FARMER MANAGED IRRIGATION SYSTEMS
IN THE CHANGED CONTEXT

Proceedings of the Second International Seminar
held on 18 – 19 April 2002, Kathmandu, Nepal

Edited by
Prachanda Pradhan
Upendra Gautam

FARMER MANAGED IRRIGATION SYSTEMS PROMOTION
TRUST
Kathmandu, Nepal
October 2002
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EDITORS' NOTE

It was both a pleasure and privilege for the Farmer Managed Irrigation Systems (FMIS) Promotion Trust to organize the Second International Seminar on FMIS in the Changed Context. Two years ago in March 2000, it had organized the First International Seminar on Challenges to FMIS in Kathmandu. The second seminar has generated lots of interest among practitioners, policy makers, academics, farmers and people in general about the development trends in FMIS. This publication compiles the proceedings and papers at the seminar. It not only contains papers from many countries with focus on the role of the farmers, irrigation organizations and irrigation systems and the government in the changing context of FMIS, but also the roles and functions of the FMIS that need to adapt to the changes. Therefore, a number of important questions regarding the sustainability of FMIS were raised in the seminar. Questions regarding the water allocation to FMIS in the highly competitive environment of water use in the sectors such as industry, commerce and urban services were also raised. To what extent FMIS will be able to secure its share of water for agriculture was a serious question not only in terms of irrigation security but also for the well being of the rural ecology and animal kingdom that include bio-diversity, multitude of rural population, and livestock. Associated to the basic question of allocation entitlement is the question relating to irrigation water pricing policy. This policy's impact on water use would be serious as it may encourage or discourage the effective use of water in FMIS. Influence of these externalities on the existence and performance of FMIS directly brings the questions of the State ability and the governance quality to the fore. As the major criterion of effective water use is shifting from quantity to the quality of the impact (value addition and sustainability), FMIS's capacity to be socially and economically more competitive is a moot point in future evolution of FMIS. In this respect, it was indeed quite stimulating to see the adaptation of FMIS in the changed socio-economic condition in a country like Switzerland.

The venue of the seminar, Kathmandu, the capital district of Nepal, itself possesses more than 250 FMIS. If we look back to the development of FMIS in this country, one can see good progress in knowledge building and understanding towards dynamics of the functioning of FMIS. However the recognition to FMIS in Nepal came only in early 1980s though the existence of FMIS was there for
many centuries. FMIS as the people's organizations at the grass roots and as the very important organizational resource at local community level play the role in managing the water and agriculture resources for the benefit of the community. Hence, the autonomy of community-based decision-making system as developed in FMIS is to be scrupulously safeguarded. FMIS incorporate pluralistic democratic value and people's unified cultural heritage by means of their self-governing autonomy and egalitarian character. In day-to-day FMIS operations, these value and characteristic are expressed through the generation and use of the social capital. Notwithstanding the share of FMIS in the irrigated agriculture in Nepal, which is about 70%, their overarching linkages with the society and all significant sectors of the national livelihood make them a very critical organizational resource. Irrespective of the size of the Nepali FMIS that ranges from a few hectares to a few thousand hectares, the spread of FMIS make them the most extensive organizational units in the country. They can be found from 100 meters above the sea level to 3000 meters high lands in Nepal. There have been quite a few academic researches on these variable FMIS. More than a dozen Ph.D. have been written on different aspects of FMIS in the last 15 years. Cornell University, Indiana University, Wageningen Agricultural University, Tribhuvan University, and Pokhara University have been involved in promoting the knowledge on FMIS. FMIS for sure have taken a root both in the academic institutions as well as in the irrigation policy of the government in Nepal.

The panel discussion at the end of the seminar while taking stock of FMIS has viewed for future agenda for research in FMIS. This discussion identifies involvement of the young generation of farmers in the development, operation and maintenance of FMIS, ability of FMIS to adapt to the changing environment forced onto them by internal and external factors. Internal factors would include demographic change, mobility of young people to urban areas, change in the price of agricultural produces including paddy, and conflict and competition for water. Similarly, the external factors would be international price of agricultural produces including paddy, privatization and open market mechanism, new water-effective technology and agricultural subsidy policy of the industrialized countries. Within the framework of change, FMIS have to adapt themselves. Hence, the theme of the seminar was contextually appropriate and has helped raise a number of questions and agenda for further research. We hope that this publication of the seminar proceedings will stimulate debate, discussions and disagreements as well as mutual agreement and dialogue for further collaborative works on FMIS.

The seminar was characterized by a rich diversity in participation. A total of 128 participants came from 15 countries. These countries included six developed, five developing and four least developed ones. They came from Europe, Asia, and
America and included four landlocked and 11 coastal countries. The seminar deliberations were distinct for their highly non-partisan and all-inclusive nature. Participants did come with an open mind and shared their information, insight and experience in a non-lobbyist and non-partisan environment. Though it was participated by people-both young and old, and from all intellectual segments-government, non-government, academics, media, community, private sector and professional organizations, interactions took place in a tension-free and sublime atmosphere. FMIS Promotion Trust's icons of honor Prof. Elinor Ostrom of Indiana University, Bloomington, Prof. Normon Uphoff of Cornell University, Ithaca and Dr. Robert Yoder, ARD, Vermont, USA who graced the seminar with their FMIS El dorado were like fragrance-on-gold (a Nepali saying which means 'adding value to something already valuable' or "making things doubly valuable"). We would like to heartily thank all three FMIS icons of honor, who have so intrinsically added value of the seminar proceedings.

Having said this, we conclude with a few words on the editorial aspects. Much of the language and spelling structure have followed American grammar. We have attempted to organize the proceedings in a standardized manner as far as possible. Our attempt is reflected in the organization of the papers and the associated references. For the convenience of the readership, we have organized the proceedings into six sections. The first section seminar initiation consists of welcome address, the theme of the seminar, activities of the FMIS Promotion Trust in the past two years, bestowing of awards to the icons of honor, and closing remarks. The second section keynote speeches consists of the scholarly discourses that were delivered by the three honor awardees. The third section includes six Trust fund supported activities. The forth section research findings on FMIS in the changed context includes eleven papers.

The fifth section country reports includes six papers from five countries- Switzerland, Lao People's Democratic Republic, Vietnam, Cambodia, and Bangladesh. The last section final session deals with panel discussion on future direction of FMIS, and a vote of thanks. We would like to express our gratitude to Ajaya Lall Shrestha, Director, CMS for the editorial support. We would also like to put on record our thanks and appreciation to Ganesh Khaniya, Program Officer, Sagar Sigdel, Research Assistant, FMIS Promotion Trust; Deb Raj Basnet, Computer Operator, Upendra Gupta, Irrigation Engineer and Sachin Upadhyaya, Sociologist of CMS for their dedicated labor and assistance in bringing out this publication.

Prachanda Pradhan
Upendra Gautam
## Acronyms and Abbreviations

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<th>Description</th>
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<td>ADB</td>
<td>Asian Development Bank</td>
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<td>ADB/N</td>
<td>Agricultural Development Bank of Nepal</td>
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<td>AMIS</td>
<td>Agency Managed Irrigation Systems</td>
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<td>AMSL</td>
<td>Above Minimum Sea Level</td>
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<td>AO</td>
<td>Association Organizer</td>
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<td>APIP</td>
<td>Agricultural Productivity Improvement Project</td>
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<td>APM</td>
<td>Adjustable Proportionate Modules</td>
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<td>APP</td>
<td>Agricultural Perspective Plan</td>
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<td>ARD</td>
<td>Associates in Rural Development</td>
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<td>ARTI</td>
<td>Agrarian Research and Training Institute</td>
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<td>AWB</td>
<td>Area Water Board</td>
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<td>AWP</td>
<td>Area Water Partnership</td>
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<td>BADC</td>
<td>Bangladesh Agricultural Development Corporation</td>
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<tr>
<td>BAU</td>
<td>Bangladesh Agricultural University</td>
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<tr>
<td>BCR</td>
<td>Benefit-Cost Ratios</td>
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<td>BIDS</td>
<td>Bangladesh Institute of Development Studies</td>
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<tr>
<td>BKB</td>
<td>Bangladesh <em>Krishi</em> Bank</td>
</tr>
<tr>
<td>BRDB</td>
<td>Bangladesh Resources Development Board</td>
</tr>
<tr>
<td>BS</td>
<td>Bikram Sambat (Nepali calendar, subtract 57 years to derive A.D.)</td>
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<tr>
<td>BWDB</td>
<td>Bangladesh Water Development Board</td>
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<tr>
<td>CBOs</td>
<td>Community Based Organizers</td>
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<td>CI</td>
<td>Cropping Intensity</td>
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<td>CMI</td>
<td>Community Managed Irrigation</td>
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<td>DAE</td>
<td>Department of Agricultural Extension</td>
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<td>DDC</td>
<td>District Development Committee</td>
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<td>DDG</td>
<td>Deputy Director General</td>
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<td>DFID</td>
<td>Department for International Development</td>
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<tr>
<td>DIHM</td>
<td>Department of Irrigation, Hydrology and Meteorology</td>
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<td>DIO</td>
<td>District Irrigation Office</td>
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<tr>
<td>DOA</td>
<td>Department of Agriculture</td>
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<td>Department of Environment</td>
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<td>DoF</td>
<td>Department of Fisheries</td>
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<td>Department of Irrigation</td>
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<td>DoL</td>
<td>Department of Livestock</td>
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<tr>
<td>DSE</td>
<td>Deutsche Stiftung für Internationale Entwicklung</td>
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<td>DTW</td>
<td>Deep Tubewell</td>
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<tr>
<td>EDI</td>
<td>Eco-Development and Irrigation</td>
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<td>EU</td>
<td>European Union</td>
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<td>FAO</td>
<td>Food and Agriculture Organization of the UN</td>
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<td>FAP</td>
<td>Flood Action Plan</td>
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<td>FIAT</td>
<td>Farmer Irrigated Agriculture Training</td>
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<td>FMIS</td>
<td>Farmer Managed Irrigation Systems</td>
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<td>FMIST</td>
<td>Farmer Managed Irrigation Systems Promotion Trust</td>
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<td>FO</td>
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<td>Field Organizers</td>
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<td>FWUC</td>
<td>Farmer Water User Community</td>
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<td>GDP</td>
<td>Gross Domestic Product</td>
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<td>GIS</td>
<td>Gadkhar Irrigation System</td>
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<td>GOB</td>
<td>Government of Bangladesh</td>
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<td>GON</td>
<td>Government of Netherlands</td>
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<td>Government Organizations</td>
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<td>GPP</td>
<td>Guidelines for People’s Participation</td>
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<td>GPWM</td>
<td>Guidelines for Participatory Water Management</td>
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<td>GTZ</td>
<td>German Technical Cooperation</td>
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<td>ha</td>
<td>Hectare</td>
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<td>HDP</td>
<td>High Density Pipe</td>
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<td>HMG/N</td>
<td>His Majesty’s Government of Nepal</td>
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<td>HP</td>
<td>Horse Power</td>
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<tr>
<td>IAAS</td>
<td>Institute of Agriculture and Animal Science</td>
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<td>ICIMOD</td>
<td>International Center for Integrated Mountain Development</td>
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<tr>
<td>ID</td>
<td>Irrigation Department</td>
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<td>IDA</td>
<td>International Development Agency</td>
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<tr>
<td>IDMC</td>
<td>Irrigation and Drainage Management Company</td>
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<tr>
<td>IHF</td>
<td>International Health Fund</td>
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<tr>
<td>IIMI/ IWMI</td>
<td>International Irrigation/Water Management Institute</td>
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<tr>
<td>ILC</td>
<td>Irrigation Line of Credit</td>
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<td>IMC</td>
<td>Irrigation Management Company</td>
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<td>Irrigation Management Transfer</td>
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<td>IP</td>
<td>Irrigation Policy</td>
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<td>IRR</td>
<td>Institutional Resource Regime</td>
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<td>ISF</td>
<td>Irrigation Service Fee</td>
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<td>Abbreviation</td>
<td>Full Form</td>
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<tr>
<td>IWRM</td>
<td>Integrated Water Resource Management</td>
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<td>JICA</td>
<td>Japan International Cooperation Agency</td>
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<td>JWM</td>
<td>Joint Water Management</td>
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<tr>
<td>LG</td>
<td>Local Government</td>
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<td>LGED</td>
<td>Local Government Engineering Department</td>
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<tr>
<td>LLP</td>
<td>Low Lift Pump</td>
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<td>LP</td>
<td>Linear Programming</td>
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<tr>
<td>MC</td>
<td>Management Committee</td>
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<tr>
<td>mm</td>
<td>Millimeter</td>
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<tr>
<td>MORD</td>
<td>Ministry of Rural Development</td>
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<td>MoU</td>
<td>Memorandum of Understanding</td>
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<td>MOWR</td>
<td>Ministry of Water Resources</td>
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<td>MOWRAM</td>
<td>Ministry of Water Resources and Meteorology</td>
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<td>MPO</td>
<td>Multi-purpose Organizations</td>
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<tr>
<td>MRC</td>
<td>Mekong River Committee</td>
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<td>MRCS</td>
<td>Mekong River Commission Secretariat</td>
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<td>MRMG</td>
<td>Mountain Resource Management Group</td>
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<td>MV</td>
<td>Modern Variety</td>
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<td>n.d.</td>
<td>Not Dated</td>
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<tr>
<td>NEC</td>
<td>Nepal Engineering College</td>
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<td>NIA</td>
<td>National Irrigation Administration</td>
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<td>NIIS</td>
<td>Nepal Irrigation Institutions and Systems</td>
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<td>NIMP</td>
<td>Nepal Irrigation Management Project</td>
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<td>NPV</td>
<td>Net Present Value</td>
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<tr>
<td>NRs</td>
<td>Nepali Rupees</td>
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<td>NWPo</td>
<td>National Water Policy</td>
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<td>National Water Resources Council</td>
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<td>O&amp;M</td>
<td>Operation and Maintenance</td>
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<td>PAPs</td>
<td>Project Affected Persons</td>
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<td>PDR</td>
<td>Process Documentation Research</td>
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<td>Participatory Irrigation Management</td>
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<td>Project Procedural Manual</td>
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<td>PRA</td>
<td>Participatory Rural Appraisal</td>
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<td>PRASAC</td>
<td>Program de Rehabilitation au Secteur Agricole du Cambodge</td>
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<td>PDR</td>
<td>People's Democratic Republic</td>
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<td>RIRP</td>
<td>Rajapur Irrigation Rehabilitation Project</td>
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<td>RNIRD</td>
<td>Rasuwa-Nuwakot Integrated Rural Development</td>
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<tr>
<td>Acronym</td>
<td>Description</td>
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<tr>
<td>RNIRDPS</td>
<td>Rasuwa-Nuwakot Integrated Rural Development Program</td>
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<td>RWUA</td>
<td>Rajapur Water Users' Association</td>
</tr>
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<td>SCC</td>
<td>Swiss Civil Code</td>
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<tr>
<td>SFDP</td>
<td>Small Farmer Development Program</td>
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<td>SIRAP</td>
<td>Sustainable Irrigated Agriculture Project</td>
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<td>SISP</td>
<td>Second Irrigation Sector Project</td>
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<td>SPFS</td>
<td>Special Program for Food Security</td>
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<td>SPIN</td>
<td>Special Program on Food Production in Support of Food Security in Nepal</td>
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<td>SRI</td>
<td>System of Rice Intensification</td>
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<td>SRIDP</td>
<td>Strengthening and Restructuring Irrigation Development Project</td>
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<td>SSSIS</td>
<td>Shringighaat Simuniya Saatgaon Irrigation System</td>
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<td>SSSWRDSP</td>
<td>Small Scale Water Resources Development Sector Project</td>
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<td>United Nations Capital Development Fund</td>
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PART I: SEMINAR INITIATION
WELCOME ADDRESS

RAJAN SUBEDI

Respectable Chairman Dr. Trailokya Nath Upraiti, honorable keynote speakers Prof. Elinor Ostrom, Prof. Norman Uphoff and Dr. Robert Yoder, distinguished guests, paper presenters, participants, ladies and gentlemen.

On behalf of Farmer Managed Irrigation Systems (FMIS) Promotion Trust, I have the privilege to welcome you all to the Second International Seminar on FMIS in the Changed Context in the capital city of Nepal. Nepal is well known for its tradition of collective management of common resources. FMIS spread over the country provide irrigation services to more than two-third of the country's total irrigated area. Recognizing the existence of these FMIS as the provider of food and institutional security in the country, His majesty's Government of Nepal started FMIS support programs in late eighties. Now the big question is, is it really helping FMIS in facing the challenges in the changed context?

In the global context, the FMIS is influenced by changes in local social system, national and international economic environment and depleting natural resource base. Factors that emerged from such changes also comprise first, the necessity to undertake Integrated Water Resource Management so that the scarce resource is better utilized across the sectors; and second, the recognition of the role of the individuals and communities in water resources management which has an implication on water as basic human rights.

Thus, the future prospects and the role of FMIS in this changing context has been our concern. By sharing each other's experience in this seminar, we hope to learn more on future direction of FMIS development.

We have about 130 participants including 49 from 14 countries abroad. The participant's countries include: Bangladesh, Cambodia, Germany, India, Laos, New Zealand, Nepal, The Netherlands, Norway, Pakistan, Switzerland, Thailand, United Kingdom, United States of America and Vietnam.

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1 Member Secretary, FMIS Promotion Trust, Nepal.
To our distinguished participants, particularly those from abroad, we wish you all very pleasant, comfortable and memorable stay in our country.

We heartily welcome you all again. Thank you.
THEME OF THE SEMINAR

PRACHANDA PRADHAN

It is my honor to introduce you the theme of the seminar, which will be our subject of discussion for next two days. We have chosen "Farmer Managed Irrigation Systems in the Changed Context" as our theme for this second international seminar. Two years ago, we organized the first international seminar on "Challenges to Farmer Managed Irrigation Systems".

The objective of the seminar this time is to share ideas, experiences and information on the fast changing context of Farmer Managed Irrigation Systems (FMIS). Many of the countries that have been participating in this international seminar have recognizable share of FMIS in contributing for the food security of those countries.

We are very much pleased to have among us Dr. Lin Ostrom, Dr. Norman Uphoff and Dr. Robert Yoder. These people have contributed a lot to understand the dynamics of the FMIS. They have helped promote the knowledge of FMIS.

Similarly we have participants from India, Bangladesh, Pakistan, the Netherlands, the United Kingdom, Germany, Thailand, Vietnam, Laos, Cambodia, Switzerland, Norway and other countries. I want to mention specially Deutsche Stiftung fur Internationale Entwicklung (DSE), and Mr. Franz Heim who took interest to bring participants from Vietnam, Laos and Cambodia in this seminar and to undertake study tour to observe some of the FMIS in Nepal. I want to recognize my senior colleagues here Charles Abernethy, Jitti, Mongkolnchaisariunya, and John Skutsch. We are very much pleased to have our first awardee Dr. Linden Vincent with us.

We have here senior officers from Department of Irrigation. Their participation has made the theme even more important. Currently Nepal is preparing the Tenth Plan. The 10th Five-year Plan of Nepal is expected to give special attention to FMIS. This forum brings academics, practitioners, NGOs and researchers together to discuss the changing context of the FMIS.

1 Chairman, FMIS Promotion Trust, Nepal.
We have provided equal opportunity to persons who are interested in FMIS to participate in this seminar. We posted information about the seminar in five Internet websites and also in a daily newspaper in Kathmandu. We have many requests for participation. Unfortunately, we were not in the position to support travel to those participants. The thing that has encouraged us tremendously is that those participants who have come here are on their own. Their active participation in this seminar proves that FMIS in the changed context is a very important theme, and many participants are interested to share their experiences.

FMIS is for us a symbol of democratic value because the local community manages the resources. We also take it as our national heritage because it has long history; it has helped foster unique culture of Nepal. Still the share of FMIS in the irrigated agriculture in Nepal is almost 70%. It has very important role to play in the Nepalese social and economic life of the people. They are still vibrant organizations in Nepal. If FMIS is to survive and be vibrant as they used to be, they have to be adaptable in the changing context. Appropriate policy of the government to promote FMIS will be very important. In the same way, it is important to see how FMIS can change its role and enter into new fields and new economic arena.

Changes in local social system, national and international economic environment and natural resource base including overall water scarcity influence the FMIS context. Even those old FMIS need to go through an organizational change in order to match the organization with the democratic process and economic challenges of the social system. Examples of such transformation can be found in rehabilitated FMIS.

It is also equally important to look at the opportunities by those FMIS beyond water focused activities. They need to widen their horizon and enter into more of those economic enterprises and take the opportunity to exploit more benefits to the members of the system. Can FMIS play a role in poverty alleviation program?

Sustainable utilization of water and developments of pluralistic society and self-governance have played their role in the changed FMIS context as well. Two factors have come out prominently: first, the necessity to undertake Integrated Water Resource Management (IWRM) so that the scarce resource is better utilized across the sectors; second, the recognition of the role of the individuals and communities for autonomous and decentralized water resource management. The recognition of the role of
the individuals and communities in water resources management has brought to the fore the question on water as basic human rights.

I sincerely believe that this seminar will be able to bring out the issues of FMIS in the changed context. We sincerely hope that at the end of the seminar, we will be able to get direction for our future activities.
It is my privilege to engage in dialogue with you on this auspicious morning. This morning, Kathmandu looks prettier, and more pensive. Yes, there was some drizzle last evening. But more important perhaps was your arrival in Kathmandu. Wherever friends of Farmer Managed Irrigation Systems (FMIS) go, they do bring some good omen.

We at the FMIS Promotion Trust are indeed acutely aware of the beauty and character of FMIS. What we feel though is that, despite this awareness, we have not adequately been able to understand the risks FMIS have been facing in a State, which has largely been rendered disable. A disabled State cannot properly work and negotiate with the bilateral counterparts and the multi-lateral financing and trade regimes. It is unable to appreciate the indigenous heritage and strengths of its own people, and plan to systematically enhance its national capability. The best a disabled State can offer is a gigantic opportunity to destroy or radically reform itself.

I am referring to the disabled State as an overarching variable to the change-context of FMIS. No doubt, external interest or regime dominates any disabled State's policy, institutions, rules, plans and programs. Indigenous institutions such as FMIS's struggle, therefore, need to encompass the State to contribute in developing it into an enabling State to continue protect and promote FMIS. Of late, we have tried to focus the Trust efforts and program inputs on this particular change-context of FMIS. This august gathering may agree with these words of wisdom: the best way to predict the future is to create it today.

Diversification of water user association functions, multiple use of water and upstream and downstream linkages in a sub-watershed, mechanism for communication with FMIS, new FMIS and their dynamism, recrafting role of education for FMIS knowledge promotion have been the key research areas of the Trust activities in these years. The Trust has been organizing these research activities in collaboration with independent inter-disciplinary group of young professionals, the bare foot researchers at the

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1 Vice-chairman, FMIS Promotion Trust, Nepal.
As a number of the Trust research and associated activities is being presented in this seminar, I do not need to further dwell on them. Nevertheless, I would like to mention about the best practicing FMIS award for the years 2000 and 1999. For the year 2000 best practicing FMIS award the theme selected was resource mobilization for irrigation system operation and maintenance. Chhattis Mauja FMIS in Rupandehi district won this award. It annually mobilized NRs. 745 per hectare for the irrigation system operation and maintenance. In this ceremony, I recognize Mr. Keshab Neupane, representative of Chhattis Mauja FMIS, and Mr. Dilli Ram Neupane, representative of Bhutlung FMIS in Jhapa district, the best practicing FMIS on the theme of conservation measures for irrigation system for the year 1999.

