own estimate for the O&M cost in the Panchakanya is Rs.180,000, that is Rs. 400 per ha ($ 5.4 at 2001 exchange rate) assuming a command area of 450 ha. That is, the present collection rate is already higher than required. If the WUA is able to increase the ISF collection efficiency for monsoon paddy and the maintenance cost, then its current rate can be decreased. If the rate is kept constant and the efficiency is increased, the WUA would be in a position to finance the part of the rehabilitation cost in the future.

Khageri

In Khageri, the O&M cost of the main canal is the responsibility of the government. There is an understanding that the WUA will bear 15% of this cost. Besides this, decisions regarding canal operation, including the main canal, are carried out by the WUA. The responsibility for fee collection lies with the BC, and the MC is entitled to receive 20% of the collection from the branch canals. The WUA is also required to pay the Government 25% of its collection according to Irrigation Policy[5]. But this has not been done in the Khageri so far, and the government has no asked for it.

The collection of ISF in Khageri is only for one crop, monsoon rice except for B_1 and part of B_2 where early paddy is cultivated. The spring and winter crops are cultivated under rain-fed conditions. The ISF rate is Rs. 60 per ha per crop and collection was started from 1993/1994. Before this, farmers were not paying any service charge to the government, though under the law, they were supposed to pay Rs. 60 per ha per crop.

Beside the ISF, each branch canal carries out the canal cleaning and desilting work employing voluntary labour. The rule for this is different from branch to branch, but the average rate is 3 days labour per ha of land as in the case of Panchakanya. The ISF collection over the years in Khageri is given in Table 9.10. It can be seen from the Table that there has not been any increase in the ISF rate and its collection.

The unwillingness of the Khageri WUA to increase the rate of ISF is due to two reasons. The first is that maintenance cost for the main canal is to be provided by the Government and farmers have to pay only 15% of the cost. This cost is collected from different branch canals whenever required. The branch canals thus need to collect what is required to maintain their respective branch canals. As mentioned in Chapter 2, the Khageri branch canals are constructed in well-defined ridges without any cross drainage structures and the command area is safe from flooding and inundation. Inside the whole command area of 3900 ha, there is only one aqueduct[6] (in B_1). Likewise, there are no check or cross regulators inside the command area that are needed to operate and maintain. Except the B_1, all the canal networks run only for four months in a year.

TABLE 9.10 ISF collection in Khageri over the years.

Year	*ISF in NRs*	*Collection efficiency*[7]
1993/1994	89,474	53.2%
1994/1995	107,213	63.81%
1995/1996	92,638	55.14%
1996/1997	105,316	62.68%
1997/1998	126,794	75.47%
1998/1999	93,731	55.8%
1999/2000	96,355	57.16%
2000/2001	Ongoing	

Source: WUA records.

Thus the O&M requirement of these branch canals is very low as there are no major structures to operate and maintain. The only maintenance task that a branch canal has to carry out is cleaning and reshaping the canal and cleaning weeds. The cleaning is done once in a year before the start of the monsoon season and is done by employing labour contributions as mentioned above. The cleaning of the tertiary canals below the branch canals are again done by the farmers themselves - a tradition since the construction of the system in 1967. Considering the maintenance requirement of the branch canal, the present rate of the ISF has been found sufficient.

In the Fiscal Year (1997/1998) the GA of the Khageri decided to double the ISF from Rs 60 to Rs 120 per ha. I was present in this meeting and there was a heated discussion on this. The GA and the MC had decided to increase the rate, considering that they would take over the main system management in future and this rate increase was in preparation for this. At the time of this GA meeting, there was an agreement with the government and the WUA about constructing a new lift system for augmenting the Khageri canal (see chapter 7) such that its monsoon crops would be guaranteed and at the same time it could irrigate in winter and spring season. Under the agreement, the WUA had to takeover the O&M cost of the proposed lift scheme too: hence the move to increase the ISF.

However, the branch canals, who were the actual collector of the ISF were not convinced by the argument. Many farmers believed that they were cheated by the government in the Saguntole issue. They said they would not accept the increased cost just to be prepared for a future they were unsure about. Another reason for their objection was that out of the collection, they had to give 20 % to the main committee and 25% to the government. Though they had not given any money to the government so far, they had to prepare for this. Payment to the Government was also not clear, whether they should pay on the basis of the Government rate of Rs. 60 per ha or on the basis of the new rate. If they were to pay on the basis of new rate, why should they collect more just to give it to the MC and the Government?

So efforts to increase the ISF could not materialize in practice. On the other hand, I observed a new rift between the BC and the MC regarding the payment to the MC during my fieldwork in 2000. The BCs are now saying that the MC should not collect 20% from their collection. Their reason is that since main canal O&M is financed by the government, and the contribution to be made by the MC to this is also paid by the BCs, the MC has no right to collect the 20% from them. The MC share of 20% is mostly for administrative cost, including the payment to office Secretary and clerk employed by the WUA, printing, holding GA meetings and other likely expenditures. The BCs feel that the MC should bear its administrative cost mobilizing other resources like the forest and land resources handed over by the government rather than fees paid by the BCs. Since 1999/2000, the MC has not been able to collect its share from the branch canals.

However, farmers share the view that collected money is spent fairly. Both MC and the BCs submit their income and expenditure to the concerned GA. But unlike Panchakanya, there is no annual maintenance plans here, as inside the branch canals, the maintenance is so far only for canal cleaning and there is no need to plan for it. For the main canal, the Government allocation is not based on what is needed in the system. Though the engineer looking after the Khageri told me that he makes a plan with the WUA before submitting the budget proposal with the government, the amount they get is always less than they asked for. The financial expenditures of the WUA here too are audited by the registered auditor and its reports are made public in GA meetings. From my previous experience and present observation, I have never heard of any financial irregularities inside the WUA.

Problems in fee collection

The data in Table 9.10 show that the collection in the Khageri is around 60%. The major problem in collecting the ISF is the same as in Panchakanya: many farmers evade it by saying that they do not need the canal water. The WUA complain that because of the excess rainfall, it is practically not possible to monitor who is using the canal water and who is not in the middle and lower terraces. The BC here also told me that unless the issue is addressed legally, the collection of the ISF is not going to be increased.

During July and August 2000 and 2001, I observed this problem in B_1, because it had all types of field the *Tandi,* the *Ghol* (see chapter 3) and the land in between. I found that 44 *bigha* (29 ha) of land did do not need canal water and had access to drainage water in both years, whereas 257 *bigha* (170 ha) relied totally on canal water. The rest had access to water from the higher fields. According to the WUA, most farmers belonging to this group evade paying the ISF. The ISF collection records agree with my finding: only about 185 ha has been paying the ISF in B_1 since 1994.

The branch canals in the Khageri also face a similar problem to Panchakanya in mobilizing voluntary labour for cleaning the canals. A process has begun here too to collect money to clean the branch canals, instead of labour mobilization. The M_1, at the tail end, collected Rs. 300 per ha starting from 2000 for the cleaning of the canal, separate from the ISF. The B_7 Chairman also told me that they have decided to collect a maintenance fee, as in M_1. The M_1 case has attracted attention from other BCs too, who think to do likewise. In M_1, because of the presence of large numbers of ex-Army persons, mostly from the British Army, the maintenance fee collection worked quite well. The Secretary told me that the amount collected was more than required and they have put surplus in their bank account. It remains to be seen in Khageri how this expands into other branch canals.

The Khageri also shows a policy void in the Nepal's management reform program, and how the large systems benefit from this policy weakness. The policy states that only systems lower than 2000 ha would be transferred to a WUA. It is silent on who would pay the cost of larger canal networks, and is considered as the Government's job by the farmers. This has led to a situation where large systems are still subsidized and farmers pay low costs while in smaller systems farmers have to pay more for irrigation water. For example in Khageri farmers are paying Rs. 60 per ha per crop and are contributing about Rs. 100 worth of voluntary labour, whereas farmers are paying as high as Rs. 600 per ha in Panchakanya.

The intention of the policy behind separating the area limit is that larger systems are technically complicated and the Government has to continue with their management. But the cost of system operation and maintenance per hectare generally does not depend on the scale of the system but on its system environment. The cost per ha in large gravity irrigation systems is usually less than the smaller systems (personal experience), but larger systems are more subsidized than the smaller ones. This factor so far has been overlooked but is slowly getting attention. Some farmers already raised this issue in Panchakanya. Instead of separating the management domain by area, the policy should have made a provision that the O&M cost has to be borne by the users. Then users should be given the choice about which part of the system they wanted to take, and which part they wanted to continue under Government management, but with their payment.

West Gandak

The resource mobilization in NWGIS has remained poor. There has been neither increase in ISF collection, nor any progress to mobilize funds from other resources transferred from the Government. These failures can be attributed to the lack of proper mechanism within the WUA to collect the ISF, as well as conflict and corruption within the WUA.

Unlike Khageri, the West the West Gandak is fully transferred system. That is, its O&M has to be born by the WUA out of the system: so I first explain the O&M requirements and the plan at the time of handing over to meet these costs.

I found no documents/study reports regarding actual requirements for O&M costs in West Gandak. In both Khageri and Panchakanya too, we did not have any studies of this but for different reasons. In Panchakanya, the WUA was one step ahead of us, in deciding the ISF and collecting maintenance fees to get prepared for the future. In Khageri, the main canal was to be managed by the Government: maintenance of the branch canals was simple and done through voluntary contribution. But for systems like West Gandak having such challenging operational and maintenance requirements, clear planning for the future management should have been prepared and agreed upon.

In 2000, at the time of the asset survey, I estimated costs for actual O&M requirement, which is Rs. 400 per ha (considering the command area of 8700 ha). This does not include the cost of repairing the flood control dykes which should be separated from canal O&M. This cost also does not include the cost involved in cleaning the lower order canals like the SFDs and MFDs, which is done by the farmers themselves. This is in agreement with other studies for Terai schemes[8]. The WUA executives, the DOI and consultants thought the forest and transferred properties would generate most of this cost. But according to the local people, the forest and other resource could provide Gandak about Rs. 600 thousand a year. This means, the Gandak farmers were still required to generate Rs. 2,900,000 (see annex 3) through the ISF collection.

On the other hand, there was less possibility of bearing part of this cost by contributing voluntary labour like in Khageri for two reasons. First, because of the larger canal section and heavy annual sedimentation, cleaning of the main canal and the branch canals requires heavy machinery. Secondly, there is no tradition of collective effort in cleaning canals in the past[9].

Despite no proper transfer protocols, the government had said that it would provide Rs. 850,000 (chapter 7) annually for three years as post turnover support to the WUA. Even with this government support, and expected resource collection from transferred properties, the WUA still needed to collect Rs.2, 0 50,000. They were thus required to pay Rs.235 per ha (assuming 8700 ha command area) at the beginning and increase it to Rs. 330 per ha after withdrawal of government support.

The reality

In fact the WUA could neither increase the ISF rate nor improve its collection efficiency. Collection from other sources also declined due to financial irregularities and corruption. As usual, the Government remained the sole financier of O& M cost of the system. The resource contribution by the government and the collection of the internal resources by the WUA is presented in Table 9.11. In the Table, government contribution is presented only after 1997/1998, that is, after the handing-over of the system's management. Before this, rehabilitation activities were ongoing and operation and maintenance costs were not separated. There has been no financial audit in the WUA since 1999/2000, thus the collection from other resources after this could not be established. I observed that collection from forests (sale of wood), road tax and land tax still goes on, but details are not available. The WUA say that this collection level is along the same lines as in 1998/1999.

TABLE 9.11 Resource Mobilization in NRs. 000 by WUA of NWGIS

Year	*Govt. Fund for O&M in NRS*	*ISF*		*Forest Resources*	*Road Taxes*	*Land Taxes*
		Collection	*(%)*			
1993/ 1994		124.44	21.5			
1994/ 1995		87.05	15.08			
1995/ 1996		98.40	17.05			
1996/ 1997		185.66	32.17			
1997/ 1998	850.00	97.34	16.86	143.40	62.67	37.20
1998/ 1999	1,250.00	29.89	5.18	65.72	43.73	16.22
1999/ 2000	1,600.00	0	0			
2000/ 2001	1,700.00	0	0			

Source: NWGIS project office and WUA Audit Reports

The data for the ISF in the year 1993/1994 also includes the collection of 1992/1993. I consider the initial ISF collection encouraging, as in the first year of the WUA formation itself, about 21% of farmers were paying despite lack of membership documents and water use planning. However, after that there was neither increase in rate nor in collection efficiency of ISF. There was slight increase in the FY 1996/1997, just before the handover but for different reasons analyzed later.

There are several reasons for the poor fee collection in the West Gandak. These include lack of transparency and accountability, lack of policy and regulations regarding maintenance cost recovery in the legal framework, lack of mechanisms to collect the ISF and poor service delivery.

Three have been reports of financial irregularities and even cases of corruption within the WUA in recent years. The principal scandal is with the forest resource. Under the transfer agreement, the WUAs were allowed to sell the dead and broken trees along the canal embankment. In 1998, just after turnover, the WUA hired a contractor to manage the forest resources. The contractor paid Rs. 105,000 as part of its deposit to sell the forest materials. However, the government objected to the hiring of the contractor: according to the community forestry rule, the forest resources were to be sold only to community members, and a contractor should not have been involved. The contractor was relieved from the job later on, but there was no record of how much he generated from the pruned forest materials.

After this, the selected board members were assigned to look after sale of the forest materials. However, only a fraction of the money earned out of this was deposited in the WUA bank account! The audit report for fiscal year 197/1998 shows that the Rs, 178,000 from sale of forest materials was not deposited in the bank. The matter was then brought to the DAO and the DFO. An enquiry was made to find out who had not deposited the money from the forest sale, but without resolution. Actually, 19 persons were involved in the selling forest, and it was unclear who was responsible at what level for the irregularities. The persons involved in this sale told that the villagers used to take away trees without their notice during the night and early morning. They claimed that it was not them who cut and sold the forest. Farmers believed this failure of the DAO to resolve the issue was due to political connections of the Board members. According to farmers, each political party was blaming the other for this situation, but none was in a position to take any action.