For the year 2001, we were not able to complete the planned award administration process. This was basically due to the continued poor response of FMIS. The theme selected for 2001 best practicing FMIS was diversification of activities for FMIS sustainability. The poor response of FMIS despite their most extensive presence and critical contribution in the country's agricultural political economy was indicative of complete lack of a regular communication mechanism between FMIS and the external assistance agencies.

Therefore, one of the priority areas of the Trust activity support, since 2001, has been communication. A key lesson that we have learned in all these years is: A two-way regular communication with FMIS was a prerequisite for enhancing their capacity to learn, share and transfer irrigation management knowledge and skills. External assistance to FMIS not supported by a regular communication mechanism was like an unknown value, which is not accountable. As the value is not accountable, it is unlikely to be sustainable.

For enhancing the communication on FMIS to the common people, the Trust has published a booklet entitled Kisan Byabasthit Sinchai ko Chinari (FMIS: an Introduction) in simple Nepali language. This booklet is sent to
all the Village Development Committees, District development Committees and municipalities in Nepal. It is distributed to the public irrigation offices, non-governmental organizations and members of Nepal Engineers' Association. The booklet is sent to all 450 FMIS whose addresses are there in the database of the Trust. In Kathmandu, the Trust in collaboration with Kathmandu District Unit of FMIS has sent the booklet to 238 FMIS whose inventory was prepared by the Kathmandu District Unit with support from the Trust. To forge communication with the international FMIS community, the Trust published the proceedings of the first international seminar on "Challenges to FMIS," which was organized in Kathmandu in March 2000, the report on the award winning FMIS and dialogue programs. The books on the seminar proceedings and award winning FMIS are posted on web sites www.cbnrm.org and www.inpim.org. In addition to enhancing the familiarization of FMIS to the international as well as national community, the Trust has engaged itself in developing organizational development capability of selected group of farmer representatives at the district, inter-FMIS or sub-district and FMIS levels.

Now I would like to share a few thoughts with you about the Trust management itself. Volunteers manage the Trust. We in the executive committee of the Trust certainly charge a fee when we are assigned a professional task by the Trust. But the fee that we charge is returned to the Trust as donation. The initial Trust fund that was created out of our direct original contribution was NRs. 80,000 in 1998. The support of the friends of FMIS has increased the size of the Trust Fund by 12 folds in the last four years. The proclaimed policy of the Trust is not to accept any external support on a donor-driven project-financing mode. We approached Ford Foundation and have received a grant support of US$ 100,000 for the Trust programs. In my experience of work with several multi-lateral and bilateral donors in the last 20 years or so, it is perhaps this Foundation, which rather encourages the national institutions to work on a program mode and, optimize the use of the grant with greater integrity. Indeed, we target to finance 80% of the Trust reiterative program by our internal resources in the next five years. We are committed to our policy of sustainable and autonomous development. These are as a matter of fact two fundamental values that the national cultural heritage of FMIS has so distinctively established in this country. To contribute towards this objective, the Trust has initially favorably invested a small amount of money in a commercial bank stock. It looks forward to the probable diversification of FMIS activities as one of the potentials to internally enhance its level of sustenance.
With these words, I would like to end my statement here. Thank you all for your patience and attention.
HONOR AWARDS

Keeping alive its tradition of honoring the distinguished scholars who have made remarkable contribution to uphold the values of Farmer Managed Irrigation Systems (FMIS), the Trust this year, through ample deliberation among its members, unanimously decided to honor three scholars. Names of the three scholars to be honored were declared by Krishna Murari Gautam, Master of the Ceremony. The declared names were: Prof. Elinor Ostrom, Prof. Norman Uphoff and Dr. Robert Yoder.

INTRODUCTION OF THE "ICONS OF HONOR"

Dr. Vijaya Shrestha, member of the Trust introduced the scholars whom the Trust preferred to address as "Icons of Honor". Their brief introductions are as follows:

Elinor Ostrom: Prof. Elinor Ostrom is Arthur F. Bentley Professor of Government and the Co-director of Workshop in Political Theory and Policy Analysis, Indiana University, Bloomington, Indiana, USA. She is the Co-director of Center for the Study of Institutions, Population and Environmental Change, Indiana University. She is the Professor of School of Public and Environmental Affairs, Indiana University.

She was also the President of International Association for the Study of Common Property from 1990-91. She was the President of American Political Science Association from 1996-97.

She has been associated with Grants and Funded Research in many organizations in America and abroad in capacity as the Project Director, Principal Investigator or Co-principal. She was associated with projects such as "Nepal Irrigation Institutions and Systems Database" and the Parks and People Project in the Nepal Terai".


Norman Uphoff: Prof. Norman Uphoff is the Director of Cornell International Institute for Food, Agriculture and Development and of the International Agriculture Program, College of Agriculture and Life Sciences. He is the professor at Department of Government, College of Arts and Sciences and Cornell University. Prof. Uphoff has obtained his Ph.D. degree from University of California, Berkeley in 1970. He is a Visiting Professor in many Asian, African and Western countries.

Many books, articles and journals are to his credit. This includes Improving International Irrigation Management with Farmer Participation, Managing Irrigation Analyzing and Improving Performance of Bureaucracies. He was an advisor in committee on Agricultural Sustainability in Developing Countries in 1993. He is involved in several professional activities in the capacity of an advisory councilor, research consultant and training expert in education, health, agriculture development, irrigation and social science. He has provided his expertise in different international organizations such as ADB, WB and UNDP. He was an advisor to U.S. Agency for International Development for Irrigation Management Project in Nepal from 1986-89.

He has delivered lectures in many institutions in Nepal namely, Institute of Agriculture and Animal Science, Rampur in 1998; International Center for Integrated Mountain Development (ICIMOD), Kathmandu in 1986 and 1987; International Irrigation Management Institute, Kathmandu in 1988; and Irrigation Management Center, Kathmandu in 1989.

Robert Yoder: Dr. Robert Yoder is a Senior Associate in Associates Rural Development (ARD), Inc. in the United States. He was trained as a civil and agricultural engineer. Much of his professional work has focused on research and improvement of farmer-managed irrigation systems. His recent work in Romania and Jordan included increasing farmer involvement in irrigation management.

He was team leader for the start-up phase of the World Bank-funded Nepal Irrigation Sector Project. In Indonesia, he carried out an evaluation of the ADB-funded Bali Irrigation Sector Project to determine the impact on the indigenous subak irrigation institutions and the support network provided to subaks by the water temple system. In Pakistan he helped design a project for ADB funding for farmer-management of large irrigation system.
below the main canal level. He led a study in Thailand, Myanmar, and Vietnam that examined the relationship between quality of routine maintenance and irrigation system performance. In Indonesia he assisted ADB staff in designing a project to assist FMIS in five provinces.

From 1985 to 1990, Dr. Yoder was Head of IIMI’s field operations in Nepal where he assisted WECS with a unique FMIS rehabilitation project that was designed to improve farmer skills and experience in carrying out system operation and maintenance tasks.

Together with an agricultural economist and a social scientist, Dr. Yoder carried out field-based research on FMIS in Palpa District of Nepal from 1981 to 1983. Farmer-to-farmer training techniques for strengthening FMIS institutions were developed as part of this research. In the period from 1966 to 1978 he worked for eight years at the Butwal Technical Institute in Nepal where he initiated a program for manufacturing and installing water powered grain mills and village electrification systems. He also supervised construction of the Tinau Hydroelectric Project for the Butwal Power Company.

BESTOWING THE HONOR AWARDS

After the introduction, Dr. Prachanda Pradhan, Chairman, FMIS Promotion Trust, honored the "Icons of Honor" by presenting Dosallah (shawl), which is a traditional Nepali way of bestowing honors to the distinguished persons. Dr. Upendra Gautam, Vice-chairman, FMIS Promotion Trust, honored them by presenting commendation plaques, and Mr. Rajan Subedi, Member Secretary, FMIS Promotion Trust by presenting bouquets. Mrs. Rupa Lamichhane, Trust Researcher read out the citations inscribed in the plaques conferred to the "Icons of Honor" during that ceremony.

Commendation plaque to Prof. Elinor Ostrom reads: "This plaque of honor is presented to Prof. Elinor Ostrom in recognition of her outstanding contribution in synthesizing international learning and crafting institutions related to FMIS."

Commendation plaque to Prof. Norman Uphoff reads: "This plaque of honor is presented to Prof. Norman Uphoff in recognition of his outstanding contribution in farmer-centered academic enrichment and knowledge building."
Commendation plaque to Dr. Robert Yoder reads: "This plaque of honor is presented to Dr. Robert Yoder in recognition of his indigenous research and continuous support in promoting the best farmer managed irrigation system practices."

The glorious moments of honor award ceremony were captured in the photographs which are shown in the following pages.
PRESENTATION OF HONOR AWARDS

Trailokya Nath Upraity, Chief Guest (right) being welcomed by Prachanda Pradhan with a bouquet.

Second International Seminar on "Managed Irrigation System in the Changing Context" 18-19 March 2003, Kathmandu, Nepal

Krishna Murari Gautam declaring the names of "Icons of Honor"
Vijaya Shrestha introducing the “Icons of Honor”

Elinor Ostrom (left) after being honored with traditional Nepali shawl by Prachanda Pradhan
Elinor Ostrom with the commendation plaque

Elinor Ostrom being presented a bouquet by Upendra Gautam
Elinor Ostrom delivering her keynote speech

Prachanda Pradhan honoring Norman Uphoff with traditional Nepali shawl
Norman Uphoff being presented the commendation plaque by Upendra Gautam

Norman Uphoff being presented a bouquet by Rajan Subedi
Norman Uphoff delivering his keynote speech

Robert Yoder after being honored with traditional Nepali shawl
Robert Yoder being presented the commendation plaque by Upendra Gautam

Robert Yoder being presented a bouquet by Rajan Subedi
Robert Yoder delivering his keynote speech

Rupa Lamichhane reading out the citations inscribed in the plaques
CLOSING REMARKS

TRAILOKYA NATH UPRAITI

It is my great honor to chair this initiation session of the seminar. Firstly, I would like to extend my heartfelt thanks to Farmer Managed Irrigation Systems (FMIS) Promotion Trust for providing me this opportunity. I would take this moment to appreciate the keynote speeches by the distinguished scholars.

Though I am not directly associated with irrigation, I highly regard the efforts made by the Trust from an educationist's perspective. I would like to share my own experience as regards the farmers' initiative and concerted efforts in raising their livelihoods and managing production related to the society. It was the event in a village of western Nepal in early 1950s. During my trip to that village, I was quite surprised to find the systematic and well functioning farmer organization. The villagers had maintained their own crop calendar throughout the agriculture cycle and they had an unwritten convention regarding irrigation activities. Organizational strength is thus prominently observed in FMIS that makes possible enormous contribution towards nation building.

Western influence and effect are all present in the main fabrication of the Nepalese society. Hence, we should be little more careful while adopting western models. FMIS are a more appropriate alternative for development than the indiscriminately borrowed western organizational designs.

Nepal is witnessing gloomy situations in political, social and economic spheres today. Amid this prevailing aura of pessimism too, the initiatives undertaken by the Trust in promoting the values of FMIS has helped instill an element of hope in the farmers in particular and entire nation in general. I would mention that honest commitment of the Trust is more imperative to extend its contribution in other fields beyond irrigation. Even in this bleak national scenario, I am still sanguine that courageous and skillful leaders will emerge one day to seize the opportunity for the overall

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1 President, Society for the Promotion of Civic Education, Former Vice-chancellor, Tribhuvan University, and Royal Nepali Ambassador to France. Dr. Upraiti was Chief Guest at the initiation of the seminar.
development of the nation.

To conclude my remarks, I am highly grateful to FMIS Promotion Trust for imparting me this opportunity.

Thank you!
PART II: KEY NOTE SPEECHES
HOW FARMER MANAGED IRRIGATION SYSTEMS BUILD SOCIAL CAPITAL TO OUTPERFORM AGENCY MANAGED SYSTEMS THAT RELY PRIMARILY ON PHYSICAL CAPITAL

ELINOR OSTROM

Let me share with you some of the experiences I have had in studying irrigation systems in Nepal since 1989.3

Some of you may not know how it is that I came to be a scholar with a deep interest in Nepal in general and Nepal irrigation and forestry in particular. The USAID program on decentralization funded a seven-year cooperative project between Syracuse University, Indiana University, and Associates in Rural Development in Burlington, Vermont. That program was asked to evaluate the decentralization program then established in Nepal. Professor Larry Schroeder, Dr. James Thomson, and I were sent to Nepal to do the evaluation.

Before I left Bloomington, I called Dr. Norman Uphoff and asked whom I should be sure to meet on my very first trip to Kathmandu. He indicated that the two most important people for me to meet were Dr. Prachanda Pradhan and Dr. Robert Yoder. What a fortuitous recommendation. And, what a great honor for me to share this program organized by Prachanda Pradhan with both Norman Uphoff and Robert Yoder.

I well remember my first discussion with Prachanda (Bob was not in Kathmandu at that time). I told Prachanda about some of our earlier research on irrigation, inshore fisheries, forest resources, and groundwater basins and he was quite interested in what we had done. I indicated I had read some of his work with Yoder and others on irrigation in Nepal and was quite interested in learning more. At that point, he gave me a very thorough questioning about the seriousness with which I would approach

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2 Professor and Co-director, Workshop on Political Theory and Policy Analysis, Indiana University, USA.

3 The continuous support of the Ford Foundation in New Delhi is deeply appreciated by all of us who have worked on the NIIS database through the years. We also appreciate the helpfulness of Dr. John Ambler and Dr. Ujjwal Pradhan, who have consistently supported our efforts with effective collegial input as well as essential resources.
this topic. Prachanda was obviously used to overseas consultants who fly in, take up a lot of people’s time, duplicate materials, and then are never heard from again. After asking me a whole host of questions including how we train graduate students, I obviously passed the test. I was graciously granted a long interview with him and the possibility of copying a large number of original case materials located in his fantastic files.

In stark contrast, I found that the original mission on which we were sent to be extraordinarily difficult. As many people in the audience will remember, the decentralization program “in effect” in 1989 was among the most *centralized* decentralization programs one could find in the world at that time. Several interviews with key officials in Kathmandu convinced me that we would not be able to be very constructive in reviewing that policy. Simply criticizing a government policy is not terribly useful. After several discussions with Larry Schroeder and Jamie Thomson and with the officials at USAID, we came up with a much more effective project. Since many of the irrigation systems in Nepal were already effectively decentralized, we would focus our study on the performance of Farmer Managed Irrigation Systems (FMIS) as contrasted to Agency Managed Irrigation Systems (AMIS).

During the rest of that first trip, we collected extensive materials, talked with scholars familiar with irrigation in Nepal, and prepared to do a serious study of the reasons why FMIS seem to be so much more effective than AMIS in Nepal.

It was on that trip that I also learned about the work of Ganesh Shivakoti. He was at that time just finishing his doctorate at Michigan State University. We were in great good fortune when we were able to bring Ganesh to Bloomington for a period of time after his doctorate. He worked with Paul Benjamin and others at the Workshop in the design and execution of our project. As many of you know, we created a structured database called the Nepal Irrigation Institutions and Systems (NIIS)
We shared the design of this database with a number of colleagues who are deeply familiar with irrigation, and began to code the 135 case studies that we had collected from our trips to Nepal and from the published literature—many of them authored by Pradhan and Yoder.

Discussions with colleagues at the Department of Irrigation (DOI) and the Institute of Agriculture and Animal Science (IAAS) in Rampur, and at several irrigation systems, showed us that the approach we were taking was likely going to be fruitful and generate some important information for policymakers into the future.

Our team coded most of the cases that we had brought back to IU, but then found that we had a serious problem of missing information regarding key variables for some of our cases. Whenever one uses a structured coding form to extract data from a case that someone else has written, it is almost inevitable that one finds that the case author did not share the same conceptual framework and thus did not record information on all of the key variables in the new analysis. It was at this point that we went to Dr. John Ambler who was then with the Ford Foundation. We shared with him some of our initial papers and exciting findings that we had already extracted from the completed cases. The high performance of FMIS in Nepal when contrasted with the performance of AMIS was well documented in our initial papers, even with substantial missing data. John not only supported a field visit to return to sites where we needed to obtain missing information, he encouraged us to add cases to our sample. By adding some of the smaller government systems as well as FMIS, he helped us strengthen our analysis. He was concerned—and legitimately so—that our findings regarding the higher performance of FMIS might be interpreted as due largely to the size of FMIS and not to the form of organization. By adding larger FMIS and smaller AMIS to our database, we were able to increase the number of medium-sized irrigation systems where we could do a side-by-side comparison to complement the earlier data that we had coded. Given the support of the Ford Foundation, we

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The NIIS database is currently located at the Institute of Agriculture and Animal Science in Chitwan and at the Workshop in Political Theory and Policy Analysis, Indiana University, in Bloomington, Indiana. Many faculty and graduate students at both institutions have devoted substantial time and effort to acquiring accurate and valid information about many irrigation systems in Nepal. We are all indebted to the many farmers who have spent long periods of time with us in the field telling us about the history and operation of their system as well as many Department of Irrigation staff members who have shared information and insights with us.
were able to visit 80 systems, fill in missing data, corroborate the coding we had done earlier, and add new systems. Much to all of our relief, we found that our earlier coding had been quite accurate and that adding new systems only strengthened the relationships we had found earlier and did not weaken them (see Lam, 1998).

With the hard work of many colleagues at the Institute of Agriculture and Animal Science in Chitwan, we have added still further cases to the database. We have now analyzed information on the structure and performance of 231 irrigation systems (183 FMIS and 48 AMIS) in Nepal (see Joshi et. al., 2000). Since we have undertaken a lot of statistical analysis through the years, I won’t bore you with many tables and figures. There are, however, some important facts that have been consistently found in our studies (see Ostrom, Lam, and Lee, 1994; Ostrom, 1996; Sowerwine et. al., 1994; Shivakoti et. al., 1997; and Shivakoti and Ostrom, 2002).

What we have consistently found through all of our analyses is that FMIS generally achieve higher levels of performance than AMIS in regard to the following performance variables:

1. The physical condition of the system—how well maintained is the system given the type of headworks and canals in use?
2. The technical efficiency of the system—of the water that reaches the head end of a system, what proportion reaches the tail end?
3. Agricultural productivity—what is the cropping intensity achieved on a system?

Further, we have consistently found that FMIS are more capable of getting water to the tailenders of a system. Of the FMIS included in our analysis, for example, 53 percent are able to deliver adequate levels of water in a predictable fashion to the tail end of their systems while only 11 percent of the AMIS have a similar record (Joshi et. al., 2000).

How is this consistently higher performance possible when most of the AMIS have iron and steel head gates, cement-lined canals, and all the advantages of modern technology? Even controlling for the size of a system and the slope and other relevant physical characteristics, FMIS consistently outperform AMIS in Nepal. One finding that we have come across helps us understand perhaps how this all happens. We have the rather intriguing finding that systems that do not have permanent headworks have higher performance records than those systems with
modern cement and steel headworks. On the other hand, we find modernized systems with fully-lined canals do have high performance. Why this difference?

Having been on a number of FMIS and talking with colleagues who have attended the annual meetings of such associations, we think we understand why this may be the case. There appears to be two basic reasons: the internal dynamics among farmers related to water distribution, and the importance of getting water to the tail end. These two are related.

It would appear that on many of the AMIS—even though the headworks is a modern control structure—the system was not developed with an effort to clarify the existing water rights and management regime of various farmers. The government, or a donor, built the system and then presumed that the farmers would figure out how to distribute the water. Given that a substantial amount of labor is saved by the installation of permanent headworks as contrasted to the need to construct and reconstruct traditional headworks frequently, farmers on such a system do not have to confront one another every spring to discuss how they are going to repair or even produce entirely new headworks in order to get any water at all.

I do not have to tell the people in this room the importance of the annual meetings that occur on FMIS to discuss relative allocations of water and labor duties. On most FMIS, farmers near the head end do not have enough labor to be able to maintain the system year after year. The headenders need the tailenders. Thus, the tail-end farmers have some real voice on these systems. We consistently find that when high labor requirements exist, water tends to be distributed more equitably between the head- and tail-end farmers.

On AMIS, where maintenance requires much lower labor contributions from the farmers, the head-end farmers no longer need the labor contributions of the tailenders. This enables those who are in the physically most advantaged situation—the headenders—to be sure their fields are thoroughly watered before they let any water pass on down the canal. Thus, on these systems the proportion of tail-end farmers who receive water in the dryer seasons (the non-monsoon seasons) is much smaller. Thus, one of the major recurrent patterns is that those farming near the head end of an AMIS obtain a larger proportion of the water. Those farming near the tail end receive a smaller proportion. The overall cropping intensity and productivity for the system is thus less.
The findings regarding the lining of canals are also related to getting the water to the tail end of the system. When the canal is lined, it ensures that a larger proportion of the water gets to the tail end. Thus, lining canals has helped tail-end farmers, while building modern headworks has led to an internal dynamic among the farmers that has harmed the tail-end farmers. Of course, no necessary relationship exists between the type of headworks and reduced productivity. Everyone here knows, however, that the way farmers relate to one another, manage their own affairs, and allocate their own water affects overall productivity. Since water fees are not uniformly collected and used to manage the system from which they are collected, no one “needs” the inputs of the tail-end farmers. Without being needed, their interests can be ignored.

Well, what do we learn from all of this? One lesson I hope we are sure to learn is that we cannot be smug and self-satisfied. Not all FMIS operate as well as others. Some have failed totally. Some systems have succeeded for long periods of time before breaking down. On average, however, farmers do a much better job of governing and organizing on their own systems than government officials do on their systems.

Further, we cannot assert that mud and wooden dams will always be more efficient than modern engineered works. It is not the modern engineering that leads to a reduction in productivity but rather the primary focus on physical capital and absence of a focus on social capital (see Uphoff, 2002). All too many farmers in Nepal face a three- to five-month period every year of hunger. All too many of their families are not able to get a decent education or reasonable health care. Thus, if improvements in physical capital were matched with the recognition of prior social capital and efforts to enhance future social capital, the negative relationship between modern headworks and performance could be reversed.

Achieving a higher standard of living without losing some of the strong capabilities of self-governance is a major challenge. To do so, however, requires listening to farmers in the first place and gaining information about their needs, their property rights, their ways of governing irrigation, and facilitating their plans for ways of managing improved physical capital. For some engineers who pride themselves on their technical training, the idea of listening to farmers who have much less formal education is an anathema. The farmers, however, have much more local knowledge about the biophysical conditions in their region. And, if they have managed their own system in the past, they know what kind of property rights and duties have been established in the past that need to be
taken into account in any effort to “modernize” a system. An effective irrigation system is not just an accumulation of good physical capital. No physical plant runs effectively anywhere in the world without a build up of social capital among those operating the systems.