This event had a very negative impact on local farmers' feeling towards the WUA. In an another case, it was found that about Rs. 9500 was not deposited in the WUA from the Road Tax collection. Likewise, some of the BC members collecting the ISF were found not depositing the money in the WUA account. Upon hearing this, those who were paying the ISF also stopped paying fearing that the money would be misused. One *Toli* representative, who was also charged with not depositing the money in the bank account once told me that he does not feel sorry for this, as those in the MC have earned far more than him.

There have been also charges of corruption in expenditure of fund provided by the government: both farmers and the WUA say that agency personnel are also involved in this and I came across two such cases. In the first case in 1997/1998, an overseer and a Board of Director was given 90,000 rupees for buying a gear box for the gates at the intake. It was later found that inferior quality material was bought at almost half the price. The WUA blamed the technician for this. The technician was later transferred without investigation.

In another case Rs 45,0000 was spent on canal de-silting in 1999/2000 out of the Government fund. However, the de-silting was done poorly and farmers objected to the DAO, which has not been resolved so far. The estimate for the works was prepared by the technicians of the DOI and executed by the WUA employing machinery. The records show that the heavy machinery had been mobilized for up to seventeen hours a day and payments of fuel and for operator were accordingly made, which can never be possible practically. When I asked one of the operators of the machine whether it is true that he worked for 17 hours a day, he simply laughed. He told me that he did what he was told by the WUA member involved in supervision and by the technician. The operators as well as the technicians are also charged with the corruption in the DAO. Any visitor in NWGIS now hears about financial irregularities and corruption in WUA, not the irrigation and water management practices.

The confusion behind the ISF and lack of legal support in its collection has been discussed chapter 7. The poor collection of ISF in West Gandak is also a result of the poor policy framework, due to which neither the WUA nor the irrigation agency gives attention in the ISF.

There are no established mechanisms in the system for the collection of the ISF. There are no records regarding the members and their land holding, and it was never clear to the WUA who should collect the ISF and how it should be collected. Poudel (1998) notes that the ISF collection in the beginning was done by the FOs (chapter 4) hired for the organizing activities. The FOs had prepared the membership lists for the different canal sections for the election of the functionaries. The same list was used later for collecting the ISF and no effort was made to revise the list in later years. On the other hand the collection made by the FOs was not even enough to pay for their salary for four months because of poor collection and low rate of the ISF.

When the FOs were relieved after WUA formation, the responsibility of the collection of the ISF was then given to the *Toli* and *Upatoli* (see chapter 4). It was decided that the person collecting the ISF from these committees would be given 10% of the collected amount. But many of them could not decide who would collect the money, as no members wanted to do this Those who started collection complained that it was difficult to monitor the irrigation application in the monsoon season and they also did not have correct list of farmers. They also found their payment of 10% too low for the job. The WUA later decided that the person collecting the ISF would get 20% of the collection and the MC would not realize any contribution from the lower order committee. Otherwise, the lower committees here also were required to pay 20% of their collection to the MC. But this also brought no change in the ISF collection, because of lack of a member list.

Can farmers afford to pay?

In all the three cases presented, there were no fees collected before turnover: and any payment to maintain the system is an additional fee to farmers. Box 9.3 summarises changes found in production after IMTP[10]. In all cases it was found that there has been no increase in crop productivity as such, only from expanded irrigated area, and increase in early paddy area in both Panchakanya and Khageri. That is, the program has brought benefit to farmers who had no access to water before whereas for many farmers, who had access to water before, it brought no change. The new farmers will be willing to pay, whereas for those whose situation is unchanged, may be reluctant to pay, unless forced by other means. The lower collection of ISF in monsoon season in both Khageri and Panchakanya is also due to this fact.

Box 9.3 Changes in irrigated production

The following points are summarized from interviews with farmers and the ADO, and other reports.

Panchakanya has seen considerable change in cropping patterns. The areas growing spring paddy has increased from 12 ha in 1995/6 to 105 in 200/01 and irrigation in monsoon paddy has increased from 265 ha to 360 ha. In Khageri, farmers report that as a result of canal improvement, it was possible to grow early paddy in 100 ha additional area. Kalu *et al.* (2000) also show increase in early paddy area by more than 150 ha. At the same time, there has been increase in irrigated are by about 10 to 15 ha at the tail end of the command area of each branch canals. Combining all, about 300 ha additional land has now access to irrigation in monsoon season in Khageri. In West Gandak, due to reduced canal supply, the access to irrigation in monsoon paddy has decreased to 4000 ha area from previous records of 7300 ha area. There has been no change in the cropping intensity in all the schemes. The reason is that even in absence of irrigation water, farmers cultivate under rainfed condition.

High increase in crop yield in Panchakanya has been reported for both early paddy and monsoon paddy by the monitoring report and Ghimere *et al*, 2000 (from 3.5 to 4.8 for monsoon paddy and from 3.6 to 6 t/ha for early paddy between 1995 to 2001). But my interviews suggest present average production rate is 3.9 t/ha for monsoon rice and 4.2 t/ha for spring paddy. Farmers give credit to not only to improved water availability scenario, but also a switch towards high yielding variety crops. In West Gandak, despite the poor performance of the canal system, the crop yield has not been affected. The reason is that for monsoon rice they depend on rainfall and in winter and spring, farmers are switching to ground water to irrigate the wheat and sugarcane.

Studies made so far show that cost needed to maintain the system is only a fraction of the benefit derived from irrigated agriculture. According to the HR Wallingford (2001) study, the net financial return per ha at 2000 prices is Rs. 5532 for Khageri and Rs. 6099 for West Gandak. This study is based on irrigated and un-irrigated conditions for wheat and main paddy only, the two predominant crops in the area. The limitation of the study is that it assumes a crop yield difference of 25% and 33% for monsoon paddy and wheat between irrigated and un-irrigated condition. Farmers agree in case of West Gandak, but in Khageri, farmers say rain-fed rice production is as low as 40% of irrigated levels.

A study by NISP for Sunsari Morang Scheme (66000 ha) and Kankai Scheme (8000 ha) in the Eastern Terai shows the net benefit for these schemes is Rs. 12552 and Rs. 27,669. Thus, since the agroecological and market conditions in Terai areas do not differ substantially, these two studies have quite different results. However, both figures suggest that paying of ISF of an average of Rs. 400 per ha is still less than 10% of the net income generated form irrigation services, even at the lower profit level of the Wallingford study. The question in Nepal is thus not whether the farmers can afford to pay for the irrigation or not, but how it can be collected. In Panchakanya farmers easily pay up to Rs. 600 per ha if they receive a good irrigation service. Initial collection of ISF in Khageri and farmers views in West Gandak also suggest that farmers are willing to pay fees, but do not do so for the several factors discussed earlier.

9.4 Conclusions

Most often, the IMT programs haven been implemented together with the project support to facilitate water management change. The changes and outcomes presented in this chapter has shown that, this depends on how they can translate opportunities and constraints in practical design and provide better working condition to farmers. In Panchakanya, the technical change brought about by the project could work as catalyst in the evolution of the new management bringing better water availability and new production options, with valuable crops that help achieve financial self sufficiency and acceptable management practices. Its smaller size also made change easier. The WUA thus acquired the necessary skills, generate the resources and maintain accountability in service delivery. Khageri too arrived at suitable delivery pattern which a large majority of farmers considered acceptable. Though maintenance issues are overlooked here due to lack of resources, this is more to do with legal and administrative gaps, than system constraints. The IMT Project did not bring any visible changes in West Gandak that could provide better working conditions for farmers. The WUA could neither acquire the skills nor generate resource or maintain accountability in service delivery.

These variable outcomes suggest that project support does not necessarily provide incentives to local organization, it depends on the approach of the project. A critical issue in a participatory approach is that designers are needed to build familiarity with the local system environment. They are limited in their instrumental purpose if proceeding without adequate learning of system environment, and can then fail to bring the desired change in infrastructure water delivery and institutions - as happened in West Gandak.

Project support when it proceeds with system learning, the key to participatory development, forms only a base for future management. Sustaining water management beyond project launching depends on wider water control dimensions: socio-political, organization and technical, which are dynamic, and continuously bring new challenges in management continuum. Local organization need to adapt to the ever changing environment to sustain water management, build up necessary skills, generate resources and develop accountability between the key actors. This also needs legal, political and often further financial support from wider administrative and political institutions.

Notes

[1] This reform targeted to reduce total number of civil servant in the government from 115,000 to 77,000. The ADB is funding this program providing extra incentives for those taking early retirement.

[2] The area planned here is less than the potential command area of the system, 8700 ha. According to the consultant, this target was set after discussion with the WUA and field level technicians.

[3] Any out side researchers have to pay Rs. 1000 to acquire information about the system. If it also involves help from the WUA members, Rs 200 per hour is charged for the lectures and Rs 150 per hour for the field visit.

[4] Under the law, registered organizations in Nepal have to carry out an annual audit by a registered auditor and its report has to be made public.

[5] Where the responsibilities of main canal and headwork lies with the Government, the WUA is required to pay 25% of its ISF to the Government.

[6] Structure constructed above a stream/drains to carry the water.

[7] Irrigated area varies in Khageri from year to year depending upon rainfall. Here average irrigated area is assumed, which is 2800 ha.

[8] NISP Irrigation subsidy study (2000) Phase II reports mention typical cost for operation and maintenance for medium and large Terai schemes to be Rs. 670 and 270 per ha.

[9] Poudal (1998) mentions that at the beginning of group formation, many branch and minor canals especially at the head end (from MC_1 to MC_{11}) attempted several times to clean their canals themselves but did not succeed. Only in selected MC blocks, where there were farmers with a hill migration background, was this successful.

[10] It is very difficult to gather valid and reliable data on changing production in rural Nepal: even IMTP and government reports caution about unreliability of data. There are some studies on agrarian change, for examples by Ghimere et al (2000) for Panchakanya and Adhikari et al (2002) for West Gandak, but these also use secondary sources.

10

Conclusions

This thesis attempted to explore the scope and challenges of participation in the engineerability (makability, Halsema, 2002) of irrigation. It began with the objective of contributing towards irrigation management reform in Nepal, and promotion of participatory approaches in intervention policies and practices and participation in irrigation water management. I did not limit myself on only one context of participation, but rather tried to explore different contexts and domains of participation to provide a comprehensive review on participatory methods to build new irrigation organisations, the participatory nature of new organisations, their experiences in transforming local irrigation management practices, and the gaps and weaknesses in government policies supposed to empower these new organisations. The research involved revisiting work that I was earlier involved with as an engineer: with the hope that information from our action could help the design of future programs to transform local water management. Despite the challenges, the methods used were able to bring new information on governance change and show the dilemmas in participatory approaches. Although involved in studying my own professional colleagues, I have never been victimised for these findings.

This chapter presents the core findings of the study, with reference to its four interlocking themes. The chapter ends with exploring future research agendas and path ahead for future irrigation development in Nepal.

10.1 The Evolution of New Forms of Irrigation Governance

The process of irrigation management reform in Nepal was initiated by the government and users were not consulted about their future role in water management. They were required to participate in the processes whose agendas were already set by the government. However, users rather viewed the WUAs as a platform to increase their economic and political power to bargain and negotiate with the government and other institutions linked to water management. Their commitment towards the reform process was further accelerated by the climate of political decentralization in the country, as WUA development began parallel with the beginning of the multi-party democracy in the country. The thesis showed that all the WUAs have been able to use their political dimensions especially to bargain and negotiate with the government and other institutions as needed. However, they have quite different outcomes in terms of their management performance.

In Panchakanya, there has been improvement in water availability, increase in irrigated area and change in cropping pattern. Local people believe in their organization: the WUA is accountable to its members and is financially capable to take up new management responsibilities. In Khageri, there has been improvements in water delivery schedules, an increase in irrigated area, and change in cropping pattern, but not on the scale seen in Panchakanya. The system falls short in financial viability. However, farmers have strong support to their organization, which has fought battles externally to defend system water supply. Whereas in West Gandak, the new management arrangement is dysfunctional. The WUA has lost its credibility and acceptability at local level. Attempts to improve system performance through local organization here has been rather disappointing resulting in frustration and demoralization of the local community.

Incidentally, the scale of change in these systems is in parallel with their service area: the Panchakanya is the smallest among the three with 600 ha area and has better outcomes in terms of service delivery whereas the West Gandak, the largest with 8700 ha command area, has experienced in management incompetence. However, these variable outcomes cannot be looked at simply with respect to their area, but also at the challenges of regulation and control of the wider environment (both socio-political and the physical-technical) of system management which are discussed below.

Local political dynamics

The thesis has shown that how local social and political dynamics influences the institutional arrangements and the management regimes. In Panchakanya, the new institutional arrangements were shaped by the users prior experience of collective action: a social capital to start with. Beginning management reform here was thus like 'beginning with champions' (Groot, 2002). In Khageri, different groups of farmers had different access to water resources, and management reform began with a conflictive environment. However, because of relatively educated and politically conscious society, different groups of farmers were able to negotiate new management arrangements and provide continuity in them. Both WUAs were accountable to their users and thus enjoyed local credibility and acceptance, which further strengthen the legitimacy and power of these WUAs. Whereas West Gandak had different societal relations. Users were more dependent on powerful political figures in their everyday lives. Party politics dominate the WUA agendas and no accountability mechanism could emerge between the users and the WUA, rather the WUA became a platform for political parties to check their strength in the society.

Local socio-political dynamics have often been excluded in the design of the new institutional arrangements. A community is often assumed as homogeneous with solidarity and harmonious relationships among farmers, which fails to recognise power relations and socio-political dependence in the society. Instead of trying to fit the institutions to a set of designed guidelines, the existing socio-political structure can guide new institutional arrangements.

External support and networking

The thesis showed that local organization does not stand on its own, they are part of external non-local environment and its recognition by wider governance organisations is essential for the sustainability of the system. WUAs thus continue to struggle to gain legitimacy and power through external support and networking. All the WUAs presented in this thesis tried to expand their networks and get support from other economic and political institutions (though at varying degree of success), such as the VDCs, DDCs, administrative offices and NGOs involved in the agriculture sector. The formation of the federation at national level was also aimed at expanding their recognition to wider world and increasing their legitimacy and power at local level.

This study has shown that external support has values in several other ways. First, when WUAs are recognized by external institutions, their legitimacy at local level also increases. Secondly, support from external institutions also help implement internal rules and regulations of the WUA. Thirdly, wider networking is also essential to increase their negotiating and bargaining power.

Most of the debate on local organization however is confined at local level only, forgetting how these locals need external support for their survival (see for example Ostrom, 1992, Wade 1995). The thesis shows that no single organization is capable of managing complex process like irrigation management and problems are solved only when they are represented in different domains and this equally holds true for the WUA too. In order to be able to govern and manage irrigation water, the WUA must be able to gain control over the resources they need (finance, equipment etc) and have influence over the external environment. They should be able to bargain and negotiate with other agencies that affect their functioning.

As building economic and political networking also increases individual economic and political power, people thus use their social status and political affiliation to be elected in the WUA and also use their status as WUA executives further to expand their economic and political power. The WUA also acts as springboard to aspirant politicians to jump further in their political careers. In all the three cases, the WUA members, especially the executives were the persons who were already active in other parts of their village and political life. They got elected in the WUA through this social recognition and used their status of WUA executives further to expand their economic and political network. Kloezen (2002), Narain (2003) documents similar dynamics in Mexico and India.

Support from the state has been also given less attention in the current debate on local organization, and state is most often seen as constraining factor for the local governance. However the thesis showed that empowerment to WUA would not come into effect unless visible support is provided by the state. In countries like Nepal, only the political and administrative institutions of the state are seen as source of power. Common farmers do not believe in the authority of the newly established local organization. Because of this situation, only granting autonomy to the WUAs and empowering them with Acts and Regulation is not helpful to establish local governance. The state must provide visible support (action oriented) to local organization to help it execute rules and regulations, such that people believe in the authority of the WUA. State has also visible role in making local organization to be recognized by other political and administrative institutions. Besides boosting the recognition of the WUA in the wider world, the state also has an important role in the settlement of unspecified rights and major disputes (Ranjan, 1997), as clearly reflected in this study. However, the state's active role should not limit the right of local users to craft and implement the new institutional arrangements, but work as background support for the emergence of local governance.

Both elements the local socio-political dynamics and wider support and networking needed to sustain local management show how political actions are embedded in local governance. The only difference is that when the organization is functioning, its political character is shadowed, whereas when it fails to function, its political activities become visible. Political actions are not necessarily problematic, but are needed to sustain the local organization. Thus as argued in chapter 1, WUA should also be viewed as a political body against the often-assumed non-partisan, non-political body.

However, there is need to separate between two different areas of politics: everyday politics and party politics. As shown in this thesis, everyday politics is part of the organizational evolution and essential to mange and govern irrigation water. When party politics dictate the agendas of everyday politics, it begins to be problematic.

Restructuring of local organization

Type, size and membership of an organization have got considerable attention in literature of the WUA design (Patel and

Lele, 1996). This study has shown that this depends on the management pattern of the WUA and physical layout of the canal systems. The WUAs presented in this study were designed as multi-tiered associations with varying sizes in the lower unit of the WUA structure. However, the size and structure of these WUA changed together with the management transformation process, because of the new operational requirements. In Panchakanya, the WUA changed itself from two-tier to three-tier organization, with groups formed even up to 5 ha outlets. Like wise Khageri also turned from two to three tiered organization with a lower unit of about 20 ha. In both the systems, the needs for groups at lower level were determined by the changing operational requirement at lower level. However, the lower order groups are confined only in water distribution activities. West Gandak also tried to change its management style adding a separate management committee and four regional committees, because of the new field level situation.

The size of the group however depends on the management model of the WUA. The WUAs presented in this thesis are operating in 'Participatory model', and farmers groups at lower order canals were needed to co-ordinate the daily water management activities. However, examples from Mexico (Kloezen, 2002), Columbia where WUA function on 'Management model' show much larger group size, as the everyday management of these WUAs are performed by the hired professional staff. The size of the group is thus function of management model and daily water management arrangement, which differs from system to system, and there can not be any optimal size of the group suitable to local management.

The WUAs presented in this thesis were based on their hydraulic boundary. However, in Khageri and Panchakanya, representation in the MC was also balanced in terms of geographical area. However, in West Gandak the WUA was solely based on hydraulic considerations, which resulted in a highly unequal representation, which has been also one of the reasons for the non-functioning of the WUA. This shows that the organizational design, though are based on hydraulic boundary, must also equally consider the geographical or political boundary within the network characteristics of the particular systems.

The thesis presented two different ways of structuring the WUAs: the unitary and federated model. It shows how power and control of local organization are concentrated to a few powerful people in a unitary model, whereas in federated model politics of organization are distributed in federal linkages. Out of the three WUA presented, Panchakanya exhibit partly the unitary and partly federated character, the Khageri is structured in federated model whereas the West Gandak is a perfect example of an unitary model. Because of its unitary character in West Gandak, the lower tiers of the WUAs were almost non existence, as membership to lower tiers are seen as only a means to jump in the MC. Organization design has to consider how the power of the organization can be distributed and how one tier of organization can be held accountable to other. In this connection, structuring a WUA in a federated model offers better potential than the unitary model.

10.2 Institutional Reform and Participatory Development Process

Participatory and process-based intervention emphasizing participation of stakeholders and social learning has been widely called for (Bond and Hulme 1995; Rondinelli, 1983; Mossee *et al.* 1998; Brienkohoff, 1996) in recognition of the political and interactive nature of development intervention, however, the thesis showed that they fall short in real practice. Though efforts have been made to shift away from blueprint towards the process approaches, in reality, blue-print ideas about project planning and implementation dominates the intervention, and learning and participation are mostly confined at local level of project implementation. The thesis further showed how the hierarchical organizational structure, lack of organizational learning, shorter time frames, failure to link the project with the broader development objective all posed barriers to IMTP proceeding as a process based intervention. Participatory process-driven approaches in Nepal have become a sort of 'good theory, poor practice'. There is a need for fundamental changes in the way projects are designed and implemented to achieve participatory development in real world situation.

IMTP as a process intervention

The IMTP implementation was designed to be participatory, but in reality the design of its framework began in usual top-down fashion: it was shaped by the donors, consultants and the higher authorities in the IMD of the DOI (see chapter 3). The design of the participatory trajectory was not a bottom up process, even the field level project managers and the farmers were not aware of the framework, although key actors in the implementation process. It was only after field level managers and WUAs at local level raised concerns about the implementation process, that a meeting was organized in Kathmandu to discuss the framework. Though interaction later altered and redesigned some of the framework, it was a compromise, rather than a best alternative. However, it was not fully top-down: actors at local level had had considerable flexibility to redesign and adopt change, especially in the technology change process.

The limitation however was that participation was taken in a very narrow sense: as communication between actors at local level only. Actors at central level, the donors, the higher authorities and the consultants shaped the implementation framework, and managers at local project level were asked to implement it, collaborating with the water users at the local level. The focus was thus on 'single system only' with no realization of related system at other levels. The actors at higher institutional layer decision making considered themselves as contextual factors and set aside from the change process. So the development of wider coalitions and shaping the process out of mediation and negotiation as demanded by the participatory process (Mahanty, 2002, Lewis, 2000, Brienkohoff, 1996) could not become the agenda in the IMTP. Because of this situation, the processes meet resistance at the time of management turnover process.

Despite this, actors at local level negotiated, altered and redesigned elements of the designed framework as required. But this only was not enough to manage the change process as many of the decision making power was concentrated at the senior level and those implementor at the local level were junior and less senior staff, with accountability towards the seniors. These powerless representatives (Groot, 2002) had no mandate and capacity needed to make commitments or negotiate agreements to bring about overall change. Neither they were in a position to build coalitions and networks essential for the change process beyond local level, which limited the outcome of the change process.

The hierarchical structure of DOI and the institutional arrangement with in it also limited the innovation and flexibility in the process. Despite a decade of advocacy towards participatory process-driven approaches, the working process has not changed fundamentally in Nepal. Though authors like Korten strongly argues for use of existing permanent institutions and their capacity building to facilitate participatory process, they have often remained as controlling actors than the facilitating one as shown in this thesis. Uphoff's work in Sri Lanka also argues that an irrigation bureaucracy are not necessarily the constraining factor in implementing the participatory learning process, but sprit of Gal Oya has not continued there after. The issue for future is thus not only the irrigation management reform, but also the bureaucratic reform needed to facilitate participatory processes.

Another key issue here is the role of engineers, who have remained the key actors in designing and implementing the change process. I myself was responsible in leading the change process in both Khageri and Panchakanya and as mentioned in chapter 1, had both success and failures. As per my own learning, the issue here is not whether engineers can lead the change process or not, but their orientation, commitment and organizational culture. There are two problems facing engineers in internalizing participatory approaches in their working. First is that education of irrigation engineers is still dominated by hard scientific approaches. Second, irrigation bureaucracies are still short of in internalizing soft approaches, and participation and reform are more seen as justifying further investment in irrigation sector. Unless the culture of the organization changes, it is very difficult to change individually. Irrigation engineering profession thus needs change both in current working practices and university training of the new generation of engineers, to recognise that knowledge and expertise from other disciplines is equally important in informing irrigation design processes.

The project approach and institutional reform

The use of 'project approach' has been criticised for participatory initiatives, for providing narrow space for participation and learning (Van Dam, 2000) and authors like Uphoff even argue for abandoning the project concept to focus on social learning and institutional building. Contrarily, projects are an increasing element of development activity: there has been a decrease in a state activity and much of that activity has been turned into projects-a process of projectization (Wield, 1999). Despite criticisms, no effective alternative to projects has emerged and they are likely to remain a tool for translating policies into program actions (Cernea 1991) and call to make more learning oriented has been given wider attention over the years (Hulme, 1995; Honadle and Rosengard, 1983; Rondinelli, 1983).

The management transformation process presented in this thesis were facilitated and supported through a (participatory) project framework. It had two component: developing institutional capacity of the local organization and facilitate technical change to provide better working condition to the farmers. The materials presented in the thesis show that both in Khageri and Panchakanya, the WUA's were able to gain control over the process and technical change provided visible support the WUA. Whereas Gandak fall short in capacity development, neither technical change could provide visible support to local organization. In the first two cases, the local organizations have been able to sustain the reform beyond the project phase, whereas it collapsed after the project phase. These variable outcomes suggest that a critical review is necessary about the project approach to institutional reform.

The criticism to project approach in maintaining participatory approaches are mainly due to its time bound activity (mostly shorter time frame) and rigid planning process. However, the first problem is due to our failure to separate between development objectives and projects, while the second is more to do with the approach of the project than the project itself. Project approaches do not necessarily limit the scope of participation. A clear distinction between project and the broader development objective of which the project is a part is required. Equally important is that the dominant image of projects as a technocratic exercise must be replaced with a image that recognize project as arenas of conflict, bargaining and trade-off and in which data and technical tools have the potential to clarify likely outcomes and shape arguments (Hulme, 1995).

Whether based on top-down technical exercise or participatory process based ways, projects are confined within a time frame and shorter time frame has been often assumed as the major shortfall in managing the projects in participatory ways. However, time alone is not the issue, the important issue here is one needs to separate projects and development in time continuum. Development is an ongoing social process, which can not be confined to a time boundary. Whereas projects are only part of the broader development process, and have objectives of providing support to sustain the development process. IMTP had objective of decentralization and self-governance: to initiate and sustain user participation in local water management. Both users and facilitators at local level were less familiar with this objective, and took IMTP more as system rehabilitation project. The wider development objective was thus lost and project was focused on much narrower issue of technical improvement works. So the project design and implementation must be linked to broader development process.

PTD and its scope in irrigation innovation

The current irrigation management reform lay emphasis on participatory design construction of the technology to provide better working condition for the farmers. The underlying assumption for adopting PTD has been that it creates ownership feeling among users and produces technology compatible to farmers' management. The thesis identified several major constraints in current approach to PTD in large-scale irrigation systems. The first is about the way criteria and preference is incorporated in the design process. The thesis has showed how the way users' construct their ideas and priorities are shaped by the project structure and by their over expectation on what technology can do for them.

A second constraint comes from lack of initial learning of the system environment. In chapter 1, I mention that irrigation systems are sociotechnical systems and technology of the system shapes and is shaped by ecology and society. Design should thus begin considering both the human and the physical dimension of irrigation systems The strength of participatory design depends first on what people, both users and designers, know about the system, and its opportunities and constraints. Only then can an interactive design process be maintained. In both Panchakanya and Khageri, farmers were familiar with their system opportunities and constraints and were able to interact with the engineers in the design process. Whereas in West Gandak, lack of knowledge about system opportunities and constraints by the farmers limited the outcome of the PTD. Both the farmers and the engineers thus need to learn about their system, the people, the technological system and the environment. However in irrigation, such learning can not come unless one is directly involved in the management of the technological system. This initial learning is essential for technology and institutions, and their complementary evolution.

The design process also has a political nature. The PTD considers participation as a communication between the designers and the engineers (see also Scheer, 1994). It is true that users and the design engineers are the key actors in shaping the design process, but when design gets implemented in the field, it enters a multi actor environment and the design is contested between different actors, especially in the construction phase. Adopting changes and maintaining flexibility is not always possible at local level, and require approval of higher authorities and donors. These actors at different decisions making level are not involved in daily design process, but are crucial to maintain the participatory design process. Participation then goes beyond the communication and calls for accountability between the different stakeholders and demands effective meditation and negotiation between the various actors. The thesis showed how failure to maintain the accountability resulted a conflicting situation between the users and the NLIO. Like wise the Gandak case showed how design is challenged while implementation in the field.

PTD as a means to achieve service oriented water control

I have argued in the thesis that participatory design and construction should not be seen on its own, but rather be used to achieve service oriented water control. Discussion in chapter 5 and 6 show that design for achieving service oriented water control has three central characteristics: initial learning, defining service and interactive and iterative design construction.

The design begins with the initial learning of the system environment by both users and the designers. They learn about the water supply regimes, the technical features, the prevailing practices of system operation and maintenance and identify their opportunity and constraints in transferring irrigation practices. In parallel, they learn about the different water users groups, their social relation and its shaping of water management. They gain this through directly being involved in the system operation and maintenance. This initial investment in learning about the system constraints by both designers and the future users prepares the base for the future design process. As shown in chapter 5, this initial investment has also another value. It does not necessarily calls for the radical change in the existing technology in favour of the particular set of new technology. It gives opportunity for the farmers to test it, find its constraints, change or modify it as per their operational plan rather than to freeze them in favour of new structures.