When donors speak to me about increasing the democratic process in Nepal and other countries, I immediately think of enhancing the capability of FMIS and forest-user groups. Some outside interventions have, however, endangered these democratic institutions by ignoring them or presuming they did not exist. Where they have survived, however, they are a solid foundation on which to build broader-based democratic institutions (so long as we do not confuse party dominance of an electoral process with a democratic process). True democratic processes allow individuals from all walks of life to perceive and articulate the problems that are most important to them and find ways of overcoming them. The farmers of Nepal have for many centuries found ways of solving some of their problems relatively well by associating, sharing knowledge, getting technical information where relevant, and monitoring government to be sure that it is honest, fair, and efficient. FMIS, and the FMIS Trust in particular, will play a major role in the democratic process in Nepal well into the future.
REFERENCES


UNDERSTANDING AND UTILIZING THE SOFTER ASPECTS OF 'SOFTWARE' FOR IMPROVING IRRIGATION MANAGEMENT

NORMAN UPHOFF

INTRODUCTION

Purposeful efforts to introduce participatory management into the irrigation sector began about 25 years ago, with the innovations introduced into Agency Managed Irrigation Systems (AMIS) by the National Irrigation Administration (NIA) in the Philippines with Ford Foundation assistance (Bagadion, 1997; also F. Korten, 1982, and F. Korten and Siy, 1988). This was followed in 1980 by an initiative to establish farmer organizations in the Gal Oya irrigation scheme in Sri Lanka as part of a USAID-supported project there (Wijayaratna, 1985; Uphoff, 1996; Wijayaratna and Uphoff, 1997). Then during the 1980s and 1990s there were a variety of efforts made to institutionalize farmer participation in poorly-managed large-scale systems in India, Indonesia, Nepal and elsewhere around the world.

These efforts supported by donor and government agencies and NGOs evoked greater interest in Farmer Managed Irrigation Systems (FMIS), such as the indigenous subak organizations on the island of Bali in Indonesia that had been documented previously by Geertz (1967). Other examples from other parts of Asia were analyzed by Coward (1971, 1976, 1977, 1979). One of the most important case studies which demonstrated that farmer management could be effective for large systems and sustained over many decades was provided by Pradhan (1983) on the Chhatis Mauja scheme in Nepal. This capability was further documented by Martin (1986), Yoder (1986) and Pradhan (1989) for numerous other FMIS in this country.

These AMIS and FMIS "streams" of experience and analysis were not treated as separately as this simplification of history suggests. The experimentation in the Philippines began with smaller communal

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irrigation systems, ones receiving public sector support but under local jurisdiction. Over time the lessons learned from these smaller systems were transposed to larger, publicly-managed ones, which went through a transition toward farmer management. There has thus been some cross-fertilization, and even comparative analysis such as offered by Valera and Wickham (1978). Too often, however, these remained separate domains for action and evaluation, the first dealing mostly with larger schemes operating within the public sector while the other dealt with smaller systems under community or group management.

Experience has not been uniform. There have been difficulties often in achieving or maintaining the kinds of effective management in AMIS as in FMIS, even when certain structures or incentives were introduced from the latter to the former, as in the Philippines. This failure relates to the lack of attention to the 'softer' side of irrigation management which is this paper's focus.

The fact that the management of irrigation systems everywhere presents similar problems, water being one of the most uniform substances in the world and irrigation being a widespread activity, has attracted attention from a number of social scientists (e.g., Wade, 1982, 1988; Ostrom, 1990; and Uphoff, 1986, 1991).

There is now wide consensus that farmer participation in irrigation management, whether in small-scale local systems or large-scale government schemes, with appropriate organizational structures and incentives can improve efficiency and often equity under quite a range of conditions. However, I would propose that there need to be changes also in the domain of thinking and assigning values, not just in structures and incentives.

Differences between AMIS and FMIS can be conceived in the changes in three different aspects of irrigation management: operational objectives, irrigation duty, and functions performed, that need to be achieved to have appropriate structures and incentives.²

² I thank Dr. Prachanda Pradhan for his suggestions along these lines.
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There is no longer much disagreement that *in principle*, participatory irrigation management can be more successful than non-participatory alternatives. Arguments now focus on whether, and under what conditions, participatory management will be preferable *in practice*. This shift in thinking is partly because there is a growing democratic spirit at large in the world that does not accept purely bureaucratic management or unaccountable political decision-making. But the merits of a participatory approach have been demonstrated often enough that its proponents now get "the benefit of the doubt" rather than having to shoulder "the burden of proof" as before. This reflects a substantial change in public and private thinking over the past two decades.

What I would like to do in this paper is to expand upon the present thinking that accepts the value of having farmer organizations actively and responsibly involved in irrigation management, whether of large schemes or small systems. Such water user organizations are understood to be a kind of "software" that is essential for making more effective and efficient the "hardware" of physical structures for the capture, conveyance, distribution and drainage of irrigation water (Uphoff, 1986).

Thus far, the ways in which such "software" can be constructed and maintained have been analyzed mostly in terms of what I would characterize as the "harder" aspects of social relationships and interactions:

- Attention has focused mostly on *material incentives* and on what are considered to be *"rational" calculations of interest*.  

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Farmers have been regarded essentially as individual decision-makers who are seeking to maximize their respective well-being cooperatively but independently of one another.

I accept that this kind of "rational actor" analysis can capture a large part of social reality, and that it has some advantages such as parsimony and predictability. But my experiences in Sri Lanka and Nepal with introducing and evaluating participatory irrigation management there leads me to question the completeness and even the adequacy of such a perspective. I want to suggest here that we need to learn how to incorporate some of the "softer" aspects of social relationships and interaction, dealing more with norms, values and ideas, into our planning for and support of participatory irrigation management. This can give more sustainability to such efforts, I will argue, as well as greater effectiveness, efficiency and equity.

I will suggest first some empirical foundations for this alternative, enlarged perspective on the promotion of farmer management in irrigation systems. This leads into a discussion that is more theoretical, seeking to provide explanations for different outcomes and to give some guidance for facilitating the creation and strengthening of social capacity for participatory management.

**EXPERIENCE FROM SRI LANKA**

My involvement with participatory irrigation management started with the opportunity for Cornell's Rural Development Committee to work with the Agrarian Research and Training Institute (ARTI) in Sri Lanka to introduce this kind of management into the Gal Oya irrigation scheme under a USAID-funded water management project starting in 1980. We learned, after agreeing to accept this assignment, that Gal Oya was considered the most badly managed and most difficult irrigation system in the country, being the largest and most physically deteriorated.

- The main reservoir had filled only twice in the 30 years since it was constructed, so this was a chronically water-short system. The bottom third of the command area almost never got water deliveries during the dry season, and the middle reaches had had uneven and unreliable water supply. There were even some shortages within head-end areas.
- The command area in the Gal Oya Left Bank, where the project...
was focused, had expanded by at least 25% beyond the original 50,000 acres (1 ha. = 2.475 acre) developed, water shortage notwithstanding. In the past three decades many offspring of the initial settlers had encroached on reserved right-of-way areas to acquire their own land for cultivation, making maintenance and system management more difficult.

- The **soils** in the Left Bank were not very suitable for irrigation, having limited water retention capacity and being originally intended for sugar cane rather than rice production. This was not very good productive rice land, which contributed to **widespread poverty**.

- Because this scheme was populated by settlers brought in from other parts of the island during the 1950s, local communities had **little solidarity**, either traditional or modern, and there was accordingly a lot of **endemic conflict**.

- Some of the settlement of Gal Oya has been **semi-voluntarily**, as many settlers were selected by the headmen in their home villages to be relocated to this new scheme to meet quotas. Some were former prisoners who were given release if they would settle in Gal Oya with their families. Settlers had **low self-esteem** and were little respected by officials.

- Given the perennial and serious water problems, **water theft, conflicts over water**, and **anarchic behavior** were common. At the time the rehabilitation project began, 80% of gates and other control structures were broken or inoperable. Water was being regularly measured and controlled at only six locations within the 65,000-acre command area. Engineers could not distribute water effectively even if and when they wanted to do so.

- The head-end and tail-end areas were under **different administrative units** because the command area was so large and overlapped two districts, complicating management decision-making in the head and tail.

- The area was considered a **'hardship posting'** within the administration because of its distance from the capital and its lack of amenities, so irrigation and other officials tried to avoid assignment there, or got transferred out as soon as possible, which made for many vacancies and high turnover in the public service.

- To make matters worse, there were definite **ethnic divisions** as the head-end and middle areas had been settled by Sinhalese households, and the tail-end areas by Tamil families. This exacerbated the normal tensions and conflicts one finds between
upstream and downstream water users.

This was thus a very unpromising place to begin introducing, validating and institutionalizing participatory irrigation management. The Irrigation Department's Senior Deputy Director for Water Management informed us: "If we can make progress in Gal Oya, we could make progress anywhere in Sri Lanka." The top civil servant in Ampare District, where most of the Left Bank system was located, informed our young organizers as they completed their training and were about to begin work among Gal Oya farmers: "If you can bring even ten or fifteen farmers in Gal Oya to work together, that will be a big achievement." He was trying to encourage them by setting low initial expectations, so did not say that the number of farmers to be gotten into water user associations within the next four years was probably between ten and fifteen thousand.

Results from Organizing Efforts, 1981-85

It seemed almost a miracle that demonstrations of cooperative behavior and collective action were evident soon after the organizers began living and working in villages. The first round of activity began under the threat of dire water shortage as the main reservoir was only 25% full at the start of the 1981 dry season. Yet despite this -- or maybe because of it -- within six weeks' time, about 90% of farmers in the 5,000-acre pilot area were doing, at their initiative (prompted and supported by the organizers) some combination of:

- **Channel cleaning** by voluntary group labor, removing silt, weeds, and other debris from channels that had not been maintained properly for 5, 10, sometimes even 20 years
- **Rotating of water deliveries** between upstream and downstream water users so that all could get approximately equal shares of the available scarce water,
- **Voluntary saving of water**, with as much as one-sixth of water allocations upstream being donated to needier farmers downstream,
- **Adhering to a common cultivation calendar**, and
- **Managing and reducing conflicts**, to the extent possible.

An indication that there was, suddenly, a high degree of solidarity and

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3 I thank my colleague Dr. C. M. Wijayaratna, who was instrumental in the Gal Oya organizing effort, for his suggestions on this and following sections.
cooperation was the fact that in this first season, all of the changes made in voluntary rotational water deliveries were from head-end-first to tail-end-first systems rather than vice versa. These changes indicated a high degree of trust, or resolve to share shortages, since main system management in the absence of rehabilitation of the physical facilities meant that water deliveries to distributory-canal command areas were still unpredictable. The schedule for alternating deliveries of water, five days on, then five days off, was seldom kept, so agreeing to let other farmers draw water first entailed some risk.

The 1982 dry season started with even greater water shortage as the water available in the main reservoir was only 20% of its capacity. Even so, the demonstrations of farmer cooperation and solidarity continued and even accelerated, as documented in Uphoff (1996). This paper will recount only briefly the process and results of the organizational effort. By December 1985, when the USAID project ended, and Cornell-ARTI involvement with the Gal Oya farmer organizations was abruptly terminated, about 12,500 farmers were active in participatory water management in the upper and middle reaches of the Left Bank system. As discussed below, these organizations have persisted and even gained strength in important ways, though the promised support from government was less helpful than planned and expected.

Since 1985, practically the whole Left Bank has received irrigation water deliveries even during the dry season as the efficiency of water use in the system has been at least doubled. An evaluation done for the International Irrigation Management Institute (IIMI; now IWMI, the International Water Management Institute) found that the amount of rice (in kg) produced per unit of water (m³) issued from the main reservoir had been increased about four-fold as a result of project activities (Wijayaratna and Uphoff, 1997: 178). With more reliable supplies of water, farmers began investing in things that would raise their production.

A post-project benefit-cost analysis concluded that the rate of return on project investment was an unusually high 28% (Aluwihare and Kikuchi, 1991). Some of these improvements can be attributed to the physical rehabilitation of the system. But a quantitative evaluation by IIMI staff

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5 There could have been as many as 10,000 more farmers in downstream areas formally involved in water user groups if threats had not been made by the LTTE, an armed group seeking a separate Tamil state. These farmers could not safely be associated with a government-sponsored program so had to proceed informally after our cadre of Tamil organizers had gotten water user groups started.
estimated that at least half of the measurable improvements in efficiency could be attributed to the 'software' created by the project (Amarasinghe et. al., 1998), even though this amounted to only about 10% of project investment. This is the kind of evidence that makes a strong case for investment in the creation of water user associations and for participatory management overall. But the Gal Oya case is even more important for its sustainability and evidence of remarkable solidarity among farmers that under-girded their technical accomplishments.

Demonstration of Organizational Capacity in Sri Lanka, 1997

In the 1997 dry season, more than a decade after outside assistance for farmer organizations had been withdrawn, farmers faced an unusually acute shortage of water. The water level in the main reservoir was so low as the planting season approached that the Irrigation Department (ID) decided it would not even begin making water issues for cultivation because it did not have enough water in storage to sustain a full season.6

Farmers in the Left Bank were understandably distressed by this decision. They insisted that they could manage with even a much reduced supply of water because they had learned -- and had the organizational capacity -- to grow a crop with less water than was the norm -- 4 acre-feet of water per acre of cultivated land. Some quick research done by educated farmers on past inflows to the reservoir and issues from it during the dry season led the farmer organizations to conclude that there some additional supply would become available during the season, even without rain, from water already stored in the water table. (Engineers did not want to concede that they had forgotten to take this into account when making their calculations of dry-season supply.)

After the farmer organizations had mobilized support from politicians and administrators for going ahead with the cultivation season, the Irrigation Department agreed to provide 60,000 acre-feet of water however and when the farmer organizations decided to use it. The Department recommended, however, that (a) the water made available be used on the first 15,000 acres of land on the Left Bank to avoid seepage and conveyance losses from distributing the water over the whole area, and (b) farmers should not grow rice, because of its high water requirements.

6 The following account is discussed in detail, with documentation of sources, in Uphoff and Wijayaratna (2000).
The Department also advised farmers that it would not accept any responsibility for crop failures if its recommendations were not followed and that farmers would be cultivating at their own risk.

With an assurance of 60,000 acre-feet of water, the farmer organizations discussed how to distribute this among themselves. Rather than favor some areas over others, they decided, against officials' advice, that the water would be shared equally throughout the whole Left Bank, and also that farmers could decide for themselves what crop they would grow. With this information, farmers set about cleaning channels very carefully and carrying out very careful management of the available water supply. The whole Left Bank was planted, and mostly with rice, even though farmers could count on less than one foot of water per acre instead of the usual norm of 4 feet.

Farmers were correct in their assumption that there would be some additional water supply. Irrigation Department records show that an additional 38,000 acre-feet were issued to the Left Bank from the reservoir during the season, making the total 98,000 acre-feet. But this was still only about 1.5 acre-feet per acre. There was some rainfall during the season, indeed a little more than average for the dry season. But even so, farmers had to manage their crop with only about one-third as much water issue as normally expected.

To everyone's surprise and satisfaction, the crop results were excellent, with average to better-than-average rice yields over practically the whole of the Left Bank, harvesting 85 to 95 bushels per acre, according to Agriculture Department records. Meticulous management of this reduced amount of water had given tremendously high productivity of water, though this achievement would have been less surprising if farmers and officials had known at that time about the System of Rice Intensification (SRI) that was developed in Madagascar in the 1980s and is being evaluated now in a growing number of countries. It raises rice yields with about half the water.

From SRI, we are learning that rice is not an aquatic plant as commonly thought (DeDatta, 1987: 43, 297-298). Consequently, yields can be higher when rice is grown in moist but unsaturated soil, rather than in continuously flooded fields, as has been the dominant practice for millennia (Uphoff, 1999; Stoop et. al., 2002; Uphoff, 2002). The fact that farmers did not have as much water as usual to cultivate their rice thus probably worked to their advantage.
However, this was not known at the time (and farmers did not use the other SRI agronomic practices that can give higher yields when fields are not kept flooded; Rabenandrasana, 1999). Farmers thought that by sharing their limited water supply equally and making minimal water allocations per acre they were taking a big gamble. In any case, the efficiency with which Left Bank farmer organizations distributed water in this crisis situation was remarkable.

In some ways even more remarkable was their commitment to equity. It is rare to find such determination to distribute water equally among head-end, middle and tail-end farmers. Farmers' decision and their implementation of it is even more remarkable when we consider that the Gal Oya Left Bank was divided upstream from downstream along ethnic lines. Most of the farmers in the head and middle reaches are Sinhalese, while almost all those in the tail areas are Tamil.

I need not remind readers of the two decades of violence that has occurred along this ethnic division (though those involved have been a minority in both groups; see Uphoff, 2001).

The Sinhalese majority could have monopolized the season's water simply because it had locational advantage. This could have been legitimated by pointing to the recommendation of the Irrigation Department that justified using all of the scarce water at the head, claiming that this would be increase efficiency by reducing seepage and conveyance losses.

Yet all Left Bank farmers committed themselves through their farmer organizations to an equal sharing of water as an act of solidarity. This was at a time when armed conflict was ongoing between the LTTE guerillas seeking a separate Tamil state and the government's armed forces resisting this claim, with often gruesome non-combatant losses on both sides.

The Gal Oya Left Bank farmers had, however, maintained since the farmer organization effort began in 1981 that ethnic differences and divisions should have no place in their agriculture and community life. In 1997, they put this conviction to a demanding test by agreeing to share scarce water equally among all farmers depending on the Left Bank irrigation system. That their virtue, as well as their gamble, was rewarded by a good harvest for all is very gratifying.

Of particular relevance for our concerns with farmer management of
irrigation systems is the fact that participatory management capacity remains strong 20 years after organizations were first introduced. When I last visited Gal Oya, in March 2001, the farmer-representatives who met with me insisted that there are now no irrigation problems that they cannot resolve among themselves or with the cooperation of ID engineers. The water management situation in the Left Bank is completely changed from what it was when the organizational effort started.7

Unfortunately, farmers are feeling increasingly squeezed economically as their costs of production have been rising faster than their income from production given the low price for rice. But this is a consequence of government policies and globalization trends, beyond the scope of what participatory irrigation management can accomplish.

Experience from Nepal

One might suggest that such positive, cooperative outcomes from farmer participation in irrigation management reflect the benign social and cultural environment of Sri Lanka, ignoring the high levels of conflict and violence during the 1980s and continuing into the 1990s.8 Others know better than idea the experience with farmer irrigation management in Nepal, but I was involved with Prachanda Pradhan, Upendra Gautam and others in one of the first formal efforts in Nepal to introduce AMIS participatory management.

These efforts were in the Sirsia-Dudhaura irrigation scheme near Birganj as part of the USAID-supported Nepal Irrigation Management Project (NIMP) starting in 1986. The USAID mission in Nepal had been impressed with the accomplishments of our efforts in Sri Lanka and designed a farmer-management component into the NIMP. Our field efforts in Sirsia-Dudhaura began in 1987 and my involvement continued

7 In 1988, based upon positive evaluations of the changes achieved in Gal Oya and some other systems where participatory management had been introduced, the Sri Lankan cabinet made such management national policy. There are now about 250,000 farmers participating in water user association within major irrigation systems operating under the aegis of the Irrigation Department, and about that many within Mahaweli Authority irrigation schemes (Brewer 1994). Some of these organizations may not operate as effectively as those in Gal Oya because there was less investment of resources and personnel in establishing organizational 'software' elsewhere.

8 Over 60,000 persons have died in the violence engendered by the claims of secessionists for the creation of a separate Tamil state; and another 50,000 lost their lives in the insurrection launched by the Janatha Vimukhti Peramuna (JVP) in 1983 and not suppressed until 1989 (see Gunaratna, 2000).
through 1990, when the project was reorganized and the involvement of Cornell was terminated because of dissatisfaction with the prime contractor. (We were working on participatory irrigation management under a sub-contract to a consulting firm.)

As explained above, the choice of Gal Oya within Sri Lanka required us to work in one of the most difficult irrigation schemes in that country; Sirsia-Dudhaura was a similar choice in Nepal. This system was hydrologically very complex, with two different main sources of water supply, the Sirsia and Dudhaura rivers, with two separate main canals, which had overlapping command areas, so that some parts of the system had two different sources of supply.

More important, and making for more difficulties, was the social, economic and political situation since Sirsia-Dudhaura is, literally, a stone’s throw from the Indian State of Bihar.

It has the same kind of stratification and domination of social caste and economic class that have made Bihar one of the most notorious parts of the Indian subcontinent for inequality, conflict and exploitation. We were told when we first visited to acquaint ourselves with the field situation that dacoits were able to move at will in the area from sundown to sun-up, so that Irrigation Department and other government personnel simply surrendered the area to outlaw control and lawlessness for much of the time. Farmers had to find ways to survive within the constraints of unequal land tenure, great disparities in political and economic power, and heavy social restrictions. Only a few could think of prospering.

Into this situation, we fielded trained social organizers, following the examples (precedents) of institutional organizers in Sri Lanka, and community organizers in the Philippines, as well as group organizers in the Small Farmer Development Program (SFDP) in Nepal operated by the Agricultural Development Bank of Nepal (Rahman, 1984). They were somewhat better educated than the fieldworkers used in these other programs, but were able to establish rapport quite well. Within three months, we were seeing similar examples of cooperation and altruistic action that had been seen in Gal Oya within six weeks. Unfortunately, we did not find the kind of leadership and vision within the Irrigation Department at system and higher levels that helped accelerate and institutionalize our Gal Oya efforts. But within the communities, we found farmers playing similar roles as in Gal Oya and helping transform the operation and maintenance of the system.
We found other examples of farmer-management that could give encouragement and inspiration to Sirsia-Dudhaura water users, beyond the remarkable case of Chhatis Mauja. The Pithuwa irrigation system, documented by Laitos et al., 1986, gave Sirsia-Dudhaura farmers a very good example of how the assumption of responsibility, and willingness to commit farmer resources to system O&M, could greatly benefit all concerned. Given the impatience of the donor agency, human and financial resources as well as attention were redeployed to other systems, and the Sirsia-Dudhaura effort could not be consolidated as anticipated.

Anyone concerned with farmer-managed irrigation improvements, researchers as well as officials and practitioners, should seek a generic appreciation of what is required for effective participatory management. This requires thinking through an appropriate set of complementary roles and responsibilities between farmers and government agencies. Roles and responsibilities of water user organizations are the most important elements in this, and governments are often unwilling to accept either a very large role or independent responsibilities. But experience has shown that this kind of 'investment' has high returns if better system performance is the goal.

**TAKING THE 'SOFTER' SIDE OF 'SOFTWARE' SERIOUSLY**

It is widely understood that a first requirement for better management is the creation -- or strengthening, where they exist but are not fully effective -- of water user associations of some kind, formal or informal, large or small, voluntary or compulsory. Without such organizational structures in place, the transaction costs of cooperation to manage water through the decisions and actions of hundreds, even thousands, of water users are overwhelming.

Such associations are often referred to as the "software" of irrigation management, necessary to make effective the "hardware" of dams, weirs, pumps, canals, gates and other physical mechanisms for water acquisition, distribution and control. In AMIS, the administrative "software" of an irrigation bureaucracy can perform many of the activities needed for decision-making and implementation. But because the success of irrigation efforts depends ultimately on farm-level water use, it is hard to get both effectiveness and efficiency, let alone equity, from operation and maintenance handled solely by government officials and employees.
An Analytical Framework for Understanding Organization

What is needed is organization in its generic sense, those basic functions which distinguish situations that are "organized" from those that are "unorganized." Previous efforts to understand irrigation management generically, and particularly the farmer participation aspects of it (Uphoff, 1986), have led us to conclude that there are four basic functions to be performed by any organizations, bureaucratic or participatory, that seek to manage the physical structures that in turn manage irrigation water. These four sets of activities, or functions, are:

- **Decision-making**, including planning,
- **Resource mobilization and management**,
- **Communication and coordination**, and
- **Conflict resolution**, to the extent needed.\(^9\)

The management of any irrigation system requires that these four functions, or sets of activities, be regularly performed, (a) either formally or informally, and (b) at all levels, from the field channel level to the main system level. For carrying out these activities, there are likely to be:

- **Roles**,
- **Rules**,
- **Precedents**, and
- **Procedures**, that make organizational activities more effective.\(^10\)

The four sets of activities -- decision-making, resource mobilization, etc.-- are essential for the:

- **Design**,  
- **Construction** or implementation,  
- **Operation**, and  
- **Maintenance** of the physical and social structures which in turn create or control the  
- **Acquisition**, by design, construction, operation and maintenance

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\(^9\) See Uphoff (1986: 37-53, also 165-167). These four sets of activities, which are very concrete and specific, parallel the four functions that Parsons (1951) identified in more abstract terms as essential for all social systems: goal attainment, adaptation, integration, and pattern maintenance.