With their experience of water management practices through initial learning, the users would then define the service pattern they want in future management. The thesis also shows that only early experience is not sufficient to shape the design. The process of design should then follow iterative and interactive process, such that learning can be accommodated throughout the design process[1]. By iterative I mean, the design process should be carried out in different phases such that the learning can be accommodated. By interactive design I mean both the users and the designers discuss communicate and negotiate until the best feasible options are found. Participatory design demands innovative actions both from users and designers.

10.3 Matching Technology and Institutions in Irrigation Management

The study has shown that only including technical rehabilitation component in the reform process is not enough to support the local organization, it needs broader understanding of technology, pattern of its service delivery and requirement of use. As demonstrated by the study, the design of the technology influences the organizational capacity to operate and maintain the system. Technology change to support institutional reform thus should consider both the institutional capacity as well as the management objective of the local organization managing the irrigation system.

In both Khageri and Panchakanya, the process of technical change was guided by both organizational capacity and management objective of the WUA. Users in both the systems preferred to have different kinds of rotational delivery pattern depending on water availability across the seasons. They thus choose to continue with the manually adjustable gated water distribution technology, but with their re-location and modified technical characteristics to suit new water delivery requirement. The resulting technology was thus in accordance with the rotational delivery system preferred by the users. The design also considered the institutional capacity of the WUA. Both the systems were extensively developed system with fewer water control structures and canal networks. No radical changes in the existing technology were made, and changes made were incremental to meet the new field level situation. As discussed in chapter 6, the design tries to maximize both technical and social control so as to keep the number of control structures to minimum in the systems. As a result, the overall technology was simple to operate and required less number of operators and less cost to operate and maintain, at the same time was in accordance with farmers' management objective.

The West Gandak had complex canal networks with large numbers of water control structures to operate and maintain placed during the command area intervention. The system also used to suffer from heavy silt deposition in the main canal requiring high cost for annual repair and clean up of the main canal. However, the technical improvement work largely failed to recognize the requirement of use of this technology to the WUA, and was focused only on remoulding of the existing old structures. Though efforts were made to improve canal siltation problem through the construction of a silt ejector, it could not function due to poor location of the structures. Operation of the system continued to be constrained by the large number of check structures and silt laden water. Haslema (2002) has shown the challenge in managing such silt-laden water under unsteady flow condition. The WUA has neither the expertise nor the resources to operate and maintain this complex canal network. Because of failure to deliver the necessary service, the WUA lost their credibility at local level which in turn weakened their leadership.

Plusquellec (2002) has highlighted the importance of technical change to support the institutional reform. With examples from Mali (Office du Nigier, see also Musch, 2001), and Australia, he shows how combination of technical changes with institutional and policy reforms have largely contributed to the success of the reform programs. The materials from this study (from Khageri and Panchakanya) also show that technical change can provide an incentive to local organization to take up the management responsibility. But this study also shows that the main issue is not inclusion of technical change, but its design process, which must be guided by the management objective and institutional capacity of the local organization. The critical issue is the design, as many management and institutional problems are self-inflicted wounds that could be minimized or eliminated with proper designs and operational patterns (Burt, 1999). Horst (1998) also considers the design as the crux to the irrigation management and views management reform without due attention on irrigation technology as cosmetic surgery. However, the paradox is that the design approaches for technical change to support institutional reform have been less debated so far.

The debate on technology design has confined in three areas presently. The first one concerns with modern water control systems (see for example Plusquellec, 2002; Burt, 1999) and favour automated water control mechanism. However, the use of such a technology in Nepali context is out of question because of the physical characteristics of the irrigation systems and its farming practices. Irrigation systems in Nepal are supply-oriented run-of-river gravity systems and experience high variation in water flow within and across the seasons.

Researchers like Horst and Pradhan (1996) on the other hand argue for simple and transparent technology to local organization and favours simple ungated proportional distribution structures for local management. But such a bias towards a particular type of technology can have several problems. First, it may need demolition of existing technology to set up a new technology demanding huge financial resources. Secondly, this radical change would bring entirely new technology with new service characteristics, which users may not be familiar with and can be quite different from users preferences. As shown in this study, farmers in both Khageri and Panchakanya preferred to stay with manually adjustable gated technology, which they found more suitable to implement a strong rotational pattern. However, they were also careful not to increase the number of control structures. In both the system farmers tried to maximize both technical and social control and fit technology accordingly. Farmers' choices of service pattern are driven by ease of operation, workable institutions and water availability. These are dynamic, and differ from system to system. There can be thus no universal rule that a particular set of technology is suitable for all situations.

The third area involves the 'participatory approach' in design innovation and tools like PTD are promoted to help arrive locally specific design. The process of technical change presented in this study was also based on PTD. It is not biased to any particular form of technology as in the past two cases, and aims to provide methodologies for technology development in accordance with users skills, knowledge and requirement. However, as shown in this study, lack of understanding of technology and its requirement of use by both designers and the users, and other practical limitation of adopting participatory approaches has limited the scope of PTD in its use and outcomes. Considering these limitation on the current design process, I introduced the concept of 'service oriented water control' as a strategy of technical improvement to support the institutional reform. Such a concept is not biased towards a particular technology, it help to find technologies that match with organizational capacity and management objective of the local organization. This can vary from automated to simple proportional water control structures, determined by the WUA themselves.

Water availability and agroecology

Institutional arrangements are also shaped by the demands of the physical environment. It demands particular skills and resources on the part of the local organization to manage the externalities created by the physical environment. It also affects the water supply regime and hence the management arrangement. As shown in this thesis, both Panchakanya and Khageri are free from the threat of physical environment like flooding, inundation and canal siltation. This resulted in low management input on the part of the WUA. The West Gandak has more complex bio-physical environment demanding more resources and skills on the part of the WUA. Its canal networks and associated structures are most often damaged due to flood and inundation resulting in higher annual maintenance cost. The system also suffers heavy canal siltation problem which again adds to higher maintenance cost. The WUA however lacked the institutional capacity to cope with the challenge of this bio-physical environment.

Water is the key input to crop production, and its availability ultimately shapes users willingness to participate in water management. This study has shown that major factors affecting the water availability have been the temporal variation of rainfall, river regime, land topography, condition of technology, and aquifer conditions. One dilemma is that that irrigation systems in Nepal have very low potential to irrigate in winter and spring seasons as mentioned in Chapter 2. Thus attempts to reform irrigation management in Nepal have give particular attention to increase water availability situation during winter and dry season.

As there is direct relationship between water availability and management arrangement, scholars on collective action have tried to link relation between them through the concept of 'relative water scarcity', which is considered as a favourable condition to initiate and sustain collective action. However, the above discussions show that the simple relation between the collective action and water availability is not helpful. Scarcity can vary across the season, can result from several environmental and technical constraints and can be mediate through alternative sources like groundwater and technical intervention (se also Vincent, 1999 on how technology relates to water scarcity). The relationship is much more complex, it needs broader understanding of different environmental and technical considerations on how they provide opportunities and constraints in making water available to farmers field.

10.4 The Failure of Blueprint Policy Approaches

Irrigation sector reform in Nepal has involved several policy measures and legal changes. These changes aimed at improved operation and maintenance, reduced government expenditure and improved performance of irrigated agriculture. It hoped to create new institutional roles and responsibilities for governmental personnel and expanded decision-making role for water users in new WUAs. The case studies presented in this thesis show that the overall results of the policy implementation with respect to ISF, institutional strengthening of the WUA and improved operation and maintenance has been less than expected. A careful review in the policy and legal framework is required to support the organizational evolution.

The thesis shows that one of the most inconsistent factors in initiating the management reform has been the weak legal framework itself, especially in clarifying future financing of system management. It failed to address how the newly established WUA would generate and finance future operation and maintenance of their irrigation systems, which is the crucial element of the reform and decetralization process. Though the WUAs have been given autonomy over to assess and collect the irrigation service fees and decide on their expenditure, there was no directive on such fees would be assessed and charged, and legal powers given to the WUAs to execute this sensitive issue.

Because of this policy gap, both the implementers and WUAs at local level did not pay attention on future financing of the operation and maintenance of the system. Irrigation Service Fee (ISF) till then was NRs. 60 per ha per crop, which was only about 20% of the operation and maintenance cost required that time. Farmers in all the systems started with this cost and continued with it. The newly established organizations were not in a position to increase the ISF because of socio-political reasons, and felt it impossible to increase the ISF without government intervention and continued support. Over a period of five years nobody paid attention to increase the ISF rate and improve its collection efficiency.

There is also another paradox in the policy. The policy states that systems below 2000 ha in the Terai and 500 ha in the hills would be transferred to the WUA. Thus in larger systems, canal networks smaller than 2000 ha would be transferred to the WUA in joint management. The larger system will thus continue to enjoy heavy subsidy for irrigation management whereas the smaller ones have to depend on their own resources. This disparity will definitely invite conflict in future. Instead, the policy first should ensure that the total cost of system management should be borne by the farmers irrespective of their size. It is then up to the users to decide up to which part of the system they want to retain under their control and which part they want to be jointly managed with agency, but with financing from themselves.

The irrigation management transfer in Nepal also involved transfer of system properties like canal land, service roads and forest resources. For example in West Gandak, the canal embankment trees were handed over to the WUA and the WUA were also authorized to collect the tax from the canal service roads and other land properties. Though these could provide good incentives to the WUA to pay for system management the reality turned out otherwise and the results were disappointing. Such transfer of properties has raised questions. Is it appropriate to subsidy the irrigation sector from other sectors like the forest, and if it is going to subsidy the irrigation sector, what about its own sustainability?

Another issue is that by involving the WUA in other lucrative sector like forest and service road tax collection, the WUA's interest in canal management may be lost and at the same time they try to avoid resource generation within the irrigation community. This is what happened in the West Gandak, where WUA neither could mange the outside resource nor was able to generate its own. While there are arguments for multi-function organisations, Uphoff argues that irrigation organisations must succeed in the single purpose task of water management first, before it can be successful in multiple functions. Involving the WUAs in sectors other than water management may not always be productive, it can jeopardize the WUA's interest in water management in one hand and lack skills to compete with more professionally competent private sectors on the other (Brett 1996).

10.5 The Future Ahead

It has been now almost a decade and half that participation in irrigation water management has been the driving theme in irrigation intervention in Nepal. However, participatory process based intervention to support evolutionary organization have been confined only at local level interaction, with less room for learning and flexibility. Institutional reform and the decentralization of irrigation management functions as envisaged have been less able to meet the expanded management objectives. The participatory approach has been used for the continued survival of the DOI rather than promotion of self-governance and empowerment to farmers groups. Despite the present shortcomings in adopting participatory approach in irrigation water management, there can not be, however, going back from the participatory approach. The issue for Nepal thus is not whether to have participation or not but is how they can be made effective, such that future water management can be developed and sustained locally. This institutionalizing and operationalizing participatory approaches in irrigation water management needs rethinking from both the irrigation department and the local organizations. This demands for the change in current working practices from doer to supporter in irrigation management.

Shifting the agency from implementor to a facilitator also calls more responsibility on the part of the local organization. As shown in this thesis, the WUA's so far has been more visible in their political mode than on functional. They have proved effective in bargaining and negotiating with the government in getting the resources as well as on other agendas when they found others' actions threatening to their livelihood. They have however, fall short in everyday management, especially in contributing for development and management of irrigation systems, which may weaken their control over management in long run. The newly formed national federation of the WUAs, the NFIWUAN has a crucial role to play on it. It should initiate a process through which the users would pay the cost of irrigation development and management, whereas the department would transfer its control over the process to the users. The WUAs have to realize that unless the cost are financed by themselves, they would not be able to increase their bargaining and negotiating power with the government and other funding agencies.

Parallel with the decentralization of irrigation management at local level, the process of decentralization and empowerment of local political bodies like the District Development Committees (DDCs) and Village Development Committee (VDCs) has been also gaining momentum. More recently, the control of the natural resources within the district has been given to the DDC and it has been also made responsible for the implementation of the development activities inside the district. Much of the role to the DOI on irrigation development at local level has now been transferred to the DDCs, and the DOI has now changed its structure as per the decentralization policy. The functioning and sustainability of the WUAs will also depend on wider networking and support from the VDCs and DDC. On the other hand, these political bodies may try to gain control over the WUAs. It remains to be seen how the WUAs will struggle to keep their autonomous status in this changing context. and we need to know how this changing local governance structure will affect irrigation governance: a key area for future research.

However, whatever changes take place in local governance structure, user participation in irrigation water management will continue to remain central to irrigation sector development in

Nepal. I hope the understanding on local organization and participatory support processes presented in this thesis will help in engineering participation, with more participatory engineers and WUAs in the future.

Notes

[1] In this thesis I am dealing with design in the process of rehabilitation, where previous experience of the users is available and very important to shape the design. However, in new design cases one has to follow both iterative and interactive design processes.

Appendix 1

The MOA format showing terms and condition of the transfer processes and arrangement[1]

MEMORANDUM OF AGREEMENT

BY AND BETWEEN

THE DEPARTMENT OF IRRIGATION
OF HIS MAJESTY'S GOVERNMENT OF NEPAL
AND
THE.........................WATER USERS ASSOCIATION

This Memorandum of Agreement is executed and entered into this [date] of [month/year] at [place of MOA signing] by and between.

The DEPARTMENT OF IRRIGATION OF HIS MAJESTY'S GOVERNMENT OF NEPAL, with its principal office at [office address] hereinafter called DOI,

and

the ....WATER USERS ASSOCIATION, a water users association registered in accordance with the Water Resources Act, 2049 and the Water Resources Regulation, 2050, hereinafter called the association.

WHEREAS, DOI has built, operated and maintained the .... Irrigation System, hereinafter called the Irrigation System, which covers the area shown on the map attached as Annex 1 to this Memorandum of Agreement;

WHEREAS, the member of the Association use the Irrigation System for irrigation water;

WHEREAS, DOI and the Association wish to jointly under take certain repairs and improvements of the Irrigation System, as outlined in the Plan of Action attached as Annex 2 to this Memorandum of Agreement: and WHEREAS, it is intended that the Association will operate and maintain [certain parts of] the irrigation System after these repairs and improvements have been completed.