\(^10\) This formulation gives equal weight to roles, which I have stressed in my analysis of irrigation management, and rules, emphasized by my colleague Elinor Ostrom (1990).
of structures,
− Allocation, by design, implementation, operation and maintenance of rights,
− Distribution, by design, construction, operation and maintenance of canals, and
− Drainage of water, by design, construction, operation and maintenance of facilities.11

Contrasting Structural Analysis with Alternative Approaches

Whether one gives more emphasis to roles or to rules when seeking to analyze, evaluate or promote irrigation management, these are essentially structural aspects of organization -- or of social capital if one thinks in these terms (Uphoff, 2000). These encompass aspects of social relationships that structure interactions, making behavior more predictable and stable over time. This can happen because people in roles conform to the expectations (theirs and others') about how persons in that role should perform, or because rules are accepted as binding on people with sanctions employed if they are not followed. Precedents and procedures also structure behavior by expectations of how people should and will act and by creating repertoires for behavior.

With this set of factors creating patterns for behavior, structural analysis explains what persons will do in terms of individual calculations of what are their incentives -- the relative magnitudes of benefits vis-à-vis costs from different decisions and courses of action. These can operate independently of roles, rules, precedents and procedures, but will be more effective when considered in conjunction with roles, rules, etc.

While incentives are not, strictly speaking, structural, being a consequence of people's desires, perceptions and evaluations of alternatives, they fit into this category because when trying to create and maintain organizations, incentives are planned and manipulated so as to get behavior that is desired (from the viewpoint of those persons doing the designing and managing) and to make it predictable.

Moreover, the standard approach, focusing on the calculation of individual self-interest, ignores the influences on decision-making and behavior that

11 See Uphoff (1986), Chapter 3, for a more complete presentation of this analysis which integrates most of the irrigation activities discussed in the literature into a single framework.
come from more collective considerations, such as costs and benefits for the community, and even for the larger society. What weight if any will be given to considerations like improved water and land productivity in the aggregate?

This benefit may not be a strong consideration if it must be achieved the expense of individual costs. But if it can be achieved in ways compatible with individual benefit, where there are no or few tradeoffs, such collective benefits can become additional factors that motivate cooperation and collective action. These considerations take us into the realm of thinking and valuation, not just responding to incentives that are provided by the structure of the situation that people find themselves in.

Within social science, "structural" approaches are ones that seek to explain, predict or manipulate behavior for average or typical persons, by designing roles, rules, precedents and procedures that pattern behavior in certain ways. There is little or no consideration given to individuality or individual differences. What is of most interest is general or "normal" performance; there is no interest in what specific persons would do. The people in structural analysis are abstractions, not individuals (Uphoff, 1996: 330-336).

Converse approaches can be variously described as behavioral, cognitive or normative. They are concerned with the perceptions, interests and capabilities of individuals, not as abstractions in the way that structural analysis treats them, but as thinking, feeling, caring persons with different values, needs, energy levels, networks of affinity, aspiration, etc. (Uphoff, 1996: 336-352). While incentives are considered important, there is a recognition that real people value a great many different things. Their interests are not simply or usefully subsumable under the broad heading of "self-interest." What motivates people is not just material rewards but also family and group connections, self-respect, religion and culture, and a host of other considerations.

In particular, I could see in our program in Gal Oya (and to a lesser extent in Sirsia-Dudhaura, where I spent less time and got less personally involved) that understanding what brought about changed behavior among farmers for more participatory (and more equitable) irrigation management required consideration of more factors than those dealt with in terms of structural analysis. There were important cognitive and normative elements in the process of changing thinking and actions regarding water allocation and distribution that could not be adequately
accounted for in terms of roles, rules, precedents and procedures. These are real but instrumental, unemotional elements of organization that apply to everyone and have no special connection to people as individuals, as unique personalities. This becomes particularly important, for example, when engaging in system "turnover" to farmer management, looking only at visible structures and not at the human resources and networks that animate and control these.

This is a difficult subject to discuss because we have not developed social-scientific language and concepts that address "idiosyncratic" and "subjective" factors in rigorous, commonly-agreed terms. A good demonstration of this is the concept and phenomenon of friendship, a very critical factor in successful irrigation management. In fact, the most systematic analysis of friendship was done over 2,000 years ago by the Greek philosopher Aristotle in The Nichomachean Ethics. It has been ignored largely because it is idiosyncratic and subjective, even though it is a universal phenomenon.

**Considering Friendship as a Factor in Irrigation Management**

In contemporary social science, friendship is considered traditional, even somewhat atavistic and thus unmodern, being classified as "particularistic" in the theorizing of Talcott Parsons. I would like to propose, however, that we cannot understand and improve irrigation management without an appreciation of the contribution of friendship to social organization. It is a factor that remains exogenous to structural analysis.

Friendship can be operationalized as a rigorous concept in social science terms by using the economics concept of utility functions. Economists assume that people's motivations, decisions and actions can be understood and explained in terms of their trying to achieve things that they think have utility, and are thus desirable, and by avoiding things with disutility, i.e., undesirable.

The things that motivate people can be aggregated and represented in terms of a utility function, a set of things that are desired (being utilities, with positive signs) or disliked (disutilities, with negative signs). People, as rational actors, are said to seek to maximize their respective utility

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12 This is related to the concept and phenomenon of trust, which has received in recent years somewhat more systematic consideration thanks to the growing interest in social capital, e.g., Fukayama (1995).
functions, composed of things that they wish to have because of positive satisfactions (or to avoid because of negative assessments): \( U = (f) A, B, C, -D, -E, -F, \ldots, n \), meaning utility (U) is a function \((f)\) of more A, B and C and less D, E and F, etc.

Most economic analysis assumes, for the sake of simplicity, that people have independent utility functions, i.e., each person seeks to maximize his or her own net utility, irrespective of others' welfare. The justification for current economic thinking, derived from the classical economic analysis of Adam Smith, is that total aggregate well-being will be maximized by allowing (encouraging) each person to maximize her or his own respective welfare (represented by his or her own utility function), not trying to enhance that of others. Each person should use his or her own resources to achieve as much well-being as possible, implying that everyone is deciding, acting and evaluating essentially in isolation from others.

This concept of reality and human nature regards people essentially as strangers. It reflects a basically Hobbesian view of the society as characteristically "a war of all against all." In fact, many irrigation schemes in this world are some of the best arguments for the validity of Thomas Hobbes' thesis. Certainly this is how the Gal Oya irrigation scheme in Sri Lanka was viewed before the organizing effort began in 1981. Recall the remark, reported above, of the Ampare district official made to the young organizers as they were about to begin their work, cited above. He thought they would be lucky to get even 10 or 15 farmers to work together.

Yet the organizers managed to get a thousand times that many farmers participating in problem-solving organizations that have lasted now for two decades. After one year of organizing effort, one farmer-representative told me, "There used to be lots of fights among farmers here over water, even murders. You can check the records of the police if you don't believe me. Now there are no more." (Uphoff, 1996: 10). In March 2001, when I visited Gal Oya and talked with several dozen farmer-representatives, all agreed that conflict and inequality in water distribution are things of the past. The language that farmers used in referring to each other and even to their relationship with officials was that of friendship, something unheard when we became acquainted with that system more than 20 years earlier.

**Raising System Productivity through Reoriented Social Relationships**
Indicators of the increased effectiveness, efficiency and equity of water management in Gal Oya were reported above. To me, as a social scientist, what is more impressive is how thousands of farmers living in "a war of all against all" could join together in cooperative, even altruistic endeavors, especially in such a short period of time. We do not have similar statistics to cite from Sirsia-Dudhaura, but farmers there reported similar improvements in channel cleaning and water distribution within about three months of the start of efforts to establish organizational capacities.

How such changes could be introduced and maintained is one of the most interesting challenges for applied social science. I think this experience also pushes us to think more deeply and revise some "basic" understandings of social science, the preference for structural analysis to the neglect of other modalities. This is not to reject structural approaches. They are the bedrock of social science and are important for explaining "what is." They are, however, less useful, I now believe, for understanding and creating "what could be."

This is a both-and world where taking one perspective to the exclusion of the other is almost always going to be suboptimal. So the following argument is not a rejection of structural analysis but rather the presentation of an alternative, not really antithetical, perspective. I believe that taking idiosyncratic and subjective factors into account in a serious, systematic way can expand upon and improve our present social science approaches to irrigation management, and indeed, to most social subjects that we try to explain, i.e., develop theory for.

**Using the Concept of Utility Function**

While much of human behavior can be accounted for in terms of independent utility functions, when it comes to irrigation management, I want to suggest the importance of having -- or fostering -- positively interdependent utility functions. This means that individuals are including in their definition of their own welfare also, to some extent, others' welfare. This is, indeed, a good technical definition of friendship -- that people value each others' well-being, and are willing to make some sacrifices for each other because they consider others' benefits as a fulfillment of their own desires. (The technical definition of an enemy would be the converse, negatively interdependent utility functions, where any improvement for one's enemy detracts from one's own sense or reality of well-being.)
Friendship is a matter of degree, not simply of kind, so that there are friendships where people are willing to incur large costs for others' sake, while other friendships are moderate, having definite circumscription of the costs that would be borne for others' benefit. Such calculations are of course synchronic, at a particular point in time. Over time, we know that where people are willing to help, support and protect each other, the net benefits for both are usually greater than in the absence of such cooperation.

This willingness to benefit each other can be prompted by a social norm of reciprocity, by pragmatic calculations of net utility, by affective bonds of love, empathy and mutual regard, or by some combination of these. Where there are net benefits for both friends, or a credible expectation of net benefits in the future, the sense of obligation that espoused friendship entails and the emotional attachments which represent the most exalted but ethereal aspects of friendship will be reinforced by individual payoffs, present and/or future.

**Dealing with a Variety of Motivations**

Reductionist social scientists try, literally, to reduce friendship just to the latter -- individual benefits. But this is a simplistic and largely barren way to understand friendship. Benefits are clearly important, but they are more a result than an entire cause. I say this because from my discussions with farmers in Gal Oya, when I tried to account for the transformation in social relations that had taken place -- not just between and among farmers but also with officials and engineers -- I was struck by how often farmers talked about the cognitive and normative dimensions of what had occurred.

Farmers would say that they now cooperated in regimes of water allocation and water saving because previously they had not thought about the consequences of their actions (water stealing, structure breaking, or simply water waste) on others, whom they now knew through their associations. Upstream farmers had felt no bond with downstream farmers, which they now had. It was most intensive with farmers who got water from the same field channel and who formed the field-channel group, the organizational 'building block' for a larger system of farmer organization. But through their representatives, they became aware of the larger number of farmers who were interdependent on a single, limited source of water. This included for Sinhalese farmers in the upper reaches, taking account
of Tamil farmers downstream. If thought about before, these others were abstractions. Through the system of farmer organization, these were now real persons, with personalities, with families, with legitimate needs.

Now it helped the organizing process immensely that through cooperation, this scarce resource of water could be, in effect, increased, so that water distribution became positive-sum rather than zero-sum (or negative-sum when structures were broken and seepage and conveyance losses were increased). The remedial actions planned and implemented by field-channel groups to solve their own water shortage problems aggregated to large water savings, ultimately to roughly a doubling in water-use efficiency.\(^{13}\)

The unspoken rule of thumb in improving irrigation management in Gal Oya and Sirsia-Dudhaura was "Pareto optimality," where in terms of water distribution, no farmers who had previously received water should be made worse off, i.e., deprived of the minimum of water needed to grow a crop. Farmers in privileged locations were expected to agree to redistribution of all water above this minimum with the assurance that if the minimum proved to be inadequate, some supplemental issues would be made. Farmers in less advantaged geographic positions were willing to make such an accommodation because they were now getting more water than before.

Thus, one might say that there were no costs to such a system. But in fact, there were: the labor and time required to clean channels and maintain structures and to operate an equitable, efficient system of distribution. Why should farmers at the head-end who had been getting a surfeit of water (and wasting that which flowed through their fields into drainage canals) cooperate in planning meetings, channel cleaning, etc. when with their locational advantage they could get sufficient water by doing nothing?

I once asked this question of a group of organizers. One answered: "It's hard to be selfish in public." By catalyzing field-channel groups, there was now a public space in which farmers were expected to meet regularly. In

\(^{13}\) Cleaning channels speeded up water flow and reduced seepage and evaporation losses; rotating water deliveries among fields rather than supply small amounts continuously to all fields did the same; monitoring deliveries to cut them off to fields and to channels as soon as the minimum water requirement had been met redistributed water from areas that had previously gotten a surplus to areas where even small amounts of water would have high agricultural productivity payoff (Wijayaratna, 1986).
such situations, consensus on efforts to remedy the problems of those in need was usually very quickly reached. Why did head-end farmers participate? one might ask. From my discussions in the field, I think because of the multi-stranded relationships that farmers had even in a settlement scheme, where for the previous 20-30 years, there had been no evident social cohesion and an abundance of conflict and strife.

Farmers who wasted water were evidently engaging in "anti-social" behavior, felt keenly by those affected by it. Their wives were likely to be regarded less favorably by other women in the community. Possibly their children would be less welcome in the groups that kids form. If a water buffalo happened to break into their rice fields, the most attractive ones in the area, neighbors were unlikely to come tell the privileged farmer or to chase the beast out themselves.

In a situation where there was what Sinhalese call \textit{ekamutakama}, a spirit of unity or oneness, this would be very different: all women would feel more solidarity, as would children, and fields would be more secure. The extra effort by head-end farmers to participate in an efficient and equitable scheme of water distribution was compensated by kinds of security and satisfaction that only show up in very inclusive utility functions, not just yield and income as credits and time and money spent as debits.

But from discussions with farmers, there seemed to be still more than this (still utilitarian) set of considerations motivating their new-found spirit of cooperation. There was a sense of solidarity and an appreciation of the \textit{ekamutakama} which now animated their communities, providing many psychic as well as material benefits.

Channel cleaning in Gal Oya and Sirsia-Dudhaura was done usually by \textit{shramadana}, an ancient tradition common in most of South Asia where people engage in voluntary community service such as irrigation improvement, road repair, temple maintenance, etc. This is thought to confer merit on participants in Buddhist and Hindu traditions, but this benefit is much deferred and rather intangible. \textit{Shramadana} occasions are usually enjoyable social events, despite the hard work done. There are refreshments partaken and a spirit of camaraderie as everyone engages in the labor. (Actually, this is an idealization, since often the richer members of a community "participate" by providing funds for the refreshments.)

I mention this because we found that \textit{shramadana} was important not just for the greater efficiency and predictability in water distribution it enabled,
but for the canalization of community solidarity. This was reinforced by meetings, committee work, delegations, etc. where farmers got to know each other, initially and then better. Especially traveling together to other places was important for building solidarity, since it heightened a sense of common identity and interdependence.\textsuperscript{14}

**INTEGRATING STRUCTURAL AND OTHER KINDS OF ANALYSIS**

The farmer organizations introduced in Gal Oya and Sirsia-Dudhaura could be analyzed from a structural perspective. They introduced *roles*, particularly that of farmer-representative, which were essential for facilitating (lowering the transaction costs of) decision-making, resource mobilization, communication and coordination, and conflict resolution. There were also a variety of *rules* that were formulated by the farmers themselves once the group process was underway.

For example, to prevent the associations from becoming politicized and used for partisan purposes, it was agreed that any farmer chosen to fill an irrigation management role should resign any positions he or she held in local party organizations. There were also rules about membership eligibility and responsibilities. *Precedents* were set for work obligations, reaching consensus, resolving conflicts, etc., and various *procedures* for collecting and accounting for funds, for informing farmers about any changes in the water distribution schedule, etc.

There were thus established a set of socially-constructed relationships -- obligations, expectations, sanctions, etc. -- that enabled farmers to engage in collective action to improve their irrigation management. Most of these were informal, at least in the initial period, when farmers were trying to determine what would be the most effective and least-cost ways to make improvements.

One of our program's hypotheses was that we would be more successful by initiating the program on an informal basis rather than start by forming an organization -- approving a constitution, electing officers, etc. Our motto was 'work first, organize second,' meaning organize *formally* only

\textsuperscript{14} This was important not just for farmers. The USAID project in Sri Lanka provided funds for groups of central government officials, members of parliament, and irrigation engineers to visit the Philippines, to observe the NIA program which was more advanced than ours in terms of participatory management. The personal relationships cemented during such tours were probably more important for the progress of our program than the knowledge that was gained.
after people have demonstrated for themselves the value of working together. This creates a 'demand' for organization instead of starting off by providing a 'supply' of organization (see Uphoff, 1985, for this and other program 'hypotheses').

This dynamic was reinforced by another hypothesis, that we should start the organization process at the field channel level, where there would be 10-20 farmers all getting their water from the same source. These field-channel groups became the 'building blocks' for the system of organization. Their small size made friendship and caring about others more feasible as people met and interacted with each other frequently in day-to-day activities.

This approach was basically structural, and I would make no criticisms of or apologies for this. It was fundamental for creating capacities for mutually-beneficial collective action. At the same time, it was not, as I reflect on our experience, sufficient for success, as this was not by itself motivating. There were many material, indeed individual benefits that could be produced by such cooperation. But overcoming the previous selfishness, indifference, suspicion, even antagonism required more than just opportunities. There had to be elements of trust and solidarity to get the process going and to sustain it.

The young organizers who were deployed into the villages in Sri Lanka and Nepal to catalyze these processes of change were not trained to be "change agents" in the conventional sense. We did not expect to change the farmers in these communities so much as to give them new opportunities and to evoke from within these communities existing potentials for cooperation and innovation. This was why we used the word 'catalysts' to describe the organizers, rather than the common term 'change agents.'

There were two particular values that animated our program, and the organizers who represented it in the field, in addition to the obvious value of efficiency that the USAID project emphasized: participation and equity. These were values that the organizers, having a lot of youthful idealism, could feel strongly about. There were farmers in each community, not always a large number to begin, who shared these values, even if they had not been able to give any public expression to them in the past, when the prevailing social scene was better described as anarchic than cooperative.

Probably many of the farmers, even a large majority of those who came
forward to work with the organizers, were motivated by desires to improve the efficiency and productivity of water management for their own families' benefit. But those who moved into leadership positions and who set the semantic and moral tenor of discussions were persons who had a greater sense of idealism and community spirit than the average farmer. They were willing to invest their own time and money in getting the organization process moving. They took the lead during the first phase when everything was done informally, organizing work parties, leading delegations to the Irrigation Department, keeping records, etc. They were the obvious and natural choices to assume formal leadership roles when these were established by consensus after some months.

What was interesting to watch was how these more altruistic farmers set the tone for an organization which was more other-regarding than if we had approached the organization process purely on the basis of incentives, emphasizing what was 'in it' for each individual. Even more interesting was to watch how persons who had been farmer-leaders in the community before had to adopt more community-centered approaches and rhetoric to maintain their leadership status. (Some examples are given in Uphoff, 1996: e.g., 80-85).

In irrigation management, it is fortunate that there are material payoffs from idealistically framed cooperation. By increasing the effective supply of water, by reducing seepage and conveyance losses, the expressions of empathy for tail-end farmers given expression through better O&M had the effect of 'increasing the pie.' In such an environment, the criterion of Pareto optimality led to a conflict-reducing situation, feasible because the 'pie' was now bigger.15

The situation in Sirsia-Dudhaura was not that encouraging today: The cultural and economic conditions were less favorable for these values in that part of Nepal, effectively an extension of the caste and class system of Bihar, and we had less time to work with farmers to reinforce these values. However, we can see in Gal Oya that 20 years after participatory irrigation management was introduced, there is an indigenized and institutionalized commitment to equity and participation.

15 There were also non-material payoffs, such as the often-cited benefit that with a reliable and equitable distribution scheme, "We can now sleep at night." Farmers no longer had to stay up all night in their fields during their channel's turn for water issues, guarding the trickle of water allocated to them, and maybe encroaching on their neighbors' supply. There were many reasons why they would rather be back home in bed.
This commitment is not perfect or total, and the advantages of political and economic power as well as geographic locational advantages surely influence outcomes. But I would argue, the norms of equity and participation are stronger and more operative -- with concomitant outcomes of efficiency and productivity -- than if we had proceeded purely with structural thinking and with an emphasis on individual, material incentives as is common in the social science literature.

My suggestion is that we engage in the best possible structural social science analysis and practice but regard this as just one part of the task. Beyond structural approaches, if we want improved irrigation management in either AMIS or FMIS that is equitable and sustainable, as well as efficient and productive, we should think and act in terms of the cognitive and normative dimensions of social structures.

Norms, values, attitudes and beliefs that are inside people's heads (and hearts?) are not just reflections of individual, material interests. They are shaped by people's culture and religion as well as by their personal experiences and convictions. These are influenced by family and community interactions to produce unique individuals with a sense of self-interest but also of fairness, legitimacy, justice, and solidarity.

**CONCLUDING THOUGHTS**

A fuller appreciation of this broader set of factors that motivate and reward people would require another paper, or several. I have discussed these issues analytically in Chapters 12 and 13 of *Learning from Gal Oya* (1996), exploring the contributions of ideas and ideals as well as of friendship to the establishment of sustainable capacities for mutually-beneficial collective action, which are essential for long-term improved management of irrigation systems.

A desire for rigorous and parsimonious analyses can reduce the relevance and realism of our conclusions. This paper is not disputing the existence and importance of incentives and 'rational choice' but rather questioning their adequacy for understanding and improving irrigation performance. The 'soft' side of 'software' -- values, norms, attitudes and beliefs -- may be less tangible than are the material interests and resources that we see in individual incentives and physical payoffs. But its consequences can be very real and concrete.
Indeed, the significance of these 'softer' aspects of management decisions and activities is enhanced by their softness, in that they are not subject to the same limits of physical scarcity that material factors are. If people decide to become and act as friends, including others' welfare within their own utility functions, this subjective act is just a matter of choice. It will have some material consequences, and certainly some costs. But it can also produce multiple benefits, magnified because a benefit for any one among friends produces satisfactions for all of them.

The world will not be freed from the reality of many zero-sum constraints, where tradeoffs are unavoidable, and one person's gain represents another person's loss. This is part of the human condition. But it is not the entirety of the human condition.

The irrigation sector is probably unique among domains of human activity in that it holds out many possibilities for escaping the limits of zero-sum relationships. Unfortunately, when we view it through the zero-sum assumptions of neoclassical economics and rational-choice theory, we cannot see these possibilities. This is why I think we need to expand our social science horizons to give equal footing or billing to these 'softer' factors which can produce many 'hard' and very desirable results.16

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16 This has also been elaborated in Uphoff (2000a).
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INTRODUCTION

Much of the irrigation research emphasis for the past few decades has focused on technical, management, and governance issues related to operation and maintenance of irrigation systems. Less emphasis has been placed upon the agricultural production outcome that motivates Nepal’s farmers to invest their labor and cash to access and control water for their fields. For many farmers in Nepal’s remote areas, the most evident change they face is a growing population and its impact on their community’s limited forest, land, and water resources. Close to cities and for fields near the ever-increasing network of rural roads, however, urbanization and the global economy compete for land and labor that have long supported household food production. This paper briefly examines the origins and characteristics that distinguish Farmer Managed Irrigation Systems (FMIS) in Nepal. It then examines the impact and choices farmers with access to irrigation may have as their landholdings shrink and they face new circumstances.

SUBSISTENCE AGRICULTURE AND IRRIGATION

Nepal’s irrigated agriculture system appears static when viewed from only a few decades of observation. A bit longer time-slice, however, suggests dramatic change over the past two centuries. Myths of the Gurung hill tribe in central Nepal suggest that only a few hundred years ago they were shepherds who practiced limited cultivation by shifting fields each year (Hodgson, undated). Horses are mentioned, but never plough animals. As cereal crops became more important to them, they moved lower into the valleys and in the past 150 years began growing rice. Valley bottoms that could sustain multiple crops were malaria infested and settled only after the hilltops could no longer support the growing population. Land scarcity became a serious problem in the last half century. Population growth turned an expansive economy, where resources of land, fodder, timber, grazing, and wildlife were abundant, into a labor-abundant economy where

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natural resources limit growth.

While most hill slopes in Nepal remain dependent on rainfall for crop production, springs, streams and rivers have been diverted on a massive scale to supplement rainfall for more reliable agriculture production. The story told by a farmer in Chherlung of Palpa District may represent many communities in Nepal that built irrigation systems in the past 100 years. Chherlung is in a favorable location with several areas of gently sloping, fertile fields and a mild climate. However, by the 1920s the community could no longer grow enough rainfed crops to supply subsistence food needs. Most households sent members to work in India to supplement their income. Migration to the Terai or other less populated locations was a possibility but malaria posed a serious threat in the Terai and less populated locations in the hills also had fewer resources. Some concluded that building an irrigation system provided the best alternative for increasing food production in Chherlung. Growing more subsistence food was the driving force that enabled a group of 27 households to mobilize cash and labor to construct a long and difficult canal.

Without financial assistance from outside the community, the Chherlung farmers contributed their own labor to complete a small canal. They hired local experts in canal building to survey the alignment and construct the channel through difficult sections. They reportedly sold jewelry and some land to pay for this assistance. When a small trickle of water was successfully delivered after four years of work it confirmed the alignment and proved to skeptics in the community that irrigation was possible.

CONSTRUCTION AND OWNERSHIP OF FMIS

While many FMIS were built by community groups and may mirror the experience of the Chherlung community, other hill irrigation systems in Nepal are hundreds of years old and little is known about their initial design and construction. The Raj Kulo in Palpa District\(^2\), for example, is said to have been constructed under the authority of Mani Makunda Sen, the first Sen Rajah of Tansen, which makes it over 300 years old. Likely, holders of birta land originally constructed many of the irrigation systems.\(^3\)

\(^2\) There are a number of Raj Kulos in Nepal. The Raj Kulo referred to in this paper is in the village of Argali of western Palpa District.

\(^3\) Land could be given by the state as birta to individuals in appreciation of their services. The birta grants made to individuals were usually on an inheritable and tax-exempt basis. The recipients included priests, religious teachers, soldiers, members of the nobility and the royal family (Regmi, 1978).
Birta-holders were entitled to share the production of peasants who farmed the land, and they were granted the authority to exact unpaid or corvee labor from these tenants for various purposes, including the construction of irrigation canals (Regmi, 1972). The birta-holder could mobilize the labor needed for construction and secure the rights-of-way for the canal.

In 1959, the birta system was abolished and all the birta lands were converted into raikar landholdings by granting permanent rights to tenants who had records to show that they cultivated the land (ADB/HMGN, 1982). There is evidence from the operation and maintenance rules of irrigation systems that ownership of the system is understood by farmers to be vested with the persons entitled to use water from the system. When tenants with land irrigated by the Raj Kulo system became landowners, they changed some of the operating procedures for the Raj Kulo. Instead of using the money collected from fines throughout the year for a feast at the end of the season, they began systematic investment in upgrading the irrigation system.

The national government was also sometimes involved in developing irrigation systems in the 18th and 19th centuries (Regmi, 1984). This was a period when increased agricultural production was needed to support a large standing army following the expansion and consolidation of a unified Nepal. There is little information about the ownership of these systems. However, in a law on reclamation of wasteland it is clear that the government recognized the efforts that farmers had made in developing irrigation systems. The law declares: "Water shall not be available for others until the requirements of the person who constructed the irrigation channel at his own expense with his own physical labor are first met" (Regmi, 1963).

CRAFTING FMIS INSTITUTIONS

Groups of farmers, if by dictate of a birta owner or on their own initiative as in Chherlung, recognized the value of irrigation and worked together to construct irrigation systems. By pooling their resources they accomplished much more than was possible by the labor of individual families. Though construction was often fraught with conflict, the incentive of reliable and increased food production motivated development of creative ways to

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4 Both by law and tradition, land was the property of the state. As both sovereign and landowner, the state was entitled to the payment of a part of the produce of the land as tax or rent. This system of state land ownership is called raikar.
manage differences. The need to move ahead with construction in ways acceptable to all participants forces farmers to find ways to make collective decisions. They adapted the process of institution building to their socio-cultural experience in the same way that the structures built were tailored to fit the physical environment.

In the process of carrying out the construction of their irrigation system, Chherlung farmers discovered that they needed a leader with skills in organizing the work, a leader they all trusted to distribute the workload fairly and to keep records of each household's contribution. They found that they needed to hold frequent planning meetings where they could discuss and eventually agree on the details of the different tasks that needed to be done and determine who among them was best able to do the job. Because of the enormous amount of work to be done, they required cooperation from all members. They learned by experience that a working agreement was necessary before proceeding with an activity or else some members would not cooperate. Disagreements and misunderstanding over decisions reached earlier resulted in assigning one person to write a record of the discussion at meetings. Since many of the farmers were illiterate, they initiated the practice of reading the minutes aloud at the end of each meeting before asking those attending to sign. The institutions crafted by the farmers investing in the construction and early period of system operation in Chherlung still endure today, over 70 years later.

FMIS have evolved in many different ways in Nepal. Not all users of FMIS have gone through the process of constructing their own system or even necessarily had much responsibility for making physical improvements. However, in many cases, the construction and ongoing improvement processes provide both the incentive and the experience essential for establishing enduring institutions to govern FMIS enterprises.

**Water Rights**

The right to use water for irrigation is carefully controlled by FMIS irrigators. Although the state views the water resources of the country as a common good, it does recognize that those who worked to develop an irrigation system have the first right to use the water. To protect prior rights, a new intake cannot be established above an existing one if doing so will decrease the amount of water being diverted into an earlier canal (Mulki Ain, 1936).

The right to use water from an existing irrigation system and the amount of
water that a user is entitled to is often fixed and carefully controlled by the
FMIS organization. Persons gain entitlement to irrigation water by
participating in the construction of a system or by buying or inheriting land
that has been allocated the right to use water. In a few areas the entitlement
is not tied to a specific parcel of land but is viewed as property that can be
exchanged (Martin and Yoder, 1998). In both cases all the persons who
cultivate land irrigated by the same canal are members of the organization
that operates the irrigation system. The organization records the allocation
of entitlements to water (the percent of the total irrigation supply for which
each member has entitlement) and attempts to operate the irrigation system
to deliver the water according to the allocation.

*Rice Terraces*

To grow flooded rice, fields must be leveled and bunds built to pond
water. Tremendous labor has gone into reshaping hillslopes into bunded
terraces. An individual cultivator’s family usually does this work although
a wealthy landowner may hire labor or have it done on contract. In the
past, corvee labor may have been the major input for the construction of
terraces. Terrace building usually does not begin until the irrigation
channel is complete and it is certain that it will operate. Then year-by-year,
in periods when labor is available, the terraces are built. Expansion of
irrigated land continues as long as there is enough water to irrigate or until
all the land available to those who have the right to use the irrigation water
has been converted to terraces.

*SUBSISTANCE AGRICULTURAL PRODUCTION*

Most FMIS in Nepal were constructed to supplement rainfall in the
monsoon season for growing rice. Maize was considered a bari (slopping
usually unirrigated fields) crop. In the Raj Kulo maize was first introduced
as an irrigated crop in the khet (level and bunded fields to pond water for
growing rice) between 1910 and 1920 (Yoder, 1986). Prior to that the khet
fields were used for grazing except in the monsoon rice-growing season.
Wheat was first grown in the Raj Kulo khet fields in about 1960. It was
possible to introduce wheat as a third annual crop only after short season
variety maize became available. Even with shorter season varieties of rice,
wheat, and maize, farmers must minimize the time between harvest of one
crop and planting the next in order to maximize each growing season. By
the late 1970s these three subsistence grain crops were grown in nearly all
of the Raj Kulo khet each year. Most farmers had 300% cropping intensity
in their irrigated fields year after year.
Bottlenecks to Increasing Subsistence Agriculture Production

For Chherlung, the controlled water supply enabled the addition of two irrigated growing seasons. Shifting from one to two or more crops per season has been critical in accommodating the growing population in many communities in Nepal. Increased annual production per unit of land, however, has been offset by the decreasing size of landholdings as family landholdings are divided among sons in each generation.

Land Constraint

In 1982, land holding of irrigated khet in the Raj Kulo, and in many other of Nepal’s FMIS, averaged less than half a hectare per household. With good water control and use of some fertilizer Raj Kulo farmers averaged about 7500 kg/ha annual cereal production (Yoder 1986). The average Raj Kulo family’s half hectare produced sufficient grain for the subsistence needs of about 17 persons. For the average household of six persons this level of production allows the sale of enough grain to purchase seed, fertilizer, and meet other household needs. Already in 1982 about a third of the households farming in the Raj Kulo command area were not able to grow sufficient grain to meet household consumption needs. In one or two generations only a few households will have enough irrigated land to grow all of their own food in the Raj Kulo command area.

Water Shortage

With few exceptions, the large snow-fed rivers are not available to FMIS irrigators. They are cut deeply into the valleys and require longer and more complex canals than can be built and maintained by a few farm families. Farmers use the streams and springs of smaller watersheds for irrigation. Intensification of rainfed agriculture in these watersheds removes the forest cover and increases runoff of rainfall. Less rainfall infiltration reduces the flow of springs and the base flow of the streams diverted for irrigation. Villages and towns use the same springs and streams for their water supply and have higher priority for using the water than irrigators. As the demand for municipal water increases, the supply of fresh water

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5 Subsistence cereal needs for an adult are assumed here to be 220 kg/year. This is based on the National Planning Commission (1978) poverty line income level set at the daily intake of 2256 calories, which requires daily consumption of approximately 0.6 kg of cereal.
available for irrigation near Nepal’s towns and villages will decrease.

**Temperature/Growing Season**

The command area of the Raj Kulo is at about 600 m elevation but many of the fields irrigated in the hills of Nepal are at higher elevations where lower temperatures limit the growing season to two crops. In many hill areas and especially in the Terai, lack of sufficient surface water limits the extent of irrigation in the dry season. The intensive agriculture system of the Raj Kulo, while not unique, is considered close to the upper limit of production for cereal crops under irrigated conditions with the seed quality and fertilizer levels currently used.

**Labor Constraint**

The Chhattis Mauja system near Butwal and the systems of the Kathmandu valley are facing growing labor constraints. Since smaller landholdings do not support full family employment or production levels for subsistence as in the past, many household members have taken day jobs to supplement family income. These jobs require regular working hours that make it difficult to be available to carry out system maintenance as in the past. The Chhattis Mauja system allows members to pay for others to be hired to carry out maintenance. Kathmandu valley has a number of FMIS that are slowly falling into disrepair. Farmers say they can no longer mobilize labor for maintenance because of the high percentage of household members with off-farm employment.

In many communities, young people are leaving agriculture. Fewer of the younger generation have experience with canal maintenance and operation. There is growing concern that leadership as well as labor will soon not be available. Higher income from irrigated agriculture has enabled some farmers to send their sons and daughters to school, which has opened opportunities for higher paying, less demanding jobs outside the community. Unfortunately, few educated persons are choosing the agriculture profession and this contributes to FMIS leadership problems.
Urbanization

Urban sprawl has taken over much of what was productive agriculture land only a few decades ago in the Kathmandu valley and near other urban centers. Population growth and industry compete for the water supply and increase the pollution of water sources used downstream for irrigation.

INCREASING AGRICULTURE PRODUCTION

Three generations ago Chherlung residents faced a food crises that led them to building new irrigation systems. Even with the improvement and expansion of those systems, many households in Chherlung are again facing a situation where their current agriculture system cannot supply their needs. Nearly all the land commanded by Chherlung’s canals has been converted to khet for growing rice and is under intensive annual three-crop cultivation. This situation is repeated in many FMIS in Nepal. To a large extent Chherlung is land constrained. Further improving the system to bring additional water will bring little change in the cropping pattern or the crop production.

The Raj Kulo in Argeli, Palpa is limited by its water supply. It commands land that is currently only irrigated in two seasons while there is potential for three cropping seasons. Water delivery efficiency could bring some additional land under three-season irrigation in water abundant years. However, Raj Kulo farmers will not allow system expansion because they are fully aware that in drought years there is not enough water for all the fields that are currently entitled to water. The watershed above the Raj Kulo is small and fully developed for rainfed agriculture. There is little potential for changing land use in the upper watershed to increase rainfall infiltration, which would increase the discharge of springs in the dry season. The Raj Kulo shares its water supply with the town of Tansen, which pumps most of its municipal water supply from a spring just the Raj Kulo intake diversion. Since municipal supply for drinking has priority over irrigation use, the Raj Kulo faces a decreasing water supply.

Shifting Emphasis to Agriculture Production

For the past few decades there have been programs for improving the water delivery performance of FMIS. Both the Asian Development Bank and the World Bank have sector loan projects that are designed to engage farmers in improving the diversion and canal structures for more efficient
water delivery. In some systems this has increased the water supply delivered in the rainy season for growing rice. In others it has improved reliability of the systems and improved the performance in multiple cropping seasons. In most cases these programs have reduced the maintenance required to repair the diversion, which is greatly appreciated by the farmers. However, the expected expansion in irrigated area and cropping intensity has not been achieved. Fully evaluating existing and negotiating future water rights and better assessment of the available water supply are areas that require more attention from the assistance programs.

While a great deal of attention and assistance funding has been focused on physical improvements and to some extent on the governance and management institutions for improving FMIS, little effort has been made to improve the agriculture systems of FMIS. Agencies responsible to support irrigation and agriculture are under different Ministries and have a poor record of cooperation and coordination. FAO is providing support to the World Bank-funded Nepal Irrigation Sector Project for on-farm water management. This is based on FAO’s Special Program on Food Production in Support of Food Security in Nepal (SPIN). SPIN has shown significant improvements in production that can be achieved by introducing on-farm water management improvements in combination with improved agricultural practices. Much greater investment and better coordination are necessary to promote research-based agricultural practices that will increase production levels of subsistence crops irrigated by FMIS.

**Beyond Subsistence Crop Production**

Recasting FMIS assistance programs to focus first on the agriculture system to ensure that green revolution technology is fully used, as in the SPIN project noted above, is an important step. However, with landholdings shrinking and water supplies increasingly diverted to drinking and municipal use, other measures are required to keep FMIS viable, especially near urban areas. Helping FMIS move beyond subsistence agriculture to access market opportunities should be made a priority. This requires addressing post-harvest handling and storage, processing, transport, and marketing issues. There are examples where individual farmers have discovered ways to move into higher value production but there has been little systematic effort in helping irrigation based producer groups develop strategies and institutions for effective market penetration.
In the Raj Kulo command area one family experimented with vegetable and fruit production in the 1970s. Even when transport required carrying produce 3-4 hr to a market and spending the day at the market to sell the produce, the family demonstrated higher returns than with subsistence crops. When a road was completed to the Raj Kulo command other farmers began experimenting with vegetable production and marketing. There was some success but without organized post-harvest storage, processing and organized marketing, the returns were limited.

Past experiments in trying new crops have not all proven as successful as expected. Coffee produced in Nepal is of high quality but does not have a strong domestic market and faces oversupply in the international market. Apples grown in Nepal are of high quality but due to transportation costs were not initially able to compete with lower quality apples from India in Nepal’s domestic market. Market research and marketing expertise needs to be a part of the program as much as introduction of technology and information for production of new crops.

A significant segment Nepal’s rural population currently searches for work in the cities and abroad. Opening productive, higher value agricultural enterprises could employ some of that labor in their home communities. Nepal has a wide range of climate and soil conditions, and capacity for excellent water control. There is considerable potential for growing higher value crops provided appropriate support structures are put in place. As transportation improves and international markets grow, there will be opportunities for Nepal’s agriculture to fill labor-intensive niche markets. Individual farmers are at a disadvantage to establish such new enterprises. However, already established FMIS groups or new marketing organizations could be established to provide a level of production that can penetrate new markets.
REFERENCES


PART III: TRUST SUPPORTED ACTIVITIES
FORMATION OF NEW FARMER MANAGED IRRIGATION SYSTEMS AND THEIR DYNAMISM

MIN BIKRAM MALLA THAKURI, TEJ PRASAD SUBEDI, AJAY CHANDRA LAL AND RUPA LAMICHHANE

GENERAL BACKGROUND

Agriculture is one of the primary sectors in Nepalese economy. It contributes about 40 percent of the Gross Domestic Product and provides employment to more than 80 percent of work force. The irrigation has been identified as one of the main inputs, which can accelerate, intensify and sustain the agricultural growth. Inadequate provision of irrigation facility has been identified as the key reason of poor performance of the agriculture sector in Nepal.

The farmers of Nepal have been developing and managing the irrigation systems since the time immemorial. These indigenous systems have been built with little or no support from state or other agencies all over the country and they are popularly called Farmers Managed Irrigation Systems (FMIS). Some of them have abandoned due to one reason or other in the course of time but most of them have sustained themselves over the decades.

With the increase of population and intensification of human activities in land resources, the demand for irrigation water has also increased very rapidly. Indigenous irrigation systems coped fairly well in the past, nowadays they are becoming more and more inadequate to meet the ever-increasing demand of the user farmers. Moreover, the necessary supports for Operation and Maintenance (O&M) for FMIS at the present degraded environmental condition is beyond the capacity of the user farmers. Similarly, there exists a vicious circle of *low income- low saving- low investment- low production* and again back to low income in our rural society. Considering the importance of irrigation facilities, large numbers of irrigation systems have been intervened either by constructing new or rehabilitation of existing indigenous systems after 1980s

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1 Study conducted under the Research Grant of FMIS Promotion Trust.
2 Members, Young Interdisciplinary Team of Researchers.
The past studies suggest that about 69 percent of the country’s total irrigated areas are covered by the FMIS (Parajuli, 1999). These systems vary in size from less than a hectare to larger than 15,000 hectares. The total number of FMIS in Nepal has been estimated to be about 17,700 in numbers (Pradhan, 1989). Of which 15,000 are located in hill and mountain ecological regions covering about 322,000 hectares and remaining 1,700 are located in Terai ecological region covering about 520,000 hectares (Poudel, 1992). These FMIS are contributing considerably in the national economy and that has become the main livelihood for the farmers in Nepal. The practice of self-governing systems and strong community participation are important and common features throughout the management of these systems. Local innovativeness and skills have been applied over the ages to develop and manage these systems. FMIS have been changing according to the situation and have sustained themselves over the decades. Dynamism is the heart of FMIS.

Process of FMIS formation is changing as compared to past. The farmers' access to resources has been increasing and farmers now have better knowledge on irrigation technology at larger scale. It is the need to study dynamism behind the formation of the new FMIS in the context of (i) wider access to outside resources; (ii) more knowledge to farmers about irrigation technology; (iii) changing biophysical environment; (iv) new political scenario in the country; and (iv) Government policy for FMIS development and management.

In this background, it is pertinent to identify enabling factors for the formation of New FMIS and track the changes in it to identify necessary measures for the sustainability of irrigation systems.

**OBJECTIVE OF STUDY**

The overall objective of the study is to identify the enabling factors behind the formation of New FMIS and the process of resource allocation and mobilization in the changing socio-economic and political contest.

Specific objectives of the research include:

- To study the enabling factors behind the formation of new FMIS;
- To study the pattern of resource generation and mobilization for the creation of new FMIS;
• To study local level institutions and its impact on creation of new FMIS;
• To study the technology choice in system development and influencing factors; and
• To analyze the dynamism in the new FMIS.

STUDY METHODOLOGY

The study was carried out in two phases as described below:

Inception/Desk Study Stage

During this phase of the study, secondary data related to FMIS and agency support programs were collected. Based on review of literatures and data, the following activities have been completed during this phase of the study:

- Development of field instruments; and
- Development of indicators.

Field Investigation Stage

The main objective of the field study was to verify the data collected during the desk study stage, seek additional data, and also collect on-the-spot data and information. To collect relevant data in the field, various tools were applied, which include (i) data collection from local offices of study area; (ii) system walkthrough; (iii) interviews with key informants; (iv) PRA; (v) observation and field measurements; and (vi) household survey.

The information and data collected were analyzed and synthesized to understand the dynamism of the New FMIS. The inferences were drawn from the analysis and synthesis of information and data collected during field investigation using different tools and techniques.

LIMITATION OF STUDY

This study is primarily based on detailed field investigation made on selected three newly formed FMIS (Gadkhar – Nuwakot, Bhutlung-Jhapa and Laugain-Kapilbastu). Although, sampling has been made in such a
way that they represent the entire newly emerging FMIS, the result based
on three systems may not represent the entire systems.

SYSTEM INFORMATION

**Gadkhar Irrigation System**

The *Gadkhar* Irrigation System (GIS) is located in the Chaughada Village Development Committee of Nuwakot District of the Central Development Region of Nepal. It is linked with 12-km long fair weather road to Gangate/Battar, a point on the Kathmandu – Trisuli highway.

The system named after the *Gadkhar* Village constructed during implementation of Rasuwa-Nuwakot Integrated Rural Development Program (RNIRDP) (1976-1982), financed by International Development Agency (IDA)/World Bank. For GIS, IDA/World Bank provided 67 percent of the construction costs and remaining cost was borne by His Majesty’s Government. The system was rehabilitated three times (1994, 1998, 2001). Major rehabilitation and extension of command area was done in 1994 with the financial and technical assistance of Department of Irrigation.
**Bhutlung FMIS**

The Bhutlung FMIS is located in Topgachhi Village Development Committee (VDC) of Jhapa district in the Eastern Development Region of Nepal. The irrigation command area is located around 9 km east–south of Damak Municipality. The system is accessible through 4 km-gravel road from the Mahendra Highway (Rajmarg). The command area of Bhutlung FMIS is about 182 hectares. The irrigation system was initiated in 1956 by a landlord Narendra Bdr. Basnet. In the beginning, it was like a personal property. In 1961 other farmers from ward number 3 of Topgachi VDC also participated in the irrigation system.

At the initial stage, the headwork was temporary in nature and used to be damaged time to time due to flood during rainy seasons. Ultimately, in 1995 the farmers constructed a concrete diversion structure (dam) with the loan and grant of ADB/N. The total construction cost of the system was NRs.1,443,642.20 (60% grant, 10% labor contribution and 30% loan from ADB/N).