NOW, THEREFORE, the parties agree as follows:

A. Establishment of Subproject Committee

1. There will be a Subproject Management Committee (hereinafter called the SMC) consisting of (a) [name of DOI official] as Subproject Manager, and (b) [names of Executive Committee member, which should number between three and seven] being the Executive Committee elected by the [Main Committee] [General Assembly] of the Association for this purpose.
2. The Subproject Manager will act Chairman of the SMC.
3. The SMC will be responsible for supervising, coordination and monitoring all activities undertaken under the Plan of Action.
4. The SMC will meet as frequently as necessary, but at least [once a month]. The Chairman of the SMC will arrange for written minutes of each meeting to be prepared and provided to all SMC members.
5. The Subproject Manager will be responsible to keep DOI informed at all times of the status of activities under the Plan of Action.
6. The Executive Committee will be responsible to keep [the Main Committee of] the Association informed at all time of the status of the activities under the Plan of Action.

B. Implementation of Plan of Action

1. The rehabilitation, improvements and related training activities to be undertaken by DOI and the Association are as described in Part I of the Plan of Action.
2. The responsibilities of DOI, the Association and the SMC for implementing the Plan of Action are as described in Part 11 of the plan of Action.

3. The estimated costs of the rehabilitation and improvements to be undertaken by DOI and the Association are as described in Part 111 of the Plan of Action.
4. The cost-sharing arrangements between DOI and the Association for such rehabilitation and improvements are as described in Part IV of the Plan of Action.
5. The Association will mobilize resources to satisfy its share of the costs of such rehabilitation and improvements according to the plan described in Part V of the Plan of Action.
6. The tentative timetable for implementing the Plan of Action is as outlined in Part VI of the Plan of Action, which is subject to the conditions set forth in Part C below.

C. Sequencing of Rehabilitation and Improvements

1. Emergency maintenance and repairs (described in Part (A) of the Plan of Action) may be undertaken immediately.
2. Essential structural maintenance, catch-up maintenance and system calibration (described in Parts 1 (B), (C) and (D) of the Plan of Action) may be undertaken only after the SMC confirms in writing that all of the following activities have been completed by the Association of DOI, as the case may be:
(a) The Association has adopted all necessary and appropriate rules and regulations;
(b) The Association has set up a record keeping system, including accounts and one or more registers of Association members;
(c) The SMC has conducted a "walk through" of the Irrigation System to identify needed rehabilitation and improvements;
(d) DOI has completed all necessary diagnostic surveys and studies relating to the rehabilitation and improvements to be undertaken;

[Other conditions can be added, if appropriate, relating to members' registration and payment of registration fees; members' contributions to the cost of the rehabilitation work; etc.]
3. System improvements and improvements to canal service and farm-to-market roads (described in Parts 1 (E) and (F) of the Plan of Action) may be undertaken only after the SMC confirms in writing that all of the following activities have been completed by the Association of DOI, as the case may be:
(a) The Association is enforcing its rules and regulations;

(b) The Association is keeping accurate and complete accounts, water delivery records and records of registration fees and other payments made by Association members;
(c) At least [should be more than 50] per cent of households using the Irrigation System have registered as members of the Association and have paid the applicable registration fee;
(d) The Association has prepared operation and maintenance plans for the Irrigation system, and a related budget, Which are satisfactory to the Subproject Manager;
(e) The Association has calculated an irrigation service fee (ISF) based on the budget referred to in Subsection (d) above;
(f) The Association has collected at least [must be 40 or more] per cent of the ISF due from users of the Irrigation System for the period [specify period of time to which payment relates];

[Other conditions can be added, if appropriate.]

D. Procurement

1. The SMC will supervise and monitor all procurement activities in accordance with the Plan of Action.
[Add other provisions, if needed, to clarify the responsibilities of the SMC, DOI and/of the Association for certain types of procurement-- e.g., civil works contractors, equipment, labor and materials.]

E. Construction

1. The SMC will supervise and monitor all rehabilitation and improvements undertaken under the Plan of Action.
2. The SMC will review the progress of such activities regularly, and will modify the scope of work, implementation arrangements and/or timetable as needed, in consultation with DOI and [the Main Committee of] the Association.
3. The SMC will monitor closely the quality of rehabilitation and improvement work performed under the plan of Action, and will promptly take all necessary steps to correct and defects of deficiencies noted in such work.

[Add other provision, if needed.]

F. Commissioning

1. Upon completion of each phase of rehabilitation or improvement work under the Plan of Action, the SMC, with assistance from DOI, will conduct a joint survey necessary steps to correct any defects of deficiencies noted. [Add other provision, if needed.]

G. Management Transfer

1. Upon written confirmation by the SMC that the rehabilitation and improvement work outlined in Part 1 of the plan of Action has been completed and commissioned, DOI will transfer [specify scope of transfer-- e.g., responsibility for routine operation and maintenance of the Irrigation System, excluding headwork's]" to the Association, provided the Association has met the following additional conditions:
[List here any additional conditions for transfer, such as the election or appointment of a special Association committee to oversee O&M; specified improvements in record keeping and collection of ISF; completion of specified training courses offered by DOI; an audit by DOI of the Association's accounts and other records; etc.]
2. Such transfer will be carried out as follows.
[Depending on the type of transfer, list and steps DOI must take to make the transfer effective under applicable law and regulations--e.g. any approvals that must be obtained, notices of filings that must be made, etc.]

H. Ongoing Responsibilities

1. Following the Management transfer described in Part G above, the Association's responsibilities will include:
[Depending on the type of transfer, list here the Association's ongoing responsibilities in the areas of operation, maintenance, monitoring, further repairs and improvement, record keeping, collection of ISF, reporting to DOI, etc.]
2. Following the management transfer described in Part G above, DOI's responsibilities will include:
[Depending on the type of transfer, list her DOI's ongoing responsibilities in the areas of operation, maintenance, monitoring, technical assistance, further repairs and improvements, audit and inspection, Specify any limitation or conditions on further financial assistance.]

1. In the case of partial management transfers, it may be useful to refer to marked sections of the map included as Annex 1: in the case of legal

ownership transfers, it may be useful to refer to an additional Annex 3, which would include a detailed list of the land plots, irrigation facilities an equipment being transferred.

I. General Provision

1. DOI will (a) have the right to inspect all rehabilitation and improvement work undertaken under the Plan of Action; (b) have the right to conduct inventories of all equipment, tools and materials it has provided or financed for such work; (c) have the right to periodically audit the accounts, registers and other records of the Association; and (d) provide the Association with any training and other institutional support needed for the Association to carry out its responsibilities under the Plan of Action and this Memorandum of Agreement.
2. The Association will (a) maintain accurate and complete records of all contributions made by its members (whether in cash, labor or kind) to the cost of the work undertaken under the Plan of Action; (b) hold in a separate account any cash raised for such purpose; (c) safeguard and conduct inventories of all equipment, tools and materials used by the Association for such work; (d) have the right to inspect (through its Executive Committee) any equipment or materials supplied by DOI and any work Undertaken by contractors engaged by DOI under the Plan of Action; and (e) make its officers and members available for any meetings and training activities scheduled by the SMC.
3. The cost required to repair any equipment or facilities damaged due to the negligence of DOI (including its employees and contractors) or the Association (including its members, employees and contractors) shall be borne by the negligent party.
4. DOI (through the Subproject Manager) and the Association (through its Executive Committee) will take all necessary steps to involve members of the Association in all phases of activity under the Plan of Action. In particular, DOI and the Association will ensure that women are given full opportunities to receive training and participate in all other activities under the Plan of Action.
5. DOI and the Association will take all necessary step to make available any land and facilities required to carry out the Plan of Action.
6. If a joint bank account is to be established, include a provision here for opening the account; authorizing designated representatives of DOI and the Association to operate the account, making initial deposits into the account, and making withdrawals form and replenishments to the account.]

7. This Memorandum of Agreement (including the Plan of Action) may be amended only by a writing signed by the authorized representatives of both parties.
8. This Memorandum of Agreement is subject to the applicable laws, regulations and policies of His Majesty's Government of Nepal.

[Add other general provision, if needed.]

IN WITNESS WHEREOF, the parties have here under signed this Memorandum of Agreement as of the date written above.

DEPARTMENT OF IRRIGATION

BY---

NAME:
Title:

WATER USER ASSOCIATION

BY---

NAME:
Title:

BY---

NAME:
Title:

BY---

NAME:
Title:

[Include as many signatures as required under the Association's constitution or by-laws.]

PLAN OF ACTION
FOR
------------ IRRIGATION SYSTEM

(Include a System Map)

I. Scope of Work and Related Training

[For each relevant category below, describe in detail the work to be done, including the materials and technology to be used and the location of the facilities to be maintained/repaired/improved.]

A. Emergency Maintenance and Repair

[Work under this heading may include repair/reconstruction of flood-damaged irrigation structures; repair of irrigation structures in an advanced state of deterioration, and minor civil work to remove bottlenecks in irrigation and drainage systems.]

B. Essential Structural Maintenance

[Work under this heading may include maintenance and repair of flow control and conveyance structures; and reconstruction of guide bunds at headworks.]

C. Catch-up Maintenance

[Work under this heading may include removal of sediment and weeds from and branch canals; and reconstruction of canal banks and drainage networks.]

D. System Calibration

[Work under this heading may include calibration of flow control structures and establishment of a network of flow measuring points.]

E. System Improvements

[Work under this heading may include construction of sediment settling basins; redesign or relocation of diversion works; lining of main or branch canals; re- excavation or extension of tertiary canals; improvement of drainage networks; provision of additional flow control structures of flood protection dikes; and other improvements to the water delivery and drainage systems.]

F. <u>Improvement of Canal Service and Farm-to- Market Roads</u> [Work under this heading may include grading and graveling of canal service roads, and improvement and expansion of selected village roads in the vicinity of the Irrigation System.]

G. <u>Training</u>

[Identify here any additional training needed by Association officers and/or members in order to participate in the maintenance, repair and construction work described above, and to operate and maintain the irrigation facilities after they have been repaired and improved.]

II. Division of Responsibility

[For each category of work described in Part 1 above, excluding training specify the responsibilities of DOI, the Association and/or the SMC in the following areas: (a) surveys and studies; (b) detailed designs (if needed); (c) detailed cost estimates; (d) Preparation of tender documents (if needed); (e) hiring of civil works contractor (s) (if needed); (f) Procurement of equipment and construction materials; and (g) carrying out of rehabilitation and/or improvement work.]

III. Cost Estimates

[For each category of work described in Part I above, excluding training, provide a breakdown of estimated costs.]

IV. Cost- Sharing Arrangements

[For each category of work described in Part I above, excluding training, specify the contributions of DOI and the Association (Which may be in cash, labor, kind or a combination of these) to the estimated Costs.]

V. Resource Mobilization Plan

[Describe the Association's Plan for mobilizing the cash, labor and/or in-kind contributions identified in Part IV above.]

VI. Timetable

[Include here a tentative timetable for completion the work described in Part I above, bearing in mind the institutional development activities that must be carried out by the Association before certain types of work can be undertaken (see Part C of Memorandum of Agreement.]

Notes

[1] Source: Project Administration Memorandum, Irrigation Management Transfer Project, Asian Development Bank.

Appendix II

Mean Monthly Hydrological and Meteorological Data in Chittwan

J	*F*	*M*	*A*	*M*	*JU*	*JL*	*Ag*	*S*	*O*	*N*	*D*
Rain Fall in mm (Average annual rainfall is 1947 mm)											
17	13	21	46	140	333	556	399	311	83	6	15
Temperature ^{0} c minimum average											
8	9	12	17	21	24	24	24	24	23	19	12
Temperature ^{0} c maximum											
22	25	31	35	35	34	32	33	32	31	27	23
Relative Humidity											
97	90	72	57	68	77	84	84	85	84	90	97

Source: RTDB, DOI; CEMECA Consult (P) LTD (2001)

For simplicity, data are put in round figures.

Appendix III.

O&M cost Computation for West Gandak at the time of handing over.

This does not involve cost of cleaning the farm ditches and flood damage repair cost which generally requires Rs. 100,0000 annually. The data presented are based on discussion with the technicians involved in system operation and maintenance.

Maintenance Requirement

Total cost for desilting of main canal	: Rs. 800,000
Total Cost for desilting of Branch canal	: Rs. 800,000
Maintenance of Branch and Minor Canal Structures	: Rs. 1,500,000
Operational Cost for Main and Branch Canals	: Rs. 400,000
Total cost required to maintain the system (A)	: Rs. 3,500,000
Cost per ha (For a command area of 8700 ha)	: Rs. 402 per ha

Possible Income

Forest Resources	: Rs. 400,000
Income from other sources (land and road tax)	: Rs. 200,000
Government support (first three years from 1998)	: Rs. 850,000
Total income (B)	: Rs. 1,450,000
Deficit to be borne from the farmers (A-B)	: Rs. 2,050,000
Cost per ha for farmers with government support	: Rs. 235 per ha
Cost to be raised by farmers when government Support stops	: Rs. 2,900,000
Cost per ha without government support	: Rs.333 per ha
Cost per ha assuming a collection efficiency of 60%	: Rs.555 per ha.

References

Adhikari, B. 2000. *Irrigation Management Transfer Process and Impact in Nepal.* MSc Thesis. IHE, Delft, the Netherlands.

Adhikari, S. N. 2002. *Impact Assessment of Irrigation Management Transfer Program in Nepal West Gandak Irrigation System.* MSc Thesis. IHE, DELFT, the Netherlands.

Agarwal, A. 2001. Common property institutions and sustainable governance of resources. *World Development,* Vol 29, No.10: 1649-1672

ADB. 1995. Project administration memorandum, irrigation management transfer project, Loan, No. 1311-NEP(SF).

Altieri, M. and Hecht, S. (Eds.). 1990. Agroecology and small farm development. CRC Press: Boston.

APROSC. 1978a. Irrigation impact evaluation study; Gajuri irrigation project. Agriculture Project Services Centre, Kathmandu.

APROSC. 1978b. Irrigation impact evaluation study; Manusmara irrigation project. Agriculture Project Services centre, Kathmandu.

APROSC. 1978c. Irrigation impact evaluation study; Tika Bhairab irrigation project. Agriculture Project Services Centre, Kathmandu.

Ashby, Jacqueline A. and Louise Sperling. 1994. Institutionalizing participatory, client-driven research and technology development in agriculture. Agricultural Administration Network Paper 49. Overseas Development Institute, London.