The canal (Paini) was rehabilitated by the farmers for the first time in 1963. After that, the canal has been rehabilitated five times. The system has been receiving external assistance mainly from ADB/N since 1995 only. Before that period, the farmers used to rehabilitate the irrigation systems out of their own resources.

Brahman, Chhetri, Rai, and Newar are the main settlers/users of this system. The command area covers two villages (Bhutlung and Samayagad).

**Laugain FMIS**

The Laugain Irrigation system is located in Motipur Village Development Committee in Kapilvastu district in Terai of the Western Development Region. It is at a distance of 35 km west from Butwal. Most of the settlers
of this community are migrants from Gulmi, Arghakhanchi and Pyuthan districts. Whereas most of the original settlers (the Tharu) have migrated to the Southern part of the district. At present there are only four landless Tharu households in this area.

The water to the Mauja (command area) is supplemented through Tin Gaun Kulo System off-taking from the Banganga River at Singheghat. Likewise, there are 2 Deep Tubewells (DTWs) to supply water to the area. The system was an offspring of Groundwater Irrigation Development Project, Butwal-1990. The Project provided 60 percent of the construction costs as grant and remaining cost was borne by the farmers themselves to install DTWs. The farmers took loan from ADB/N under Small Farmers Development Program (SFDP) to make their share in DTW installation. The Laugain Irrigation system was planned, designed and implemented with total construction cost of about NRs.0.8 million under the supervision of the project.

The Laugain irrigation system has been providing the supplementary irrigation to the Laugain Mauja for more than 50 years. The system was built at the initiation of local farmers to supplement water for paddy and winter crops mainly mustard and wheat. However, the farmers have started growing improved wheat crop in limited areas since last ten years. As the water in the source is inadequate for year round irrigation, farmers have explored ground water as alternative source of irrigation to irrigate dry season crop like maize and off-season vegetables. In addition, it provides irrigation facility to irrigate fruit farms like banana, mango etc. This is an excellent example of conjunctive use of groundwater and surface irrigation system managed by the farmers at local level.

The system information is enlisted in Table 1.

<table>
<thead>
<tr>
<th>Headings</th>
<th>Gadkhar FMIS</th>
<th>Bhutling FMIS</th>
<th>Laugain FMIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>District</td>
<td>Nuwakot</td>
<td>Jhapa</td>
<td>Kapilvastu</td>
</tr>
<tr>
<td>VDC</td>
<td>Chaughada</td>
<td>Topgachhi</td>
<td>Motipur</td>
</tr>
<tr>
<td>System Type</td>
<td>Surface</td>
<td>Surface</td>
<td>Surface &amp; Ground</td>
</tr>
<tr>
<td>Water Source</td>
<td>Likhu Khola</td>
<td>Bhutlung Khola</td>
<td>Badganga river + DTWs</td>
</tr>
<tr>
<td>Command Area (ha.)</td>
<td>105</td>
<td>182</td>
<td>53</td>
</tr>
<tr>
<td>Households</td>
<td>121</td>
<td>159</td>
<td>325</td>
</tr>
<tr>
<td>First Intervention</td>
<td>1979</td>
<td>1995</td>
<td>1990</td>
</tr>
<tr>
<td>– Supporting Agency</td>
<td>DIHM under RNIRD Program</td>
<td>ADB/N</td>
<td>Dol, Groundwater project under ILC program</td>
</tr>
</tbody>
</table>
ENABLING FACTORS BEHIND THE FORMATION OF NEW FMIS

In previous days, bunds across the water source (River) used to be constructed using forest products and soil, but due to increasing awareness for environment and labor shortage such activities became difficult. Similarly, due to population increase and hence the water demand enforces the farmers to reorient their irrigation system to meet their increased demand. These factors along with other institutional and government policies prompted for the formation of new FMIS. The enabling factors for formation of such FMIS are enlisted in Table 2.

Table 2: Enabling Factors for Formation of new FMIS

<table>
<thead>
<tr>
<th>Enabling Factors</th>
<th>Gadkhar</th>
<th>Bhutlung</th>
<th>Laugain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government Policy:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Government huge investment of loan and grant funds after mid 1980s</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Farmers access to power (Political decision makers)</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Establishment of democracy (increased people’s empowerment &amp; participation)</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Social: Social unity</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Exposure, increased awareness,</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Agriculture: Irrigation for dry season</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Meet production demands and agricultural needs of farmers</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Technical: Interest for permanent structure (to decrease the labor requirement for repair and maintenance)</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>To mitigate the effect natural disaster on irrigation system.</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interest for increasing volume and reliability of water.</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economic: Increased access to the market for inputs as well as for outputs</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Dependency in agriculture for livelihoods.</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Farmers increased access to financial resources (ADB loan etc., subsidy)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Institutional: Existence of institutions (informal WUA, farmers’ group)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

DYNAMISM IN NEW FMIS

The field investigation of the three selected FMIS revealed the fact that the intervention in these systems has brought change in different aspects of agriculture practices in which irrigation is one of the components. In the part days, these systems were developed and managed on adhoc participatory basis while at present it is managed by the formal WUA.
The dynamism in these systems was analyzed in different aspects like social, institutional, technical etc. The information gathered from the field were analyzed to understand the performance level of the systems in three different time period i.e.

- Situation before intervention;
- Situation during the intervention; and
- Situation after the intervention (at present).

The detail findings of the analysis for each aspect is presented below:

**Institutional Aspect**

Major dynamism in new FMIS was found in the institutional aspect as shown in Table 3. Significant changes were observed in the power, composition, legal status, activeness, etc. of Water Users Association (WUA).

**Table 3: Dynamism in the Institutional Aspect**

<table>
<thead>
<tr>
<th>Subject</th>
<th>Before Intervention</th>
<th>During the Intervention</th>
<th>At Present</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existence of WUA</td>
<td>Very active informal WUA in 2 schemes (Bhutlung and Laugain)</td>
<td>Active WUA</td>
<td>Active</td>
</tr>
<tr>
<td>Legal status</td>
<td>Not registered in all systems</td>
<td>Registered</td>
<td>Re-registered in Gadkhar, Timely Renewal in Bhutlung</td>
</tr>
<tr>
<td>Composition</td>
<td>Landlords/elites, higher caste and political leaders</td>
<td>Increased participation of all groups</td>
<td>Equal participation of all (caste, areas, income level)</td>
</tr>
<tr>
<td>Structure</td>
<td>WUA</td>
<td>WUA, loan committee, construction com.</td>
<td>WUA, branch-committees, subcommittees, Separate management com. of 2 DTWs at Laugain and branch com. at Bhutlung</td>
</tr>
<tr>
<td>Power of WUA</td>
<td>Very powerful</td>
<td>Strong in Bhutlung and Laugain Weak in Gadkhar</td>
<td>Strong</td>
</tr>
<tr>
<td>Relation of WUA and sub/branch committees</td>
<td>-</td>
<td>-</td>
<td>Increased power and independency of sub/branch comm.</td>
</tr>
<tr>
<td>Selection procedure of WUAMC</td>
<td>High influence of political leaders and landlords No regular selection</td>
<td>High influence of political leaders and landlords</td>
<td>Mass approval (High participation) Reconstitution of committee in one year in Laugain and 2 years in Bhugtlung and Gadkhar</td>
</tr>
<tr>
<td>Meeting</td>
<td>Ad hoc basis</td>
<td>Regular</td>
<td>Ad hoc</td>
</tr>
<tr>
<td>Record</td>
<td>No</td>
<td>Yes</td>
<td>Yes (not satisfactory)</td>
</tr>
</tbody>
</table>
### Keeping Account Keeping

<table>
<thead>
<tr>
<th>Keeping</th>
<th>No</th>
<th>Good</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relation with GOs</td>
<td>Only relation with VDC level</td>
<td>Increased access to irrigation related organizations and banks</td>
<td>Increased relation with irrigation as well as other organizations</td>
</tr>
<tr>
<td>Gender participation in WUAMC</td>
<td>No provision of women participation</td>
<td>Not involved</td>
<td>Increased participation (Women: 3 in Gadkhar, 1 in Bhutlung)</td>
</tr>
<tr>
<td>Conflict resolution by WUAMC</td>
<td>Able to solve all irrigation related problems</td>
<td>Dependent to others in Gadkhar</td>
<td>Independently able</td>
</tr>
<tr>
<td>Responsibility</td>
<td>Solely responsible for overall activities of irrigation</td>
<td>Supported by loan committee and construction committee</td>
<td>Assisted by branch and sub-committees</td>
</tr>
<tr>
<td>Political intervention</td>
<td>High</td>
<td>High</td>
<td>Low</td>
</tr>
</tbody>
</table>

### Resource Generation and Mobilization

Before the intervention, the irrigation technology was labor intensive, while after the intervention it has been changed to capital intensive. Due to the change the FMIS management has compelled to collect fund for O&M. According to the need, WUA has been collecting fund from the beneficiaries. Likewise, it has been approaching to the external agencies for the financial support for major maintenance works and new construction. Major features of the changes are shown in Table 4.

#### Table 4: Dynamism in Resource Generation and Mobilization

<table>
<thead>
<tr>
<th>Subject</th>
<th>Before Intervention</th>
<th>During the Intervention</th>
<th>At Present</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access to external support</td>
<td>Little support from VDC and DDC in Bhutlung and Laugain</td>
<td>Major rehabilitation &amp; construction from external support (mainly under DoI and ADB/N)</td>
<td>Maintenance of systems from the external support (mainly under DoI and ADB/N)</td>
</tr>
<tr>
<td>External support</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gadkhar</td>
<td></td>
<td>DIHM under RNIRDPS, Rs.29,46,793/-</td>
<td>Dol support 4.8 million on 1995, 1.5 million on 2001, and little support at required time for maintenance</td>
</tr>
<tr>
<td>Bhutlung</td>
<td>VDC, DDC 50000/- in different periods</td>
<td>ADB/N Support 60%</td>
<td>ADB/N support 60% of the total cost (twice) for maintenance</td>
</tr>
<tr>
<td>Laugain</td>
<td></td>
<td>ILC support 75%; Rs.9,24,829/-</td>
<td>VDC and ADB/N support at required time</td>
</tr>
<tr>
<td>Internal Resource Generation</td>
<td>Ad hoc cash and kind collection from beneficiaries</td>
<td>Labor and Cash Contribution from beneficiaries in the const./rehab cost</td>
<td>Creation of O&amp;M fund, Regular collection of water charge</td>
</tr>
</tbody>
</table>

86
- High labor contribution
- No regular water charge collection
- Fine collection from defaulters

- No O&M fund

- Fine collection from defaulters
- Interest collection by mobilizing the collected fund
- Able to generate fund for operation only
- Not enough fund to maintain the system
- New membership fee coll. in Bhutlung and water selling to Ghatta in Gadkhar

Social Aspect

Significant changes were observed in the migration, gender participation and availability of active labor force after the intervention as described in Table 5.

Table 5: Dynamism in the Social Aspect

<table>
<thead>
<tr>
<th>Subject</th>
<th>Before Intervention</th>
<th>During the Intervention</th>
<th>At Present</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social unity &amp; harmony</td>
<td>Good unity</td>
<td>Good unity</td>
<td>Good unity</td>
</tr>
<tr>
<td>Ethnic Composition</td>
<td>Around 95% Rais in Gadkhar Majority of Brahmains &amp; Chhetris in Buthlung and Laugain</td>
<td>Increased population of Higher caste, decrease in pop. of Tharu and other deprived groups</td>
<td>Increased population of Higher caste</td>
</tr>
<tr>
<td>Migration</td>
<td>Low in-migration of higher caste and out migration of ethnic group</td>
<td>High in-migration of higher caste and out migration of ethnic group</td>
<td>High in-migration of higher caste and out migration of ethnic group</td>
</tr>
<tr>
<td>Land fragmentation</td>
<td>Low land fragmentation</td>
<td>High land fragmentation</td>
<td>Increase in land fragmentation</td>
</tr>
<tr>
<td>Gender Participation</td>
<td>No women participation in decision making and irrigation O&amp;M activities</td>
<td>No women participation in decision making</td>
<td>– Involvement of women in committee – Participate in distribution of water to the field</td>
</tr>
<tr>
<td>Economically active population</td>
<td>Sufficiently Available</td>
<td>Started to migrate out of community in search of job</td>
<td>Increased the trend of out migration of this population</td>
</tr>
</tbody>
</table>

Agricultural Aspect

Major changes were observed in the cropping intensity and cropping pattern after the intervention as shown in Table 6. The farmers are more
interested toward high value crops after the availability of irrigation facility.

Table 6: Dynamism in the Agricultural Aspect

<table>
<thead>
<tr>
<th>Subject</th>
<th>Before Intervention</th>
<th>During the Intervention</th>
<th>At Present</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crop coverage Area (% of total)</td>
<td>About 160% cropping intensity (CI)</td>
<td>About 230% CI</td>
<td>About 240% CI</td>
</tr>
<tr>
<td>Summer season</td>
<td>Millet (100%) in Gadkhar Paddy (100%) in others</td>
<td>Paddy (100%)</td>
<td>Paddy (100%)</td>
</tr>
<tr>
<td>Winter crop</td>
<td>Fallow- Gadkhar Wheat - 20% in others</td>
<td>Wheat 40%</td>
<td>Wheat 40%</td>
</tr>
<tr>
<td>Spring season</td>
<td>Maize (about 20%)</td>
<td>Maize (60%)</td>
<td>Maize (60%) Early paddy (6% in Gadkhar and Bhulung)</td>
</tr>
<tr>
<td>Agriculture Practice</td>
<td>Tradition technology, local materials and seed use</td>
<td>Introduction of improved farming techniques Use of improved seed, imbalanced use chemical fertilizer, imported tools</td>
<td>Increased use of improved seed, imported tools. Balanced use of chemical fertilizer</td>
</tr>
<tr>
<td>Availability of inputs</td>
<td>Use of local inputs</td>
<td>No timely availability</td>
<td>Easily accessible</td>
</tr>
</tbody>
</table>

Technical Aspect

The technical aspect deals with the methods of water extraction, conveyance and distribution. The structure constructed during the intervention for the purpose is functioning as per the need of the farmers and whether the farmers are capable for operating and maintaining these structures are some aspects that have been tried to analyze. The analysis focuses that the intervention has increased the water reliability, water adequacy and checked the environmental degradation to some extent. At the same time it has increased the dependency of the farmers on external agency for maintenance work. The details of dynamism in technical aspect is presented in Table 7.
Table 7: Dynamism in the Technical Aspect

<table>
<thead>
<tr>
<th>Subject</th>
<th>Before Intervention</th>
<th>During the Intervention</th>
<th>At Present</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Source</td>
<td>• No specified discharge in the canal</td>
<td>• Discharge was calculated as per suggested cropping pattern.</td>
<td>• An approach channel construction in Gadkhar</td>
</tr>
<tr>
<td></td>
<td>• Frequent flooding in the low lying flood plain</td>
<td>• The designed discharge was diverted to the canal system</td>
<td>• A temporary bund of Gabions is constructed annually to divert water</td>
</tr>
<tr>
<td></td>
<td>• Ground water is harnessed for winter crop in Laugain</td>
<td>• Discharge was calculated as per suggested cropping pattern.</td>
<td>to the approach channel.</td>
</tr>
<tr>
<td>Intake</td>
<td>• Temporary side intake made up of boulders and forest</td>
<td>• Side intake in Ghadkhar</td>
<td>• Side intake in Ghadkhar is in dilapidated condition</td>
</tr>
<tr>
<td></td>
<td>products</td>
<td>• Concrete weir across Bhutlung</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Temporary bund across Banganga</td>
<td></td>
</tr>
<tr>
<td>Type of canal</td>
<td>• Earthen</td>
<td>• Reshaped and lined wherever required in Gadkhar and Laugain</td>
<td>• In Bhutlung, canals are in dilapidated condition</td>
</tr>
<tr>
<td>Main and branch canal</td>
<td>• Main Canal</td>
<td>• Branch canals constructed</td>
<td>• Lined branch canal in Bhutlung</td>
</tr>
<tr>
<td></td>
<td>• Preliminary branch canal</td>
<td>• Command area development work initiated</td>
<td>• Pipe (HDPE) canal in Laugain for ground water</td>
</tr>
<tr>
<td>Command Area Development work</td>
<td>• No Command area development work in Gadkhar and Bhutlung</td>
<td>• Command area development work initiated</td>
<td>• Command area development work continued</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Command area development work initiated</td>
<td>• Covered canal in settlement area in Laugain</td>
</tr>
<tr>
<td>Distribution System</td>
<td>• Politically active and upper caste people were getting</td>
<td>• Rationale distribution system in accordance with the command area was</td>
<td>• Rationale distribution system adopted strictly</td>
</tr>
<tr>
<td></td>
<td>more water</td>
<td>developed</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Proportional distributors were constructed</td>
<td></td>
</tr>
<tr>
<td>Construction Quality/ Material</td>
<td>• Poor/earthen</td>
<td>• Lined canal, Concrete, brick work in Gadkhar and Bhutlung, HDPE in</td>
<td>• Improved skilled of local farmers, quality is maintained with limited</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Laugain</td>
<td>resource</td>
</tr>
<tr>
<td>O&amp;M Procedure</td>
<td>• O&amp;M in ad hoc basis</td>
<td>• Defined regular and periodic maintenance practices</td>
<td>• Trained farmers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Defined regular and periodic maintenance practices</td>
<td>• Better O&amp;M practice</td>
</tr>
<tr>
<td>Water Adequacy and reliability</td>
<td>• Poor</td>
<td>• Satisfactory</td>
<td>• Satisfactory</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Satisfactory</td>
<td>• Better in Laugain</td>
</tr>
</tbody>
</table>
Operation and Maintenance

As the technology has changed, the skill is required for efficient operation and management. The local farmer has to get proper training about operation schedule and techniques. There have been notable changes in contribution requirement, O&M practices, support staff etc. Before the intervention, the farmers used to undertake the O&M activities on adhoc basis but after the intervention the farmers are trained to undertake O&M as per the annual calendar for O&M prepared by WUA. The detailed changes are enlisted in Table 8.

| Subject                     | Before Intervention       | During the Intervention             | At Present                                                      |
|-----------------------------|---------------------------|-------------------------------------|                                                                |
| Cash and kind contribution  | High labor contribution   | Low cash and kind contribution      | Need of high cash and labor contribution                      |
| Affordability               | Beyond the farmers’ capacity |                                      | Beyond the farmers’ capacity                                  |
| O&M practice                | Frequent maintenance with the labor mobilization |                                      | Depend on the external support for large maintenance         |
|                             |                           |                                      | Canal cleaning and small maintenance carried out twice in a year |
| Support staff               | None in Bhutlung and Gadkhar, 1 Badghar and 1 Chaukidar in Laugain | Two Dhalpales, One Chaukidar in Bhutlung, No change in Laugain | Addition of support staff to manage distribution of water (Panipales, Dulpales) |

Financial/Economic Status

In early days the system used to run on faith and trust on each other but after the intervention, capital instead of labor contribution increases and hence the need of transparent accounting system was felt. Therefore, in many systems bank account and water charge collection system have been adopted. Similarly the agriculture extension services and local market have been explored for marketing of agricultural products. The economic condition of the people in the command area has changed manifold. The shift in economic situation is outlined in the Table 9.
Table 9: Financial/Economic Status

<table>
<thead>
<tr>
<th>Subject</th>
<th>Before Intervention</th>
<th>During the Intervention</th>
<th>At Present</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bank Account</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Balance</td>
<td>No</td>
<td>Satisfactory</td>
<td>Nominal (not adequate)</td>
</tr>
<tr>
<td>Account keeping</td>
<td>No</td>
<td>Yes</td>
<td>Satisfactory in Gadkhar and Laugain</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Not satisfactory in Bhutlung</td>
</tr>
<tr>
<td>Regular collection</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Market for Agriculture prod.</td>
<td>No</td>
<td>Need to transport prod. to the market</td>
<td>Dealers and brokers come to the village</td>
</tr>
<tr>
<td>Food adequacy</td>
<td>Not sufficient</td>
<td>Sufficient</td>
<td>Sufficient</td>
</tr>
<tr>
<td>Impact of external shocks</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Income level</td>
<td>-</td>
<td>-</td>
<td>Increased</td>
</tr>
<tr>
<td>Access to public facilities</td>
<td>No bank, no telephone, no cooperative institution, no dairy</td>
<td>Establishment of bank, better motor able roads, fear weather motorable road, school etc.</td>
<td>Facilities of bank, telephone, fear weather motorable road, school etc.</td>
</tr>
</tbody>
</table>

Environmental Aspect

Forest product and earth were used for construction of dam across the river for water diversion annually. As a result, the soil erosion and deforestation was severe in the area. The environment was degrading and the fertility of the soil was threatened. After the intervention in the form of permanent headwork has reduced the environmental degradation drastically. The environmental change in brief is presented in Table 10.

Table 10: Environmental Aspect

<table>
<thead>
<tr>
<th>Subject</th>
<th>Before Intervention</th>
<th>During the Intervention</th>
<th>At Present</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deforestation</td>
<td>High use of forest products to divert water</td>
<td>Little during construction</td>
<td>Comparatively low</td>
</tr>
<tr>
<td>Occurrence of natural disasters</td>
<td>High flooding, landslides</td>
<td>Decreased</td>
<td>Low</td>
</tr>
</tbody>
</table>

Conflict/Conflict Resolution Mechanism

The conflict used to be minimum before the intervention as the functioning of the organization used to be very transparent and money involvement was also minimum. During the intervention and after the intervention, conflict regarding the water charge, water distribution etc increases,
however WUAs are given enough mandate by the local farmer to resolve
the conflict through the participatory approach. The details are described
in Table 11.

Table 11: Conflict/Conflict Resolution Mechanism

<table>
<thead>
<tr>
<th>Subject</th>
<th>Before Intervention</th>
<th>During the Intervention</th>
<th>At Present</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conflict on source of water</td>
<td>Less</td>
<td>High</td>
<td>Still existing</td>
</tr>
<tr>
<td>Distribution conflict</td>
<td>Domination of influential persons</td>
<td>High</td>
<td>Still high but regularly solved by WUA</td>
</tr>
<tr>
<td>Cash/kind contribution</td>
<td>No</td>
<td>High</td>
<td>Little (solved by WUA)</td>
</tr>
<tr>
<td>Access to power</td>
<td>Domination of influential persons</td>
<td>Increased</td>
<td>Increased (solved by increasing participation)</td>
</tr>
<tr>
<td>Responsible persons</td>
<td>Solved by political leaders and WUA</td>
<td>Solved by political leaders &amp; WUA</td>
<td>Solved by WUA in assistance of branch and sub-committees</td>
</tr>
<tr>
<td>Method</td>
<td>Top down method</td>
<td>Top down method</td>
<td>Participatory approach</td>
</tr>
</tbody>
</table>

Table 12: Dynamism in Participation

<table>
<thead>
<tr>
<th>Subject</th>
<th>Before Intervention</th>
<th>During the Intervention</th>
<th>At Present</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ownership feeling</td>
<td>High in certain section/group Overall low</td>
<td>Low in Gadkhar High in Bhulung and Laugain</td>
<td>High in all</td>
</tr>
<tr>
<td>Community participation</td>
<td>High in certain section/group Overall low</td>
<td>Top down method</td>
<td>Participatory approach</td>
</tr>
<tr>
<td>Dependency</td>
<td>No</td>
<td>Increased dependency on external resources</td>
<td>Increased dependency on external resources</td>
</tr>
</tbody>
</table>

MAIN FINDINGS

Every coin has two faces and the FMIS is not the exception. The
indigenous irrigation practices of farmers in Nepal have manifold socio cultural and democratic values rather than mere irrigation value. The management practices in such FMISs can teach numerous lessons to well trained managers of today. However there is need to equip these farmers with new tools and techniques to enhance their capabilities on one hand

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and their quality of life on the other. The analysis of the dynamism in these systems indicates that the intervention has certainly improved the performance level but it has also brought some negative aspects. The farmers in these systems wanted interventions but in their terms and conditions so that it can deform the existing social and managerial fabric to least possible extent. The analysis of socio-economic, technical and institutional strength also demand for limited intervention in changed water demand and socio-political condition of the country so that the FMISs can sustain over decades with minimum input.

The major advantage (positive aspect) and disadvantage (negative aspects) of intervention of FMISs are enlisted as below

New FMIS have following positive aspects:

- Management Committee (MC) able to make quick decision
- Cost effective management
- High ownership feeling, social unity, community participation
- Increased group efforts (formation of other groups)
- Highly effective to resolve conflict
- Through knowledge of MC on social, institutional and geographical settings

Negative Aspects in new FMIS

- Increased dependency on external assistance
- Use of technology beyond the capacity of the local farmers

In this review, it is pertinent to note that the farmer and their interest should be centrally placed in any short of interventions. The following aspects should be given high priority for better performance of the FMISs in changed context:

- Participation of farmers/WUA should be increased from the beginning in decision-making process.
- Training should be provided to WUA in management and O&M aspects
- The capacity of farmers for O&M should be considered at the time of Technology choice
REFERENCES


Helmi, 2000. Transition on Irrigation System Management in Indonesia: Challenges and Opportunities for Sustainability. Paper prepared for a panel on “Asian Irrigation in Transition” in the Conference of International Association for the Study of Common Property Resources Bloomington Campus of Indiana University, Indiana, USA.


BACKGROUND

Of the total potential irrigable area of $1.9 \times 10^6$ ha, irrigation facilitated land is currently about $1.089 \times 10^6$ ha in Nepal. Irrigation system in Nepal can be broadly classified into two categories, depending upon the responsibility of management, —. Farmer managed and agency managed irrigation systems. Irrigation systems that are developed by farmers’ own initiation and investment are called Farmer Managed Irrigation Systems (FMIS). These systems are designed based on indigenous technology to suit the agro-ecological settings. Irrigation systems, which are developed and managed by the government, are referred to as Agency Managed Irrigation Systems (AMIS). Engineers, taught at universities with modern technology, design such irrigation systems. However, due to lack of management components in their design, performance of many of these systems in terms of water delivery to users remained inefficient, especially in a developing country like Nepal.

It is estimated that there are about 16,700 FMISs in Nepal (1,700 in Terai and 15,000 in hills). The size of these systems range from 10 ha to 15,000 ha. All these systems are being managed by farmers themselves since several decades. Currently, 33% of the total irrigable area of Nepal is under AMIS and 67% under FMIS (Pradhan, 1989).

In FMIS, water share is determined by consensus and often based on the area to be irrigated. Each user group receives the fixed share of water either on proportional division or on rotation (in case of scarcity of water) by constructing distribution structures. These distribution structures have many names. In western Nepal, it is called Sancho. The distribution systems developed adopted by FMIS are clear and transparent to everybody. Water is equitably distributed among all the users. Everybody

---

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understands how much water is flowing and where it is going. Such systems are in use not only in Nepal, but also in Indonesia, Sri Lanka, Philippines, Laos, Thailand, India, etc.

Water distribution in AMIS is based on the crop water requirements derived from the calculation with respect to plant, climate and soil moisture. This gives flexibility in operation of distribution structures. The design principles and objectives of water distribution structures in FMIS and AMIS are given in Table 1.

Table 1: Basic Differences between FMIS and AMIS Based on Design Principles

<table>
<thead>
<tr>
<th>S. N.</th>
<th>Design Principles of Irrigation Infrastructure</th>
<th>FMIS</th>
<th>AMIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Operation Objectives</td>
<td>Simplicity</td>
<td>Equity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Transparency</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Irrigation Duty</td>
<td>Technical and Social Requirements</td>
<td>Technical Requirements</td>
</tr>
<tr>
<td>3.</td>
<td>Functions</td>
<td>Hydraulic and managerial</td>
<td>Hydraulic</td>
</tr>
</tbody>
</table>


In many cases of AMIS three practical problems occur. They are: unequal and untimely water distribution, unwanted interference of farmers in operation, and breaking of gates. All these problems are interrelated. The cause of these problems is the gap between knowledge and expectations of managers of AMIS and farmers. This gap, in turn, results from the way technical manpower is trained at formal academic institutions. In order to narrow this gap, FMIS Promotion Trust and nec joined hands and tried to revise, and recraft, if necessary, the current curriculum of irrigation engineering.

RATIONALE

Since a decade ago, with good intention of improving efficiency, FMIS intervention has been given a high priority in Nepal. Such intervention in irrigation system encounters challenges due to complex social and environmental problems. The decision-makers engaged in such process have seldom any training to tackle these issues. They acquire experience and knowledge by performing the jobs. Studies have shown that programs to improve the FMIS system have failed due to inappropriate planning. There are many reasons of failures. One major reason is the gap between the field level problems and the type of education and training provided at
the academic institutions (Universities/colleges) to solve the problems. One previous study found seven major reasons for traditional engineering curriculum concentrating only on physical aspect of irrigation and completely ignoring socio-economic dimensions (Dimer and Slabbers, 1992). Narrowing the gap requires a shift in irrigation design practice from the conventional one to the one that incorporates the socio-economic, cultural and political issues, besides the field of engineering. Role of education institutions in farmer friendly irrigation training and research has become essential to protect and promote indigenous knowledge and skills of FMIS. This indicates a need to reform the current curriculum of irrigation engineering.

The current curriculum of irrigation engineering at many universities in Nepal, including Pokhara University, lacks information on FMIS. The syllabus is based on engineering and agronomic principles. It does not include indigenous knowledge, and local technology and practices of irrigation. The faculties associated in teaching irrigation subjects are also trained in the conventional system of irrigation design. Unless the curriculum is revised to include chapters in FMIS, the faculties have no incentive to update their knowledge developments in FMIS. This reflects a need to revise the syllabus on irrigation.

Since the share of FMIS land is more than that of AMIS in Nepal, agricultural productivity is not going to improve without improvement in FMIS. To improve FMIS, knowledge and understanding of the system is a prerequisite. So, to effectively intervene and improve on the existing FMIS, trained technicians with sensitivity to the traditions and customs of FMIS is required, which can only be achieved through change in existing curriculum.

The need to reform current syllabus has already been realized by professionals involved in irrigation sector and concerns have been raised in different forums. A seminar on FMIS held in Kathmandu has unanimously concluded “that, by doing so, engineers can understand the local environment (physical & social) where the system is to be designed. Further, such training provides opportunities for incorporating indigenous knowledge in all aspects of irrigation development” (Parajuli, U.N., 2001). Despite the need for the new training and research activities, conventional curriculum in irrigation engineering subjects has not changed so far.

The indigenous knowledge of local farmers has been one of the main reasons for sustainability of FMIS in Nepal. In order to improve
agriculture in Nepal, “the local knowledge should be integrated with external (traditional engineering) knowledge” (Shrestha, H., 2001). With a view to maintain the continuity of indigenous knowledge and skills of FMIS, it is pertinent to reform the current curriculum on irrigation subject. The reformed design needs to be compatible to farmers concept and ecological setting and must address the social issues. It should be socially acceptable, economically viable and environmentally sustainable. The new curriculum, if applied in training the faculties and students, will help design environmentally sustainable irrigation systems in accordance with the farmers’ concept, knowledge and preferences.

**OBJECTIVES**

The ultimate objective of the project is to produce technical experts in the field of irrigation engineering that have knowledge and understanding of the skills and techniques used in FMIS, are sensitive to and willing to learn traditions and customs of the area, and have feeling for real needs of the farmers.

The specific objectives of the study are:

- To find gap between current curriculum of Bachelor of Civil Engineering and farmer’s needs, in relation to irrigation component, and suggest changes required in the existing curriculum;
- To revise existing syllabus, if appropriate, to introduce basic concepts of FMIS; and
- To recraft a new syllabus, to be offered as an elective, to provide detailed knowledge on all aspects of FMIS.

**METHODOLOGY**

To achieve the specific objectives of the project, the following methodology was used.

**Expert Discussion**

To find the gap between academic curriculum and the needs of the farmers, the study team conducted several rounds of discussions with academicians and professionals. To determine the relevance of academic training in irrigation management at bachelor level of engineering, the
team had extensive discussions with field engineers at irrigation offices who have several years of experience in FMIS and AMIS of Nepal.

**Collection and Review of Literature**

Based on the results of the expert discussion, the gap between the academic approach and farmers’ approach was identified. To identify and select appropriate educational materials to fill the gap, the study team collected and reviewed several pertinent literatures related to FMIS and AMIS.

**Workshop**

Based on the experts’ comments and review of literatures, the study team prepared draft version of two different syllabuses. The first syllabus was a revision of current POKHARA UNIVERSITY syllabus in irrigation engineering. In the first syllabus, attempt was made to introduce a separate chapter in FMIS without altering the overall content of the curriculum. This was achieved by deleting some sub-chapters that were covered in some other subjects. The second syllabus was a completely new syllabus to be offered as an elective subject in the final years of the 4-year civil engineering program. The second syllabus was intended to provide in-depth knowledge in technical, social, and legal aspects of FMIS.

Once the draft versions of the two syllabuses were prepared, the study team conducted interactive workshops to bring together ideas of various experts from different fields, so that coherent and comprehensive syllabuses can be formulated. The basic aim of the workshop was to put the draft version of the syllabuses to the review of the experts.

**Water Distribution Model**

In order to bring awareness on FMIS to the future engineers, the study team conducted small group meetings with the students of nec, and encouraged them to participate in a model competition for water distribution structures. The intention of this process was to involve the senior level students in designing the syllabuses by getting their feedback on the draft version of the syllabuses.
Field Visit

To get the real feeling of how FMIS are managed, the study team conducted field visits. During the visits, the team has extensive discussions with farmers and managers of various FMIS. Field surveys were conducted to collect opinions of stake-holders on recrafting the role of education in FMIS knowledge promotion. The questionnaire of the surveys was focused on getting the farmers’ feedback on what they felt was lacking in an engineering graduate. The ultimate purpose, again, is to make sure that the new syllabus will cater to the farmers’ need.

Based on the inputs from various sources, the study team revised the draft versions of both the syllabuses.

RESULTS

The expected result (output) of the project was preparation of two syllabuses that incorporates appropriate inputs from academicians, professionals, farmers and FMIS managers. As stated earlier, the inputs were obtained through expert meetings, literature survey, workshops, students’ involvement in design, and field surveys. The following are the summary of the outputs of the activities up to March 2002 of the program.

a) A revised draft copy of the syllabus for introduction of FMIS into existing syllabus of Water Resources Engineering - I (Track 1); and
b) A revised draft copy of the new syllabus of FMIS to be offered as an elective subject (Track 2).

The details of the outputs, which are the revised versions of syllabuses, follow.

a) **Track 1:** (Introducing a chapter on FMIS on existing syllabus)

**Chapter Heading:** Introduction to Farmer Managed Irrigation System

**Sub Headings**

1. Introduction of FMIS in Asian and Nepalese context 0.5
2. Characteristics of better performing FMIS 0.25
3. Use of Uphoff’s Matrix on irrigation management 0.5
4. Introduction to optimization techniques (LP & MCDM) 0.5
5. Water Policy Legislation 1.5
   5.1 Water Resources Act, Policy, Legislation
   5.2 Environment Act, and guidelines
   5.3 Formation and Management (participatory approach) of FMIS organization
6. Water Diversion, Conveyance and distribution 1.75
   6.1 Water right issues-statutory and customary rights
   6.2 Water allocation and distribution arrangement
   6.3 Water related disputes and disputes resolution
   6.4 Rational of proportional weir

b) **Track 2:** (Subject to be offered as an elective subject):

1. **Subject:** Farmer Managed Irrigation System (3 Credits)

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<th>Practical</th>
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<tr>
<td><strong>Total</strong></td>
<td>80</td>
<td>20</td>
<td>100</td>
</tr>
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**Course Objectives:** After studying this course, students should be able to understand

(i) The historical development of irrigation system;
(ii) The differences between the hierarchical and bifurcating irrigation systems;
(iii) The style and pattern of farmers managed organization (including operation and management);
(iv) The issues of equity and sustainability (gender and poverty alleviation); and
(v) The issues related with water diversion, conveyance and distribution.

3. **Course Contents**

1.0 Introduction (6 hrs)
   1.1 Irrigation practices in South Asia
   1.2 History of irrigation development (Ancient & modern)
   1.3 Evolution of FMIS
   1.4 Characteristics of FMIS
   1.5 Approaches and emerging trend on study of FMIS
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<td>Water Allocation Principles</td>
<td>(2 hrs)</td>
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<tr>
<td>2.2</td>
<td>Water User's Association (WUA), Strengthening WUA</td>
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<tr>
<td>2.3</td>
<td>Water use practices &amp; Water conservation practices</td>
<td></td>
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<tr>
<td>3.0</td>
<td>Legal Aspects of Water Resource Management</td>
<td>(2 hrs)</td>
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<tr>
<td>3.1</td>
<td>Water Resource Act and Environmental Act</td>
<td></td>
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<tr>
<td>3.2</td>
<td>Legal provisions for water acquisition, allocation &amp; distributions</td>
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<tr>
<td>4.0</td>
<td>Design, Construction and Maintenance of reservoirs and canals in FMIS</td>
<td>(10 hrs)</td>
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<tr>
<td>4.1</td>
<td>Use of Indigenous Knowledge for design and construction</td>
<td></td>
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<tr>
<td>4.2</td>
<td>Lined and unlined Reservoir Design</td>
<td></td>
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<td>4.3</td>
<td>Reducing water seepage</td>
<td></td>
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<td>4.4</td>
<td>Proportioning Weirs</td>
<td></td>
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<td>4.5</td>
<td>Uphoff's Matrix</td>
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<td>4.6</td>
<td>Techniques of upgrading old reservoirs and canals</td>
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<td>5.0</td>
<td>Social Issues in FMIS</td>
<td>(2 hrs)</td>
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<td>5.1</td>
<td>Water Trading</td>
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<td>5.2</td>
<td>Gender Issues</td>
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<td>5.3</td>
<td>Tariff setting, Resource Mobilization</td>
<td></td>
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<td>5.4</td>
<td>Contribution of NGOs in participation promotion</td>
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<td>6.0</td>
<td>GIS Application in FMIS</td>
<td>(9 hrs)</td>
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<td>6.1</td>
<td>Introduction to GIS</td>
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<tr>
<td>6.2</td>
<td>Demo Application of GIS in FMIS</td>
<td></td>
</tr>
<tr>
<td>6.3</td>
<td>Introduction to database</td>
<td></td>
</tr>
<tr>
<td>6.4</td>
<td>Demo Application of database in FMIS</td>
<td></td>
</tr>
<tr>
<td>7.0</td>
<td>Introduction to Linear Programming in FMIS</td>
<td>(9 hrs)</td>
</tr>
<tr>
<td>7.1</td>
<td>Introduction to Optimization Techniques</td>
<td></td>
</tr>
<tr>
<td>7.2</td>
<td>Application of LP in irrigation system planning and management with real case examples</td>
<td></td>
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<tr>
<td>7.3</td>
<td>Solution using LP softwares (LINDO and TORA)</td>
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<tr>
<td>7.4</td>
<td>Introduction to Multi Criteria Decision Making Approach</td>
<td></td>
</tr>
<tr>
<td>7.5</td>
<td>MCDM tool introduction for compromise programming, goal programming</td>
<td></td>
</tr>
<tr>
<td>8.0</td>
<td>Case Study: Case study of a successful and an unsuccessful FMIS</td>
<td>(5 hrs)</td>
</tr>
</tbody>
</table>
Field Visit

A field visit will be conducted for collecting relevant data and observing a FMIS. Students will be evaluated for their practical marks based on an individual report of the field visit.

ACTIVITIES UNDERTAKEN

The project is yet to be completed. The following activities are yet to be done.

a) Conduct field visits to obtain inputs from diverse section of farmers.
b) Conduct interactive workshop to obtain comments from academicians, professionals, farmers and FMIS managers on the revised syllabuses.
c) Finalize the syllabuses.
d) Present the syllabuses to Pokhara University for approval and incorporation in curriculum.

CONCLUSIONS

Based on the works completed up to now, the following conclusions are made.

a) Many FMIS need improvement, especially in infrastructure aspect. Most FMIS are excellent in management affairs. Improvements in infrastructure cannot be achieved without fully understanding overall aspects of FMIS.
b) The need for infrastructure improvement is growing with time due to changed context in
   i) Reduction of forest area from where farmers get materials for their indigenous technology of FMIS.
   ii) Migration of youth population towards urban areas that reduce the number of labor required for sustaining indigenous techniques FMIS management.
c) There is a definite gap between the need of farmers under FMIS and the input an engineering graduate can provide.
d) The gap is the result of combination of factors. They are:
   iii) Irrigation syllabuses not covering topics related to FMIS issues.
iv) The literatures on FMIS studies can be obtained only in specialized offices.

v) Most of the civil engineering faculties are not exposed to FMIS issues.

e) Careful designing and implementation of irrigation engineering syllabuses in undergraduate level courses can narrow the gap.
REFERENCES


INTRODUCTION

A team of researchers tested a number of methodologies to carry out water use inventory at watershed level. The team based their research at Bhorle Khola Watershed in Nuwakot District (Figure 1). The team also attempted to explore the status of water use within the watershed. This paper attempts to summarize progress made by the team thus and for proposes further research work based on their initial findings.

Administratively, the watershed under the study falls under Khadgabhanjyang Village Development Committee (VDC) Ward Number 4, 5, 6 and 7 and Charghare VDC Ward Number 7, Nuwakot District, Bagmati Zone. Geographically, it is situated at 85° 05' 45" to 85° 06' 57" E longitude and 27° 52' 07" to 27° 53" 32" N latitude. The area of the watershed is 2.45 sq. km. and has an altitude of 515 m amsl to 1,000 m amsl. The watershed lies in the middle mountain range of Nepal with southward facing steep slope. Subtropical climate persists in the area with average annual rainfall of 1,847 mm and maximum to minimum temperature variation of 38° C to 6° C.

WATER RESOURCES

The main stream within the study area is Bholre Khola. This Khola has different names at various location along its 3.4 km length, Gandapani Khola at the head, Bhorle Khola next, then as Judi Khola, and finally as Dware Khola before entering the Trishuli River. It has four named tributaries Rakte, Simpani, Majhi and Ganpani Khola and a few others having no names. The Khola starts at an altitude of 955 m amsl and ends at 515 m amsl. The estimated mean monthly flow of the river is presented in Table 1.

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19 Senior Engineer, Ministry of Water Resources, Nepal.
Table 1: Estimated monthly flow

<table>
<thead>
<tr>
<th>Month</th>
<th>Discharge lps*</th>
</tr>
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<tbody>
<tr>
<td>January</td>
<td>45</td>
</tr>
<tr>
<td>February</td>
<td>41</td>
</tr>
<tr>
<td>March</td>
<td>34</td>
</tr>
<tr>
<td>April</td>
<td>29</td>
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<tr>
<td>May</td>
<td>33</td>
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<tr>
<td>June</td>
<td>114</td>
</tr>
<tr>
<td>July</td>
<td>470</td>
</tr>
<tr>
<td>August</td>
<td>595</td>
</tr>
<tr>
<td>September</td>
<td>469</td>
</tr>
<tr>
<td>October</td>
<td>207</td>
</tr>
<tr>
<td>November</td>
<td>73</td>
</tr>
<tr>
<td>December</td>
<td>49</td>
</tr>
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</table>

* Using WECS Method

IRRIGATION SYSTEMS

There are 15 irrigation systems utilizing water from the watershed, of which, 9 systems divert water from the main stream and the remaining 6 from the tributaries (Figure 2). The total command area of these systems is 178 ha of which 11 ha is served by 13 irrigation systems and lies within the watershed and the remaining 167 ha is served by two irrigation systems, namely Archalephant (15 ha) and Pokharephant Kulo (152 ha), lies outside the watershed. The general features of the irrigation systems are shown in Table 2.
Figure 1: Location Map
Figure 2: Streams with Irrigation Offtakes
All the irrigation systems have temporary brushwood type weir for diversion and small earthen canal for conveyance. Formal organization for system operation and maintenance exists only in Judi Kulo. Operation and maintenance of the canal system is performed on mutual understanding.

**DOMESTIC WATER USE**

In the past water supply for domestic use was from small springs. People used to carry water from the springs in Gagris and Ghaintos (metal containers) (eastern vessels). It was only in 1990 that pipes were laid for supplying water for Pusuntar and Pokhariya. The project faced resistance from the irrigation users at the beginning marking the beginning of the intra-sectoral conflict on water.
There are 5 intakes for drinking water supply within the watershed. Out of these schemes, 3 intakes (Rakte, Simpani and Majhi Khola) are providing service within the watershed. One intake (at Gandapani Khola) is provides service outside the watershed (Charghare VDC). The remaining one providing partially outside the area. It is observed that there exist a few pipelines being laid individually to fetch the spring water to the tap. General features of the water supply schemes are given in Table 3.

<table>
<thead>
<tr>
<th>Area</th>
<th>VDC Ward No</th>
<th>Intake/Source</th>
<th>No of Water Taps</th>
<th>Household Served</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pusuntar, Majhigaun, Pokhariya</td>
<td>Khadgabhanjya ng 4,5</td>
<td>Thulo Pandhero, Simpani, Majhi Khola</td>
<td>14</td>
<td>154</td>
<td>piped supply</td>
</tr>
<tr>
<td>Chhapthok</td>
<td>Khadgabhanjya ng 4</td>
<td>Rakte Khola</td>
<td>6</td>
<td>50</td>
<td>piped supply</td>
</tr>
<tr>
<td>Chainpur</td>
<td>Khadgabhanjya ng 4</td>
<td>Gandpani Khola</td>
<td>5</td>
<td>52</td>
<td>piped supply also supplies outside watershed</td>
</tr>
<tr>
<td>Chainpur Charghare</td>
<td>7 Gandapani Khola</td>
<td>4</td>
<td>29</td>
<td></td>
<td>piped supply, are all outside watershed</td>
</tr>
<tr>
<td>Nuwakot-Jogidanda</td>
<td>Khadgabhanjya ng 6</td>
<td>Bhyaure Khola</td>
<td>1</td>
<td>29</td>
<td>Brings water from outside the watershed</td>
</tr>
</tbody>
</table>

Each of the public water supply systems has a diversion intake usually located away from the settlement area, a main conveyance system, collection reservoir and network of taps. Maintenance has been very minimal although some systems use to raise money and employ a person to carry out the work. The user organizations that were formed during construction phase have remained largely inactive.

**OTHER WATER USE**

Water is used for livestock and other rituals. Previously, few ghattas (water mills) were in operation but they do not exist any more after they were replaced by electric driven mills in 1987.

**OBSERVATIONS**

Although the watershed area is small, water use in the area is very intensive; characterized by 15 irrigation systems of different sizes, five
drinking water supply schemes and various other water uses such as livestock consumption and traditional water mill.