Auerbach, R. 1999. *Design for Participation in Ecologically Sound Management of South Africa's Mlazi River Catchment.* PhD dissertation. Wageningen Agriculture University.

Barker, R. and J. Lohani. 1987. O&M and mobilization of local resources in Government managed irrigation schemes in Nepal. IMC Special study No.1. IMP/DIIHM, Kathmandu.

Bhandari, R.P& K.R. Sharma. (Eds.) 2000. Sustainability issues of irrigation development. Workshop Proceedings, Research and Technology Development Branch, Department of Irrigation, Nepal.

Biggs, S. and Grant Smith. 1998. Beyond methodologies: coalition building for participatory technology development. *World Development*, Vol. 26 (2): 239-248.

Boelens, R. 2002. Design as a process. Mimeo, Irrigation and Water Engineering Group, Wageningen University.

Bond R. and David Hulme. 1999. Process approaches to development: theory and Sri Lankan practice. *World Development*, Vol. 27(8): 1339-1358.

Brett, E. A. 1996. The participatory principles in development projects: the cost and benefit of co-operation. *Public Administration and Development*, 16: 5-19.

Brinkenhoff, D. W. 1996. Co-ordination issues in policy implementation networks: an illustration from Madagascar's environmental action plan. *World Development*, Vol. 24 (9): 1497-1510.

Brinkenhoff, D. W. 1996. Process perspectives on policy change: highlighting implementation. *World Development* Vol. 24(9): 1395-1401

Burkey, S. 1993. *People First: A Guide to Self Reliant Participatory Rural Development*. ZED books limited, London and New Jersey.

Cernea, M. 1988. Involuntary resettlement in development projects: policy guidelines in World Bank-financed projects. World Bank Technical Paper 80. Washington, The World Bank.

Cernea B, M. 1991. *Putting people first. Sociological Variables in Rural Development*. Oxford University Press.

Cernea, M. 2000. Risks and reconstruction: experiences of resettles and refugees. Washington: The World Bank.

Checkland, Peter B. 1981. *Systems Thinking, Systems Practice*. Chichester, John Wiley & Sons (1990 reprint).

Chambers, R. 1997. *Putting the First Last. Whose Reality Counts?* Intermediate Technology Publications: London.

Clyma, W. 1986. Irrigated agriculture: a comparative analysis of development concepts. In: K.C Nobe and R.K. Sampath (Eds.). *Irrigation Management in Developing Countries: Current Issues and Approaches*. Studies in Water Policy and Management. No.8, Westview Press/ Boulder and London.

Command Area Development Project. 1982. Design reports. Department of Irrigation, Kathmandu.

Cooke, B. 1998. Participation, process and management: lessons for development in the history of orgnizational development. *Journal of International Development*, Vol. 10, No.1: 35-54.

Cooke, B. and Uma Kothari. 2001. *Participation: The New Tyranny?* Zed Books, London. New York.

Coward, W. 1980. Irrigation development: institutional and organizational issues. In W. Coward (Ed.). *Irrigation and Agriculture Development in Asia: Perspectives from Social Sciences.* Cornell University Press, Ithaca, New York.

Cornwall, A. 2001. Beneficiary, consumer, citizen: changing perspectives on participation for poverty reduction. Sussex, Institute of Development Studies

Craig D. & and Doug Porter. 1997.Framing participation: development projects, professionals and organizations. *Development in Practice*, Vol. 7 (3):

Dam C, van. 2000. Two decades of participatory forest development but how participatory? Paper presented at the international seminar-workshop on participatory methodology for sustainable forest development. Pelea, Guatemala, from 3 to 7 April, 2000.

Dusseldorp, D.B.W.M van. 1993. *Projects for rural development in the Third World: Preparation and Implementation.* Wageningen, The Netherlands: Wageningen Agriculture University.

Dwivedi, R. 1999. Displacement, risks and resistance: Local perceptions and actions in the Sardar Sarvor. *Development and Change*, Vol. 30: 43-78.

Ellis, F. and Stephen Biggs. 2001. Evolving themes in rural development 1950-2000s. *Development Policy Review*, 19(4): 4370-448.

Everest Research Centre. 1993. Baseline study of West Gandak irrigation system, final report. Research Training Branch, Department of Irrigation, Kathmandu.

Freeman, D. M. and J. Wilkins-Wells. 1989. *Local Organizations for Social Development: Concepts and Cases of Irrigation Organization.* Boulder: Westview Press.

Geijer, J.C.M.A. 1995. Irrigation management in Asia: Papers from the expert consultation on irrigation management transfer in Asia. Bangkok and Chaing Mai. 25-29 September 1995.

Giddens, A. (1989). *Sociology*. Blackwell Publishers Oxford, UK.

GITEC. 1992. Feasibility Study report, IMTP.

Grindle, Merrilee S. and John W. Thomas. 1992. Policy makers, policy choices, and policy outcomes: The political economy of reform in developing countries. *Policy Sciences* 22: 213-248.

Groot, A. E. 2002. *Demystifying Facilitation of Multi-actor Learning Processes.* PhD Thesis. Wageningen University, The Netherlands.

Groenfeldt, D. (Ed.). 1999. Advanced training course on capacity building for participatory irrigation management (PIM). Volume 1: Handbook. Bari, Italy: (CIHEAM) IAM-B and the World Bank.

Halsema, Gerardo E. Van. 2002. *Trial and Re-Trial, the Evolution of Irrigation Modernisation in NWFP, Pakistan.* PhD Thesis. Wageningen University the Netherlands.

Honadle, G. and Lauren Cooper. 1989. Beyond co-ordination and control: An interorganizational approach to structural adjustment, service delivery and natural resource management. *World Development*, Vol. 17, No.10: 1531-1541.

Honadle, G. and Jay K. Rosengard. 1983. Putting projectized development in perspective. *Public Administration and Development*, Vol. 3: 299-305

Hoogendam, P. 1994. Lively practice and hardened history. A research program on irrigation technology, engineers and artefacts. Wageningen Agriculture University, The Netherlands.

Horst, L. 1998. *The Dilemmas of Water Division.* International Irrigation Management Institute and Wagenign Agriculture University, The Netherlands.

HR Wallingford, 2001. Sustainable irrigation turnover. Report on system infrastructure, KAR Project R7389.

HR Wallingford, 2001. Sustainable irrigation turnover, system infrastructure. Field investigation results, KAR Project R7389.

Hulme, D. 1995. Projects politics and professionals: Alternative approaches for project identification and project planning. *Agricultural Systems* 47: 211-233.

Hunt, 1990. Organizational control over water: The positive identification of a social constraint on farmer participation. In: R.K. Sampath and R.A. Young (Eds.). *Social, Economic, and Institutional Issues in Third World Irrigation Management.* Westview Press: Boulder and London

ICON, Integrated Consultants Nepal. 1996. Final report, baseline study on Panchakanya irrigation system. Research and Technology Development Branch, Department of Irrigation, Kathmandu.

Johnson III, S. H, M. Svendsen and F. Gonzalez. 2002. Options for institutional reform in the irrigation sector. Discussion paper for the international seminar on participatory irrigation management 21-27, April 2002, Beijing.

Johnson III, S.H., D. L. Vermillion and J. A. Sagardoy. 1995. Selected papers from the international conference on irrigation management transfer, Wuhan, China, 20-24 September 1994. *FAO Water Reports, 5.* Rome: Food and Agriculture Organization of the United Nations.

Joshi, N. M. 2000. Planning, design and appraisal of irrigation development. In R. Bhandari and K.R. Sharma (Eds.). *Sustainability Issue of Irrigation Development*, Workshop Proceedings. Research and Technology Development Branch, Department of Irrigation, Nepal.

Kalu, I. L; P. R. Khanal and V. S Mishra. 2000. Water avability in Khageri. IMD, DOI, Kathmandu.

Khanal, P. R. 1997. Analysis of process and impacts of management transfer in Khageri and Panchakanaya irrigation projects: The lessons learned'. In: I. Neupane and K. C. Prasad (Eds.). *Evaluation of Irrigation Management Transfer Process and Performance.* RTDB, DOI and IWMI.

Khanal, P. R. 2001. Irrigation management transfer in two irrigation schemes in Chittwan Valley: Implementer's experience. In Gautam, U. and S. Rana (Eds.). *Challenges to Farmer Managed Irrigation Systems,* FMIS Promotion Trust, Kathmandu, Nepal.

Keller, J. 1990. A holistic approach to irrigation scheme water management. In R. K. Sampath and R. A. Young (Eds.). *Irrigation Management in Developing Countries,* Westview Press, USA: 31-58

Korten, D. 1984. People-centred development: toward a framework'. In: D. Korten, and Rudi Klauss (Eds.). *People Centred Development: Contributions toward Theory and Planning Frameworks,* Kumarian Press, USA.

Korten, D. 1980. Community organization and rural development: A learning process approach. A Ford Foundation reprint from Public Administration Review.

Korten, Frances F. 1982. Building national capacity to develop water users associations: experience from the Philippines. World Bank Staff Working Papers Number 528, Washington, D.C.

Kloezen, Wim H. 2002. *Accounting for Water: Institutional Viability and Impacts of Market-Oriented Irrigation Intervention in Central Mexico.* PhD Thesis. Wageningen University, the Netherlands.

Kloezen, Wim H, Carlos Garces-Restrepo and Sam H. Johnson III. 1997. Impact assessment of irrigation management transfer in the Alto Rio Lerma Irrigation District, Mexico. *IIMI Research Report 15,* Colombo, Sri Lanka: International Irrigation Management Institute.

Kloezen, W. H. and M. Samad. 1995. Synthesis of issues discussed at the international conference on irrigation management transfer. *Short Report Series on Locally Managed Irrigation, no.12.* Colombo: International Irrigation Management Institute.

Lankford B. A and J. Gowing. 1997. Providing a water delivery service through design management interactions and system management. In: M. Kay, Tom Franks and Laurence. *Water: Economics, Management and Demand.* Spon: London.

Lankford, B. 1998. Design management interaction on canal irrigation systems: a framework for the analysis of water control. PhD Thesis. University of Newcastle Upon Tyne, UK.

Lattimore, D. 1986. Water management: problems and potential for community in technology transfer. In K. C. Nobe. and R. K Sampath (Eds.). *Irrigation Management in Developing Countries,* Westview Press, USA pp 509-534.

Leeuwis, C. 2000. Reconceptualizing participation for sustainable rural development: towards a negotiation approach. *Development and Change,* Vol. 31: 931-959.

Leeuwis, C. 2003. Rethinking innovation and agriculture extension. In: H. Moll and E. Manzungu (Eds.). *Agrarian Institutions between Policies and Local Action: Experiences from Zimbabwe.* Forthcoming: Weaver Press.

Lele, S.N. and R.K Patel. 1995. Irrigation management transfer: problems in implementation. In S. H. Johnson III, D. L. Vermillion and J. A. Sagardoy. Selected papers from the international conference on irrigation management transfer, Wuhan, China, 20-24 September 1994. *FAO Water Reports 5.* Rome: Food and Agriculture Organization of the United Nations.

Long, N. and A. Long (Eds.). 1992. *Battlefields of Knowledge: The Interlocking of Theory and Practice in Social Research and Development.* London: Routledge.

Long, N. 2001. *Development Sociology: Actor perspectives.* London: Routledge.

Mahanty, S. 2002. Conservation and development interventions as networks: the case of the India ecodevelopment project, Karnataka. *World Development,* Vol. 30, No.8: 1369-1386.

Manzungu, E. 1999. *Strategies of Smallholder Irrigation Management in Zimbabwe.* PhD Thesis. Wageningen Agricultural University, The Netherlands.

Martin, E. 1986. Resource mobilization, water allocation and farmer organization in hill irrigation systems of Nepal. Unpublished PhD dissertation, Cornell University.

Meegeren, R. C. F. and C. Leeuwis. 1999. Towards an interactive design methodology: guidelines for communication. In: C. Leeuwis (Eds.). *Integral Design: Innovation in Agriculture and Resource Management,* pp. 205-17. Wageningen: Mansholt Institute, Leiden: Backhuys Publication.

Meinzen-Dick, R. 1996. Policy trends in farmer participation. Paper presented at workshop on institutional reform in Indian irrigation National Council of Applied Economic Research, New Delhi, November 6, 1996.

Meinzen-Dick, R., K. V. Raju and Ashok Gulati. 2002. What affects organization and collective action for managing resources? Evidence from canal irrigation systems in India. *World Development,* Vol. 30 (4): 649-666.

Ministry of Agriculture and Co-operatives (MOAC). 2001. *Statistical Information on Nepalese Agriculture.* Agri-Business Promotion and Statistics Division, HMG of Nepal, MOAC, Kathmandu.

Ministry of Water Resources (MOWR). 1997. *Irrigation Policy 2049 (1992).* First Amendment, 2053 (1997). HMG of Nepal, MOWR, Kathmandu.

Ministry of Water Resources (MOWR). 1997. *Water Resources Act 2049 (1992).* HMG of Nepal, MOWR, Kathmandu.

Ministry of Water Resources (MOWR). 1997. *Water Resources Regulation 2050(1993).* HMG of Nepal, MOWR, Kathmandu.

Ministry of Water Resources (MOWR). 2000. *Irrigation Regulation.* HMG of Nepal, MOWR, Kathmandu.

Ministry of Water Resources (MOWR). 1990. *Irrigation Master Plan.* HMG of Nepal, MOWR, Kathmandu

Mollinga, P.P. 1998. *On the Waterfront. Water Distribution, Technology and Agrarian Change in a South Indian Large Scale Canal Irrigation System.* PhD Thesis. Agricultural University, Wageningen, The Netherlands

Mollinga, P. P.; Doraiswamy, R. and K. Engbersen. 2001. The implementation of participatory irrigation management in Andhra Pradesh, India. *Int. J. Water,* Vol. 1(3/4): 360-379.

Mosse, D. 2001. People's knowledge, participation and patronage: operations and representations in rural development. In: B. Cooke and Uma Kothari (Eds.). *Participation: The New Tyranny?* Zed Books, London. New York.

Musch, A. 2001. *The Small Gods of Participation.* PhD Thesis. University of Twente, Enschede, The Netherlands.

Narain, Vishal. 2003. *Institutions, Technology and Water Control: Water User Associations and Irrigation Management Reform in two Large-scale Systems in India.* PhD Thesis. Wagneingen University, The Netherlands.

Ostrom, E. 1992. *Crafting Institutions for Self-governing Irrigation Systems.* Institute for Contemporary Studies Press, San Francisco, USA.

Papanek. 1985. *Design for the Real World: Human Ecology and Social Change.* London: Thames and Hudson.

Pant D. R. 2000. *Intervention Processes and Irrigation Institutions Sustainability of Farmer managed Irrigation Systems in the hills of Nepal.* PhD Thesis. Wageningen Agriculture University, the Netherlands.

Poudel, S. N. 1992. *Irrigation Profile of Nepal.* Research and Training Branch, Department of Irrigation, Kathmandu, Nepal.

Poudel, R. 2000. *Farmers' Laws and Irrigation. Water Rights and Disputes Management in the Hills of Nepal.* PhD Thesis. Wageningen University, The Netherlands.

Poudel. 1998. Monitoring and supervision of ISF collection and share system administration in West Gandak irrigation system. HRDRB, IMD, DOI (Nepali vesion).

Pradhan. T. M. S. 1996. *Gated or ungated Water Control in Government Built Irrigation Systems.* PhD Thesis. Agricultural University, Wageningen, the Netherlands.

Pradhan, U. 1990. Property rights and state intervention in hill irrigation systems in Nepal. Unpublished PhD dissertation. Cornell University.

Plusquellec, H. 2002. Is the daunting challenge of irrigation achievable?' *Irrigation and Drainage,* 51: 185-198

Rangan, H. 1997. Property vs. control. The state and forest management in the Indian Himalaya. *Development and Change,* 28: 71-94.

Rondinelli, Dennis A. 1983. Projects as instruments of development administration: a qualified defence and suggestions for improvement. *Public Administration and Development,* Vol. 3: 307-327.

Regmi, M. C. 1978. Land tenure and taxation in Nepal. In: H. K. Kuloy (Ed.). *Bibliotheca Himalaya,* Series 1, Vol. 26, Ratnal Pustak Bhandar, Kathmandu.

Saviotti, P. 1988. The measurement of changes in technological output. In A.F.J. van Raan (Ed.). *Handbook of Quantitative studies of Science and Technology.* Elsevier Science Publisher B.V (North Holland).

Scheer, S. 1996. *Communication between Irrigation Engineers and Farmers.* PhD Thesis. Agricultural University, Wageningen, the Netherlands.

Shukla, A. K. and K. R. Sharma. 1997. *Evolution of Participatory Irrigation Management in Nepal.* A Monograph on evolution, processes and performance, RTDB, DOI.

Shukla, A. K., D. V. Ghimire and Tej Bahadur. KC. 2000. Process based diagnosis of performance of irrigation management transfer in Khageri system. WMSG, Rampur, Chittwan, Nepal.

Shukla, A. K., D. V. Ghimire and Tej Bahadur KC. 2000. Process and performance of irrigation management transfer: a comparison and WUA evolution and leadership development in Khageri, Panchakanaya and Nepal West Gandak Irrigation Schemes. RTDB, DOI and WMSG, Rampur, Chittwan, Nepal.

Silt Consult. 1989. Draft report on provisional impact evaluation study of West Gandak Irrigation Sub-Project, Nawalparasi District. Command Area Development Irrigation Project, Kathmandu.

Smith, W. E.; F.J. Lethem and B. A. Thoolen. 1980. The design of organizations for rural development projects: a progress report. World Bank Staff Papers No.375, Washington D.C. The World Bank.

Smout, I. 1990. Farmer participation in planning, implementation and operation of small-scale Irrigation Projects. ODI/IIMI, Irrigation Management Network paper 90/2b.

Svendsen, M. 1997. Second generation problems of privatized irrigation systems: second generation problems. In: M. Kay, Tom Franks and Laurence Smith. (Eds.). *Water: Economics, Management and Demand.* Spon: London.

Turral, H. 1989. Allowing farmer knowledge into the design process. In Asian Regional symposium on the modernization and rehabilitation of irrigation and drainage schemes. Hydraulic Research, Wallingford, UK.

Turral, H. 1995. Devolution of management in public irrigation schemes: cost shedding, empowerment and performance, a review. Working Paper 80, ODI London.

Uphoff, N. 1992. *Learning from Gal Oya: Possibilities for Participatory Development and Post Newtonian Social Science.* Cornell University Press, Ithaca NY.

Uphoff, N. 1986. Getting the process right: improving irrigation management with farmers' organization and participation. Working paper, Cornell University, Ithaca New York.

Varshney, R.S, S.C. Gupta, and R.L. Gupta. 1983. *Theory and Design of Irrigation Structures.* Vol I, Nemchand and Brothers, Roorke, India.

Vermillion, Douglas L. 1994b. Irrigation management transfer: towards an integrated management revolution. Address made to the international conference on irrigation management transfer, Wuhan, PR China, Sept 20-24, 1994.

Vermillion, Douglas L. and Carlos Garces-Restrepo.1998. Impacts of Colombia's current irrigation management transfer program. Colombo, Sri Lanka: International Irrigation Management Institute.

Vermillion, D. and Sagardoy, J. 1999. *Transfer of Irrigation Management Services.* FAO Irrigation and Drainage Paper 58.

Vincent, L. 1997. Agro-ecology, participation and irrigation: Learning from different system concepts. Paper presented at a Workshop on more from less: better water management. Cranfield University, September 1997.

Vincent, L. 1997. Irrigation as technology, irrigation as resource: Hill irrigation and natural resource systems. In G. Shivakoti, G. Varughese, E.Ostrom, A. Shukla and G. Thapa (Eds.). *People and Participation in Sustainable Development.* Tribhuvan University, Nepal.

Vincent, L. 1994. Representing the users in irrigation design processes: how and why do irrigation engineers disagree? Mimeo, Wageningen Agricultural University, The Netherlands.

Vincent, L. 1999. Inter-sectoral water use, irrigation and water scarcity. Irrigation and development lecture, Wageningen Agriculture University, the Netherlands.

Vincent, L. and Puspa R. Khanal. 2003. Innovation in irrigation: Working in a 'participation complex'. Case study summary 17. In: B. Pound, S. Snapp. C. McDougall and A. Braun (Eds.). Uniting science and participation for sustainable livelihoods and adaptive natural resource management. Forthcoming, Earthscan Publishers.

Vos, J. 2002. *Metric Matters: The Performance and Organization of Volumetric Water Control in Large-scale Irrigation in the North Coast of Peru.* PhD Thesis. Wageningen University, the Netherlands.

Vuren, G. Van. 1998. *Farmers Participation in Water Management.* WAU-KIVI-ICID, Balkema, Rotterdam.

Wade, R. 1995. The ecological basis of irrigation institutions: East and South Asia. *World Development,* Vol. 23 (12): 2041-2049.

Wade R 1982a. The system of administrative and political corruption: canal irrigation in South India. *Journal of Development Studies,* Vol. 18 (3): 287-328.

Wahaj, R. 2001. *Farmers Actions and Improvements in Irrigation Performance below the Mogha.* PhD Thesis. Wageningen University, The Netherlands.

Water and Energy Commission Secretariat. 1981. Irrigation sector review. Report No3/2/190931/1/1, MOWR, HMG of Nepal.

Wield, D. 1999. Tools for project development within a public action framework. *Development in Practice,* Vol. 9 (1&2): 33-42.

Yin, Robert K. 1989. *Case Study Research: Design and Methods.* Beverly Hills, Sage Publication, UK.

Yoder, R. 1986. Performance of farmer managed irrigation systems in the hills of Nepal. Unpublished PhD dissertation. Cornell University.

Zaag, Pieter. van der. 1992. *Chicanery at the Canal: Changing practices in Irrigation Management in Mexico,* CEDLA, Latin American Studies No.65. PhD Thesis. Wageningen Agricultural University.

Zwarteveen, M. 1995. Gender aspects of irrigation management transfer: rethinking efficiency and equity. In: S. H. Johnson III, D. L. Vermillion and J. A. Sagardoy (Eds.). Selected papers from the international conference on irrigation management transfer. Wuhan, China, 20-24 September 1994. *FAO Water Reports, 5.* Rome: Food and Agriculture Organization of the United Nations.

Summary

The government of Nepal introduced Irrigation Management Transfer programs in the agency-managed irrigation systems during the 1990s. These programs was driven by several factors, including donor preferences for less state and more private sector involvement in the water sector, and involved promotion of Water Users Associations as a devolved organization for irrigation management. Poor system performance and increasing dependency on government for irrigation management, and successful tradition of the FMIS in the country has also inspired the program. The design implementation processes for this and its outcomes has so far received little analysis, while its understanding is crucial for future irrigation management reform in the country. The thesis attempted to fill this gap so that future water management can be better supported and sustained locally.

The study analyzed an intervention program in the Terai Region of Nepal to transfer irrigation management functions to the users. This program involves both institutional reform and technical rehabilitation. Key aspects of these policies, and the research sites of this study, are given in Chapters 2 and 3 respectively. The study analyzes both processes, and also explores how organizational evolution and water management has materialized in practice. These process and outcomes of change were studied in three irrigation systems, of different size, degrees of water scarcity,

objective of this study is not to suggest specific conditions that facilitate management change and assure achievement, but to improve understanding of change processes that translate policies on the ground. It also hopes to contribute to better understanding of participatory processes, in how they can be practiced beyond just instrumentalist perspectives.

Much expectation existed on the efficacy of participatory and process-based projects to facilitate irrigation management change. The thesis showed that participatory projects can help build up organizational evolution and bring water management change when they proceed with adequate learning of the system environment. This can translate its opportunities and constraints in practical design and build a stable project environment guiding the project process. Otherwise, it would lead to costly failure of the program process. However, such processes can form only the base for new management regimes, which is further shaped by different water control dimensions – which are dynamic - and a local organization has to continuously adapt with change in new environment, which also requires further policy and legal support to such organizations to govern and manage irrigation water.

The conceptual framework outlined in Chapter 1 discusses how participation can involve different domains and contexts in engineering participation in irrigation, in both the building of new institutions and design of technology. It introduced different domains and context of participation to show different objectives and aims of participation. There is a need to understand the clashes they can bring between people with different aims and objectives of participation. This helps explain policy as process where people reshape water management around new policy instruments and their own objectives to give both intended and unintended outcomes. To understand water management activities, it introduced the concept of the system environment to understand the elements of systems involved in water management (both physical/technical and social). It explained how technology shapes (and is shaped) by these environments and argued how understanding of action around technology plays a key role in transforming irrigation practices.

Chapter 2 describes the history of irrigation development in the country, the current irrigation policies and ongoing management reform and its implementation framework. It explained how the state got involved in irrigation development and its problematic role, and the shift of focus towards local management and policies driving them. The chapter showed how the ongoing IMT program has tried to address different dimensions of water control - the technical, organizational and socio-political - and included different development contexts of participation in its program design. Despite its comprehensive nature, the program however had several practical limitations from unclear legal provisions, on how they rely on external actors to shape local norms and rules to govern and manage irrigation water.

Chapter 3 uses an agroecology approach to trace the evolution of systems studied - the interventions to take water for irrigation and distribute it and the resultant agriculture and agrarian conditions. It discusses the opportunities and constraints of the systems for evolution of new systems of effective water control with complementary technical, organizational and socio-political control. The initial organization of the WUAs was presented in chapter 4, which also briefly describes farmers' reactions to government decisions to transfer irrigation management functions to them. It explained that farmers' support to new irrigation institutions was not only to obey government decisions but also for their hope to get better water delivery and operation.

The chapter described both structures as well as the dynamics of WUA development. It showed how unitary WUA model concentrates power and authority towards the Main Committee, weakening accountability among different tiers of organization, and argues for structuring in a federal structure so that power and authority of local organization can be distributed in federal linkages. It also argued that a WUA cannot be designed simply on the basis of design principles that supposedly provides governance, but needs broader understanding of local socio-political and physical environment, and how to transform them in organization design.

Chapter 5 and 6 together describe the participatory technology development (PTD) process to improve technical water control to provide better working conditions for farmers. Chapter 5 describes the initial planning process and development of an action plan and subsequent agreement over it. It shows that farmers are knowledgeable and capable actors, but expectations and ambitions need to be negotiated, and projects should not raise unrealizable expectations in local farmers. Likewise, one should not depend on efficacy of the participatory tools promoted, rather search for different tools and actions that can help diagnose the problem situation.

Chapter 6 describes design and construction processes to create the technical water control wanted by farmers. It describes in detail the discussions and choices, to show what levels of negotiation, support and patience must go in participatory planning. It shows how the project environment facilitating the technology development process shapes the outcomes of the actions and processes. Quality control, as well as construction of chose structures is emphasized as critical to building farmer satisfaction. Farmers did not object to flexible gate structure despite their management requirements, but often tried to minimize their number: they also hired in staff to operate these gates. A key point drawn from this chapter is that that PTD should not taken on its own, but rather be viewed as a means of achieving service oriented water control for future water management. Its scope should not be limited only on technology innovation process, but also to build coalitions among relevant stakeholders, which is key not only to facilitate participatory process, but also to sustain water management beyond the project launching. It also helps build accountability between local agencies and a WUA for future water management.

Chapter 7 describes the handing over of the irrigation management functions to the WUA and shows how the project environment and wider social environments shaped the events and outcomes of the organizational debut of the WUAs. Handing over not only brings new water management conditions, but also creates new forms of governance where both social rivalries and water management will be key areas of struggle. Without recognition of political actions, and wider support from the government and administrative institutions, the supposedly democratic nature of consultative irrigation management transfer would be no more than a paper.

Chapter 8 describes the changing governance structure for local management. It shows how WUA evolve when supported in their administration and structure. WUAs as a new form of governance try to acquire legitimacy and power from both internal and external support,. They thus provide a platform to build social and political power. This political dimension has to be accepted in program design rather than ignored.

Chapter 9 describes changes in water management practices and how they faced continued challenge from their system environment. While project support built up partial knowledge and skills to manage the system and bring better technical water control, they alone are not sufficient to shape future water management. Local organizations need to adapt with the ever changing water control environment to support water management, build up necessary skills, generate resources and develop accountability between relevant stakeholders. This also needs legal, political and often financial support from wider administrative institutions.

The general conclusions of the thesis are drawn in Chapter 10, revisiting the four inter-related themes of the study. Future organization design needs to consider both governance and structure, and necessary actions beyond local level to build up their legitimacy and power. Project support, if it proceeds with learning of system environment and translation of its opportunities and constraints in practical design, can provide incentives to local organization to take up water management. Technology commands a central role in transforming irrigation practices, shaping (and being shaped by) the system environment. Thus technical change to facilitate management reform must be based on the future service requirements of the users. Project support only forms the base for new management. Done well, participatory action around technology helps build the recognition and capabilities of WUAs and the engineers who will work with farmers, and acceptance of new irrigation schedules and management requirements. Done badly, it it can be simply the means for an irrigation department and ambitious WUA officials to further there own interests rather than those of farmers. As WUAs emerge as a new form of local governance, they still need wider legal and often financial support for their longer-term sustainability.

Samenvatting

Gedurende de jaren negentig van de vorige eeuw introduceerde de Nepalese overheid Irrigatie Management Transfer programma's (IMT) in de door irrigatiediensten beheerde irrigatiesystemen. Deze programma's zijn voortgekomen uit verschillende factoren, waaronder de voorkeur van donoren voor minder staats- en meer private-sectorbetrokkenheid in de watersector, en de bijbehorende promotie van watergebruikersassociaties (Water Users Associations, WUAs) als nieuwe bevoegde organisaties voor irrigatiebeheer. Slechte prestaties van systemen en succesvolle tradities van door boeren beheerde irrigatiesystemen in het land waren mede aanmoedigingen voor de programma's. De processen voor implementatie van ontwerpen hiervoor, en hun uitkomsten, zijn tot op heden weinig geanalyseerd, terwijl het begrip hiervan cruciaal is voor verdere hervorming van irrigatiebeheer in het land. Deze thesis tracht dit gat te vullen, zodat toekomstig waterbeheer lokaal beter ondersteund en gedragen kan worden.

De studie analyseert een interventieprogramma voor de overdracht van irrigatiebeheerfuncties aan de gebruikers in de Terai-regio in Nepal. Dit programma betrof zowel institutionele hervorming als technische rehabilitatie. Belangrijke aspecten van dit beleid en de onderzoekslokaties van deze studie worden gegeven in de hoofdstukken twee repectievelijk drie. In de studie

hoe organisatorische evolutie en waterbeheer zich hebben ontwikkeld in de praktijk. Deze veranderingsprocessen en hun uitkomsten zijn bestudeerd in drie irrigatiesystemen die verschillen in grootte, mate van waterschaarste, operationele complexiteit en niveau van voorgaand lokaal irrigatiebeheer. De inspanningen voor deze processen worden bestudeerd in de hoofdstukken vier tot en met zeven; de uitkomsten van institutionele veranderingen en nieuwe waterbeheersveranderingen worden bediscussieerd in de hoofdstukken acht en negen. De doelstelling van deze studie is niet om specifieke voorwaarden voor te stellen die beheersverandering faciliteren en succes verzekeren, maar om het begrip te verbeteren van veranderingsprocessen die beleid vertalen naar de praktijk. Verder draagt deze studie hopelijk bij aan een beter begrip van de mogelijkheden voor het in praktijk brengen van participatieprocessen die verder reiken dan slechts instrumentalistische perspectieven.

Er bestonden hoge verwachtingen van de uitwerking van participatieve en proces-gebaseerde projecten om veranderingen in irrigatiebeheer te faciliteren. De thesis toont aan dat participatieve projecten kunnen bijdragen aan de opbouw van organisatorische ontwikkeling en waterbeheer kunnen veranderen als zij vergezeld zijn door een adequaat bewustwordingsproces van de systeemomgeving. De mogelijkheden en beperkingen hiervan kunnen vertaald worden in een praktisch ontwerp en een stabiele projectomgeving opbouwen voor de begeleiding van het projectproces. Anders zou een kostbare mislukking van het programma het gevolg zijn. Echter, dergelijke processen kunnen alleen de basis vormen voor nieuwe beheersregimes welke verder vormgegeven worden door verschillende, dynamische, waterbeheersdimensies. Een lokale organisatie moet zich voortdurend aanpassen aan een veranderende omgeving, en dat vraagt verdere beleids- en wettelijke ondersteuning.

De thesis bestaat uit tien hoofdstukken. Het conceptuele raamwerk, opgenomen in hoofdstuk een, bediscussieert hoe participatie verschillende domeinen en contexten binnen de techniek van irrigatie kan betrekken, zowel in het opbouwen van nieuwe instituties als in het ontwerp van technologie. Het introduceert verschillende domeinen en contexten van participatie om de verschillende doelstellingen van participatie aan te tonen, alsmede de noodzaak tot het begrijpen van de confrontaties die kunnen bestaan tussen mensen met verschillende doelstellingen. Dit helpt verklaren dat beleidmaken een proces is waarbij mensen waterbeheer hervormen rondom nieuwe beleidsinstrumenten en hun eigen doelstellingen, met verwachte en onverwachte uitkomsten. Voor een goed begrip van waterbeheeractiviteiten introduceert het hoofdstuk het concept van de systeemomgeving, die bestaat uit zowel physische/technische als sociale elementen. Het legt uit hoe technologie vormgeeft aan, en vormgegeven wordt door deze omgeving en beargumenteert hoe het begrip van actie rond technologie een sleutelrol speelt in de transformatie van irrigatiepraktijken.

Hoofdstuk twee beschrijft de geschiedenis van irrigatieontwikkeling in het land, het huidige irrigatiebeleid, de lopende beheershervorming en het raamwerk voor implementatie hiervan. Het legt uit hoe de staat betrokken raakte in irrigatieontwikkeling, hierin een problematische rol verwierf, en de aandacht verschoof naar lokaal beheer en het achterliggende beleid. Het hoofdstuk toont aan hoe het lopende IMT-programma getracht heeft de verschillende dimensies van waterbeheersing – technisch, organisatorisch en sociaal-politiek – te behandelen en verschillende ontwikkelingscontexten van participatie in zijn programmaontwerp insluit. Ondanks de veelomvattende aard had het programma verschillende praktische beperkingen door onduidelijke wettelijke voorzieningen. Bovendien werd voor het vormgeven van lokale normen en regels voor beheersing en beheer van irrigatiewater vertrouwd op externe actoren.

Hoofdstuk drie gebruikt een agro-ecologische benadering om de evolutie van de bestudeerde systemen te analyseren. Het betreft hier de interventies voor de allocatie en distributie van water voor irrigatie en de resulterende landbouw en agrarische omstandigheden. Het bediscussieert de mogelijkheden en beperkingen van de systemen voor de ontwikkeling van nieuwe manieren van waterbeheersing met de bijbehorende technische, organisatorische en sociaal-politieke beheersing. De oorspronkelijke organisaties van de WUAs wordt gepresenteerd in hoofdstuk vier, waar ook kort de reacties besproken worden van boeren op de overheidsbeslissing om irrigatiebeheertaken aan hen over te dragen. Het hoofdstuk legt uit dat boeren de nieuwe irrigatie-instituties niet alleen ondersteunden om te voldoen aan overheidsbeslissingen, maar ook omdat ze hoopten op betere waterbezorging en operatie.

Het hoofdstuk beschrijft zowel de structuren als de dynamiek van de ontwikkeling van gebruikersorganisaties. Het toont aan hoe een unitair WUA-model macht en autoriteit concentreert bij het hoofdcomité, en zo het afleggen van verantwoording tussen de verschillende niveaus binnen de organisatie verzwakt. Het pleit voor structurering in een federale structuur zodat macht en autoriteit van lokale organisaties gedistribueerd kunnen worden via federale verbanden. Tevens beargumenteert het dat een WUA niet eenvoudig ontwikkeld kan worden op basis van ontwerpprincipes waarvan aangenomen wordt dat ze voorzien in bestuur, maar een breder begrip van de lokale sociaal-politieke en fysieke omgeving vraagt, alsmede de transformatie daarvan in een organisatieontwerp.

De hoofdstukken vijf en zes beschrijven samen het proces van participatieve technologieontwikkeling (participatory technology development, PTD) voor de verbetering van technische waterbeheersing, en uiteindelijk betere arbeidsomstandigheden voor boeren. Hoofdstuk vijf beschrijft het oorspronkelijke planningsproces, de ontwikkeling van een actieplan en de daarop volgende overeenstemming daarover. Het laat zien dat boeren kundige en capabele actoren zijn, maar dat verwachtingen en ambities onderhandeld dienen te worden, en projecten geen onrealiseerbare verwachtingen bij boeren mogen scheppen. Op dezelfde manier moet men niet afhankelijk zijn van de uitwerking van gepromote participatieve gereedschappen, maar zoeken naar verschillende gereedschappen en acties die de problemen kunnen identificeren.

Hoofdstuk zes beschrijft ontwerp- en constructieprocessen om de technische waterbeheersing zoals boeren die wensen, te bewerkstelligen. Het beschrijft gedetailleerd de discussies en keuzes om aan te geven welke niveaus van onderhandeling, ondersteuning en geduld noodzakelijk zijn in participatieve planning. Het laat zien hoe de projectomgeving – die de tecnologieontwikkeling faciliteert - vormgeeft aan acties en processen. Kwaliteitscontrole en de constructie van gekozen kunstwerken worden benadrukt als kritiek voor het opbouwen van tevredenheid onder boeren. De boeren hadden geen bezwaar tegen flexibele schuiven, ondanks de bijbehorende vereisten voor beheer, maar probeerden vaak het aantal hiervan te minimaliseren. Ook huurden zij werknemers om deze schuiven te bedienen. Een belangrijke conclusie uit dit hoofdstuk is dat PTD niet op zichzelf staat, maar beter beschouwd kan worden als een middel voor het bereiken van dienstverlening-georiënteerde waterbeheersing. Het bereik hiervan zou niet beperkt moeten blijven tot een technologisch innovatieproces, maar ook coalities tussen relevante belanghebbenden bouwen. Dit is noodzakelijk voor het faciliteren van het participatieve proces, maar ook om waterbeheer voort te zetten na de lancering van het project. Dit draagt bij aan het afleggen van verantwoording tussen lokale instellingen en WUAs.

Hoofdstuk zeven beschrijft de overdracht van waterbeheerstaken aan de WUAs en laat zien hoe de projectomgeving en wijdere sociale omgevingen de gebeurtenissen en uitkomsten van het organisatorische debuut van de WUAs vormgaven. Overdracht brengt niet alleen nieuwe waterbeheersomstandigheden met zich mee, maar creëert ook nieuwe vormen van bestuur, waarbij sociale concurrentie en waterbeheer belangrijke onderwerpen van strijd zullen zijn. Zonder erkenning van politieke acties, en zonder algemenere ondersteuning van de overheid en overheidsinstituties, zou het democratisch bedoelde en consultatieve IMT niet meer dan een apieren initiatief blijken.

Hoofdstuk acht beschrijft de veranderende structuur voor bestuur van lokaal beheer. Het toont aan hoe WUAs zich ontwikkelen als zij ondersteund worden in hun bestuur en structuur. WUAs, als nieuwe vorm van bestuur, proberen legitimiteit en macht te verwerven uit interne en externe ondersteuning. Tevens creëren ze een platform voor het opbouwen van sociale en politieke macht. Deze politiek dimensie kan beter geaccepteerd worden in het programmaontwerp, dan worden genegeerd.

Hoofdstuk negen beschrijft hoe veranderingen in waterbeheerspraktijken voortdurend geconfronteerd worden met uitdagingen uit de systeemomgeving. Projectondersteuning bouwt gedeeltelijk kennis en kunde op voor het beheer van het systeem, met betere waterbeheersing als resultaat, maar dat alleen is niet voldoende voor de vormgeving van toekomstig waterbeheer. Lokale organisaties moeten zich aanpassen aan de immer veranderende waterbeheersingsomgeving, de benodigde kunde opbouwen, hulpbronnen genereren en verantwoording ontwikkelen tussen de relevante belanghebbenden. Dit vereist tevens wettelijke, politieke en in veel gevallen financiële steun uit algemenere overheidsinstituties.

De algemene conclusies van de thesis worden getrokken in hoofdstuk tien, waar de vier inter-gerelateerde thema's van de studie herbezocht worden. Toekomstige organisaties moeten zowel beleid als structuur overwegen, alsmede de noodzakelijke acties die verder reiken dan het lokale niveau om legitimiteit en macht op te bouwen. Projectondersteuning kan, mits het samengaat met bewustwording van de systeemomgeving en de mogelijkheden en beperkingen daarvan in praktisch ontwerp, aansporingen bieden aan lokale organisaties om waterbeheer op te nemen. Technologie eist een centrale rol op in de transformatie van irrigatiepraktijken en geeft vorm aan (en wordt vormgegeven door) de systeemomgeving. Daarom moet technische worden op de toekomstige behoefte aan diensten van gebruikers. Projectondersteuning vormt slechts de basis voor nieuw beheer. Als het goed gedaan wordt, draagt participatieve actie rond technologie bij aan de erkenning en capaciteiten van WUAs en de ingenieurs die met boeren zullen werken, en acceptatie van nieuwe irrigatiesystemen en vereisten voor beheer. Als dit echter slecht gedaan wordt, kan het simpelweg de weg bereiden voor een irrigatiedepartement en ambitieuze WUA-vertegenwoordigers om hun eigen belangen te behartigen, in plaats van die van de boeren. Als WUAs uitgroeien tot een nieuwe vorm van lokaal bestuur, hebben zij nog steeds algemenere wettelijke en in veel gevallen financiële steun nodig voor duurzaamheid op de langere termijn.

CV

Graduated as a civil engineer in 1987, Puspa Raj Khanal joined the Irrigation Department of Nepal and has worked as District Engineer and Project Manager in different irrigation projects in Nepal. He has been mostly involved in facilitating participatory development in the irrigation water sector in both large and small-scale irrigation schemes in Nepal, which triggered his interest to pursue interdisciplinary research in the same field. He also worked as Chief Editor for the Irrigation Newsletters published by the Irrigation Department of Nepal. He has also been involved with various short and long term research in the field of participatory water management. He is interested in participatory development and institutional reform in the water sector. He holds a Masters degree in Water Resources Development from AIT, Bangkok, Thailand.