Water is highly competitive as the land and human requirement (demand) exceed the water resources (supply). The research team noted a few cases of conflicts, especially when the water supply scheme was being initiated. The team also noted the absence of formal mechanisms to share the water resources both for drinking water and for irrigation at the basin level. (However, the Water Resources Act, 1993 states the order of priority of water use. Drinking water is first priority and irrigation is given second priority).

In the recent years, the increase of population associated with increased activities such as increase in agriculture intensification and change in water use habits of the people such as use of piped water for drinking and sanitation, has resulted in increase in the demand of water in the basin. The supply of water already falls short of the demand. The demand aspect of water resources is compounded with the existence of two agricultural areas, namely Pokharephant and Archalephant, which though located outside the physical boundary of the watershed are dependent on the water available in the watershed. These facts have initiated conflicts among the users with regard to which system in the area has prior use right with respect to the other. Although, the conflict is not very apparent at present, it is going to be serious as the pressure of the resources increases in the future.

It is typical of many small and medium sized watershed areas in the hilly region like Pokharephant and Archalephant. They are heavily dependent on the water resources of the watershed. This has prompted the research team to conceptualize the approach of water use domain for understanding a watershed. The available water meets the water demand at present and for the coming future too based on the potential water consumption scenario for the area within the physical boundary of the watershed. However, including the committed flow for the dependent areas, the watershed is already exhausted. The study of a watershed area without due consideration of water use domain outside the physical boundary may mislead the conclusion.

As the water resources become stressed, water users in an area naturally start transforming themselves into a number of ways. The people in the Bhorle Khola watershed area have also realized the situation and started taking remedial measures. The research team had noted two important
changes taking place in the watershed, the first is the proper management of the watershed and the other is the introduction of water harvesting techniques. The first is a management tool and the second is an adoption of a new technology. Similarly, the farmers in Archale have started lifting water from the Trishuli River, the outfall of the watershed area. There has been a study recently concluded to supply water from the Trishuli River to Pokharaphant under an irrigation project in the area. In other words, the stressful situation of the resource has prompted to seek for technological intervention.

Water available within the watershed is not only used for irrigation, but also for domestic and other uses. Due to increased economic activity and population growth, competition over the use of the resource is increasing. As irrigation being the largest consumer of water, irrigation sector has been on more pressure as compared to others. Irrigation alone used to be dominant water use element in the past, but population growth and other economic activities have now necessitated the irrigation sector to accommodate them in its consumption spectrum. Within the irrigation sector itself, there is competition between the upstream and downstream users. The challenge ahead is to satisfy the demand of all sectors and also to develop efficient linkages between upstream and downstream users so that the scarce resources will be used optimally. The Bhorle Khola watershed is a typical case, which involves all these processes. An in-depth study of the linkages in the watershed would provide a window for basinwise planning or planning at watershed level addressing all types of needs.

**NEED FOR FURTHER RESEARCH**

With increased competing demand of water between and among different sectors, it is evident that the planning and development of water resources should not be based on the single sector approach as it used to be in the past. There is thus a need to take into account the multiple use of water in a watershed with sound understanding of linkages between the uses of different sectors, within each of the sectors, at different locations of the watershed and at different spreads of the time. It is very recently that a need of adopting an integrated approach of water resources development on a basin wide basis has been realized. There have been little research works, especially in Nepalese social economic setting, which could give a direction for adopting a correct approach for a basin wide planning. The proposed study will be a significant endeavor to pave the way for such research in this area.
The proposed study is different from the previous study in that the previous study tested methodologies in preparing the resource inventory of the area while the present study aims to examine the pattern of the social and technological interfaces under the given geophysical setting of the area. Although the area of watershed is relatively small, the study is expected to provide good lessons and sufficient groundwork to carry out future study in detail in bigger area to learn more on basin wide water resources planning under Nepalese socio-economic setting.

The methodology of preparing inventory of water uses would help develop the tool, which can be used in other watersheds. The outcome of the study will help water resources planning for the benefit of FMIS at micro level as well as at the district level. In analyzing the multiple use of water, GIS and other technologies will be tested.

**OBJECTIVES**

The objectives of the study are to investigate on the various uses of water in the Bhorle Khola watershed with special focus on the linkages between them, identify issues and constraints for an integrated approach of water resources development, establish and test methodologies and suggest an appropriate approach for basinwise water resources planning.

The objectives of the study, in particular, are to:

- Identify the multiple use of water within a watershed;
- Study and document pattern of negotiation for the resource utilization between different sectors;
- Study and document pattern of negotiation for water use between upstream and downstream users; and
- Access environmental impact on the availability of water use.

**METHODOLOGY**

The methodology for carrying out the research work would constitute of the following:

**Literature Review**

This part of the activities would constitute review of a broad spectrum of literatures in a number of disciplines which can throw light on integrated
planning of water resources in a basin, optimization of water use, and linkages between different sectors on water use on social, geographical and spatial interfaces. Literatures, case studies and project studies that involve participation of users in resource allocation and distribution between different sectors and at different time and space will be reviewed. Literatures, which have documented the process of environmental changes in relation to the water use and water demand over time, will also be studied in detail. The main aim of literature review will be to review and have a good understanding of the present status of knowledge base.

Field Works

The fieldwork will be carried out in three phases as follows:

Primary Fieldwork

During this stage of the fieldwork, the research team will visit the Bhorle Khola watershed area in order to have first hand information of the study area, re-verify the information collected during the previous study lead by Mr. Puspa R. Khanal, identify key informants in the area, conceptualize the nature of data that are available in the field and the required format of questionnaires and data sheets to fetch them in the detailed fieldwork phase.

Detailed Fieldwork

This part of the fieldwork will start immediately after completing a brief study phase following the primary fieldwork. The research team will collect detailed information from the field using questionnaires and data sheets, walkthrough in the area, simple surveys and observations and interaction with the people in the area.

Supplementary Fieldwork

This part of the fieldwork will take place during and at substantial completion of the study and analysis. This part of the fieldwork is aimed to collect time variant data from the field as well as to verify some hypothesis and assumptions that would arise during the study and analysis.
Study and Analysis

The data collected from the field will be analyzed in the background of conceptualized approach during literature review phase. The inventory of various uses of water in the study area will be prepared. Suitable GIS tools will be utilized to present and analyze the data. In doing so, a procedure will be followed and documented for use at later stages. The experience gained and particular lessons learnt during the study will also be documented. A number of assumptions will be hypothesized to establish linkages of the resource utilization between different sectors, different locations and different time frame. These assumptions will be tested against the information obtained from the field. The availability of water resources over time will be observed at various critical locations of the basin which will be useful to draw critical conclusion on water utilization and allocation and to access environmental impact of the availability of water use. The assumptions and analysis will be supported with the supplemental information to be collected during the supplemental fieldwork.

Change of Study Area

The study team investigated on the alternative sites that would better cover the objectives of the study. In this regard, three possible sites in Ilam district namely Ghatte khola, Jhutre Khola and Dhuwa Khola were identified and a brief site visit to the area was carried out. Out of the three sub-basins, Dhuwa Khola Sub-basin appeared most suitable for the purpose of the study.

Dhuwa Khola Sub-basin lies to the north-west of Ilam town in Ilam district of Nepal. The Sub-basin has an area of about 20 sq. km and covers two VDCs namely Jamuna and Mabu. A large part of the basin is covered by forest and the remaining is used for agriculture. The water of the basin is widely utilized for irrigation in the area with numerous traditional irrigation systems built by the farmers themselves. Department of Irrigation through its Irrigation Sector Project has supported one of the irrigation systems namely Dhuwa Khola irrigation sub-project. The VDCs are very active in water resources development and conservation. They have a good record of resources in the area. With the cooperation from a local NGO named Namsaling Community Development Center, they have prepared VDC profile identifying the resources and framing out development activities which include water resources, forest conservation,
rural roads, schools and health posts. They are also hosting Area Water Partnership (AWP) organizing activities under Nepal Water Partnership/GWP. AWP is a stakeholders' forum which helps in promoting Integrated Water Resources Management (IWRM) at the local level.

There exist a power generation plant in the area of the capacity of 10 Kw and another plant of about 14 KW is under study. There are three or four more potential sites for micro hydro plants.

This area seems more appropriate than Khadgabhanjyang in Nuwakot in the following counts:

- The area of Dhuwa Kholo is 20 sq km compared 2.45 sq km of Khadgabhanjyang, which will provide better coverage of the issues related with water resources. The outcome of this study on Dhuwa Kholo Sub-basin would provide better scope of replication.
- The local organizations related with water resources are multiple and in better shape in Dhuwa Kholo.
- The local organizations are active in environmental conservation in Dhuwa Kholo.
- The water resources management aspects in Dhuwa Kholo are matured compared to those in Khadgabhanjyang.
- There is hydropower plant in Dhuwa Kholo area with more likely to come in future while in Khadgabhanjyang there is no possibility of such plants. This would provide one more interface to the study to look at.

Given the above benefits of Dhuwa Kholo Sub-basin over Khadgabhanjyang Sub-basin, the study team has decided to select the Dhuwa Kholo Sub-basin as the next study area. The name of the study henceforth will be: Sub-Watershed Study on Dhuwa Kholo, Ilam.
REFERENCES


INTRODUCTION

The fertile land of Kathmandu district and the network of canal systems for its irrigation are considered as the unique feature of this district which has contributed for the promotion of art and architecture reflected in the temples, art and artifacts as well as social tradition of this district. We shouldn't ignore this fact while studying the irrigation management of this district.

According to the findings prepared on the basis of inventory (Attachment 1) 51 Village Development Committees (VDCs) of this district have 13,114 ha irrigated land whereas the report in 1997 (Nirmal Kumar et. al., 1999 District Profile. Kathmandu: National Research Associates) shows that Kathmandu district has 4,400 ha irrigated area.

Systems

From preliminary data, it shows that there are 238 irrigation systems in 51 VDC. Among them, 14 systems are Rajkulo (State supported Irrigation Systems in Kathmandu District).

Transportation and Irrigation System

From the survey, it is found that 44% of irrigation systems are located in less than 1 km from road head, 22% are 1 to 3 km, 7% are 3 to 5 km and rest others are (17%) more than 5 km away from road head.

Water Source and Irrigation System

Among 238 systems, 18% of irrigation systems have reported that spring is the source of water. 21% has stream as the source of water and the others (61%) have rivers as the source of irrigation water. The main rivers in

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1 Secretary, Kathmandu District Unit, National Federation of Water Users' Association, Nepal.
Kathmandu District are Bagmati, Bishnumati, Dhopikhola, Manohara, Ghattekhola, etc. Every irrigation system has adverse impact due to water pollution and mining of sand from the rivers.

**Water Availability**

From the data, 44% systems have sufficient water. 14% reported that they have only seasonal irrigation. 28% did not responded in this regard. Among the total number of irrigation systems, 14% can not get water for spring crops.

**Construction Year**

Out of the total systems, 9% are constructed between 1 to 20 years ago, 4% are constructed 20 to 50 years ago, 3% are constructed between 50 to 100 years ago and 81% of systems were constructed more than 100 years ago. Information of 3% systems are not available.

**Source Management**

Sources of 53% systems are open gate, 25% have control structures and 22% have temporary intake structures.

**Length of System**

Out of the total systems, 74% of systems have canal length between 1 to 2 km, 22% have 2 to 4 km, and 4% have 5 and above.

**Command Area**

13% systems have less than 10 hectares command area, 52% systems have 10 to 40 hectares, 19% systems have 40 to 100 hectares and rests of the systems have more than 100 hectares.

**Topography**

154 systems are in valley bottom at the plain area and 102 systems are in hill terraces. Altogether 20 systems are found in both plain and terrace areas.
Present Condition of System

Among the systems, 12% systems are considered in good condition, 38% have average condition and 38% are in bad condition. Other system's condition (12%) is not mentioned in the report.

No. of Users

- 5% systems have less than 100 users;
- 32%, systems have between 100 to 300 users;
- 39% systems have between 300 to 1000 users;
- 20% systems have more than 1000 users;
- 10 systems have above 4000 users;
- Information is not available in 4% systems; and
- It's necessary to activate WUA to take data about the users.

Water User Association

In the preliminary data, 52 systems choose their WUA members by election, 3 systems are governed by appointed persons. 107 systems are managed by other persons who are not related to the systems and 76 systems have no information in this regard.

WUA Meeting

There is no system of arranging any meeting in 85% irrigation systems. 10% systems hold meeting once or twice in a year and 0.4% systems arrange meeting 3 times or more in a year. WUA is not activate in many systems.

Water Distribution

Water distribution plays important role in water management. 46% farmers distribute water by themselves. WUAs distribute in 8% and 46% have no management in water distribution. In such situation, the conflicts regarding water distribution occur frequently. With the "Might is Right" principle reigning in the distribution of water, there is much disproportionate distribution of water. This might have resulted due to lack of WUA organization or its weakness. In 34% systems, water distribution is continuous and other 64% systems have rotational water distribution. Under rotation system, water distribution is very important. 2% of systems
have no information about water distribution.

**Resource Mobilization**

In many systems, labor is mobilized as internal resource for operation and maintenance. Among all those 238 systems, 128 systems mobilize labor as the main source of resource, 12 systems mobilize cash and labor and 40 systems mobilize cash collected from external source. Only 75% systems reported the method of resource mobilization for the irrigation system management.

**Maintenance**

Situation of 5% of the systems is good, 57% are in average condition and 32% are in very poor condition. These days, 32% systems are in very bad condition. The rest 6% have no information in this regard.

**Agricultural Condition**

There are 14 irrigation systems, which cultivate only one crop. 217 systems cultivate one to two crops in a year. There is only one system which has cropping intensity over 200 in a year.

**Possibility of Increasing the Irrigation Area**

64% of the irrigation systems have possibility of increasing the irrigated area. 36% systems have no possibility at all. 79% of the system shows the possibility of intensification of the irrigation and 20% systems indicated that there is no possibility of such practice. 77% systems have reported enough water for irrigation whereas 19% have acute shortage of water for irrigation.

**Main Problems Observed during the Study**

- Decrease of bed-level of the river with excessive sand mining for building constructions in the urban areas around Kathmandu Valley;
- No appropriate mechanism of maintenance and repair;
- Leakage of water from the canal;
- Inactive and passive WUAs;
- Risk of flood and landslides;
- Water shortage;
- Lack of people's participation; and
- Inequitable water distribution.

The summary of the findings is shown in Table 1.
## Table 1: Kathmandu District Irrigation Systems Inventory

<table>
<thead>
<tr>
<th>Total No. of VDC</th>
<th>Total No. of Irrigation System</th>
<th>Total No. of Rajkulo</th>
<th>Distance from Main Road (in km.)</th>
<th>Source of Water</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Up to 1</td>
<td>1 - 3</td>
</tr>
<tr>
<td>51</td>
<td>238</td>
<td>14 (6%)</td>
<td>114 (48%)</td>
<td>53 (22%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Water Availability</th>
<th>Construction Year (in year)</th>
<th>Type of Source</th>
<th>Length of Canal (in km.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abundant</td>
<td>Seasonal</td>
<td>Not Available</td>
<td>1 - 20</td>
</tr>
<tr>
<td>106 (44%)</td>
<td>34 (14%)</td>
<td>66 (28%)</td>
<td>21 (9%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total Command Area (in ha)</th>
<th>Command Area (in ha)</th>
<th>Topography</th>
<th>Present Condition of Canal</th>
<th>No. of Users</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Less than 10</td>
<td>10 - 40</td>
<td>40 - 100</td>
<td>Above 100</td>
</tr>
<tr>
<td></td>
<td>13114</td>
<td>37 (16%)</td>
<td>125 (52%)</td>
<td>44 (19%)</td>
</tr>
<tr>
<td>Member of WUA</td>
<td>Annual Meetings</td>
<td>Water Distribution</td>
<td>Water Right</td>
<td></td>
</tr>
<tr>
<td>--------------</td>
<td>-----------------</td>
<td>--------------------</td>
<td>-------------</td>
<td></td>
</tr>
<tr>
<td>Appointed</td>
<td>Elected</td>
<td>Not Related to Committee</td>
<td>Not Available</td>
<td>No Meeting</td>
</tr>
<tr>
<td>52</td>
<td>3</td>
<td>107</td>
<td>76</td>
<td>213</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Resource Mobilization</th>
<th>Condition of Maintenance</th>
<th>Agriculture Practices Crops Grown in a Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal</td>
<td>External</td>
<td>Good</td>
</tr>
<tr>
<td>Labour</td>
<td>Cash</td>
<td>Kind</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Problems</th>
<th>Expansion of Compound</th>
<th>Irrigation Intensity Increase</th>
<th>Enough Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>152 (64%)</td>
<td>86 (36%)</td>
<td>188 (79%)</td>
<td>48 (20%)</td>
</tr>
</tbody>
</table>
INVENTORY OF IRRIGATION SYSTEMS IN KATHMANDU DISTRICT

Form No:………..

Name of the Irrigation System.................................................................

A. **Location:** VDC Name: Name of the village(s)
   Distance from nearest roadhead

B. **Physical Characteristics**

<table>
<thead>
<tr>
<th>Source of Water</th>
<th>Spring</th>
<th>Stream</th>
</tr>
</thead>
<tbody>
<tr>
<td>River</td>
<td></td>
<td>Name………..</td>
</tr>
</tbody>
</table>

Water availability in command area
Sufficient [ ]  [ ]
Seasonal [ ]  Shortage in spring

Year of construction ………………………

Number of Irrigation systems Upstream [ ]  Downstream [ ]
Intake Free [ ]  Regulated [ ]  Temporary [ ]
Canal length ………………. Command area……………………
Terrain Plain [ ]  Terraces …………….

Present condition of the channel…………………..

Problem identified

C. **Institutions**

Number of users:………………

Users Committee members Recruited [ ]  Elected [ ]  Appointed [ ]  No official [ ]
Annual meetings No ☐ One time ☐ Two time ☐

Who supervises water distribution………………………………………

Is there water distribution rules……… Punishment for water theft……

Water distribution Continuous ☐ Rotation ☐

Water right at the system level Yes ☐ No ☐

At farmers level Yes ☐ No ☐

Resource mobilization for O&M Labor …… Cash…… Kind ……

Internal resources……………… External resources………………

Present Status of maintenance Good ☐ Fair ☐ Poor ☐

D. Agriculture

Crop Coverage by area Paddy… Wheat… Maize… Others… %.

Crop/month J F M A M J J A S O N D 1 2 3

How many crops a year? Paddy Wheat Maize/? Others

Area covered (in ropani) …………… …………… ……………

E. Problems identified

Can area be expanded?
Can intensity be increased?
Can there be assured supply of water?

F. Others
INTRODUCTION

This paper is the summary of the functioning of irrigation systems which were surveyed and analyzed by Devi Dutta Devkota under the supervision of Prachanda Pradhan. The detail report is prepared in Nepali. They are documented in Farmer Managed Irrigation Systems (FMIS) Promotion Trust's Library.

Jumla is one of those water abundant districts of Nepal. There are many river systems in this district. The rivers that flow from this district contribute water to other major rivers of Nepal like the Karnali River which is one of the major rivers of Nepal with 28,000 m$^3$/s of water during peak period and about 350 m$^3$/s during lean period at Chisapani of Kailali district.

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1 Researcher and Social Worker, Jumla District, Nepal
This is one of the highland remote districts of Nepal. Besides livestock and horticulture, paddy cultivation also occupies an important place. The paddy cultivation is done mainly in Tila Valley and Sinja valley of this district. It is estimated that there is 1,507 hectare irrigated land. The yield of paddy is reported to be only 2.0 ton/ha.

**Study Area**

The study is confined to the area of the Tilla river and its tributaries. Accordingly, 12 irrigation systems from Danasangu to Kurai have been selected for detail study. The summary of the study is given in Table 1. The selected irrigation systems are the bigger ones. Out of those 12 systems, nine of them have enough water for paddy cultivation. Out of twelve systems, six of them were 600 years old and other six systems were 200-500 years old. It is believed that the paddy cultivation started in Jumla in 1460 (Bikram Sambat) i.e. in 1516 A.D. The legend says that the paddy was imported from Kashmir by Chandannath Baba, the protector God of Jumla District. The paddy cultivation revolves around the instructions circulated by Chandannath Baba temple. The date for seed bed preparation and transplantation of the seedlings would be announced by the temple priest and the paddy cultivators follow the schedule strictly.

**Features of the Irrigation Systems**

The study shows that the longest channel is of 11km long and the shortest one is of 2 km long. The average length of the canal is 5.5 km long. Among those 12 systems, the largest command area is of 50 hectare and smallest one is of 4 hectare. They are earthen channels. There are many leaking points along the channel.

In those difficult places, the water would be conveyed with the help of wooden aqueducts locally known as "panala". In all those 12 irrigation systems, wooden aqueducts were installed. Thinke system of 4 km long with 11 hectare irrigated area has 13 wooden aqueducts of different sizes and shapes whereas in Gairung system of 2 km with 31 hectare land has only one aqueduct. The wooden aqueduct is made locally out of pine trees by the local craftsmen. They need to be replaced in 4-5 years time.
IRRIGATION MANAGEMENT SYSTEM

The paddy Jiula (land) belongs to the land owner. The land owners select between 2-6 canal operators (Kumthi in local language) in the month of February each year.

Functions of the Canal Operator (Kumthi)

- To make the water flow smoothly in the channel.
- To undertake annual and emergency maintenance
- To distribute water to the paddy fields of the water users. Sometimes, water distribution will be on rotation basis.
- To inspect the channel daily and undertake minor repair and distribute water to each paddy field
- To apply different types of water distribution mechanism to ensure the supply of water in the paddy field.

Facilities to Canal Operators

The Kumthis will be remunerated for their job in kind. A quintal of paddy/hectare will be remunerated to the Kumthis. Some land owners pays NRs. 1600 to the canal operator (Kumthis). In most of the case, paddy will be remunerated. However, cash payment is also frequently taking place.

Regulations Governing the Punishment and Fines

If it is found that water stealing has taken place, the culprit would be identified, a fine of NRs. 20-100 will be imposed. If he disobeys the fine, the water supply to his farm will be cut off.

Labor contribution for annual maintenance or emergency maintenance is to be made by the landowners. Those who fail to be present during such occasion, fine will be imposed on them at the rate of NRS. 50-150. The amount thus collected will be shared by those "Kumthis".

Annual worshipping to the canal takes place at the time of first flow of water in canal in that year. The money collected out of those fines would be used for such purpose.

Water distribution is, in some systems, done through proportioning weirs. The proportioning weirs are made of stone and mud. Such distribution system includes "Aat" (branch canal) and "Cheta" (outlet).
Paddy Cultivation Methods in Jumla

Tilla valley is situated at an altitude of 2500 meter. Hence, paddy cultivation requires special preparation.

- In March (Chaitra 12) the paddy seed would be soaked in water for 4 days. This job will be done at the village itself.
- In March (Chaitra 16), seed would be taken out from water
- The seed would be kept in warm place inside the house. This will allow to sprout the seed.
- In March (Chaitra 20), paddy seed bed would be made and allow the paddy seedlings to grow.
- In first week of June, paddy transplantation takes place. Paddy seedlings would take two month to grow.
- Hence, the canal repair and maintenance has to be completed by Chaitra 12. This is the date when first activity of seed bed preparation takes place.
- During plantation period, water distribution will be done on the basis of day. In some village, the distribution schedule is fixed. In some village distributions schedule will be agreed in the meeting of the irrigators.
- Paddy harvesting would be done in October- November (Kartik). It takes about 8 months for paddy to ripe. The paddy crops remain in the field for 6 months. Altogether it takes 8 months to grow paddy in Jumla.
<table>
<thead>
<tr>
<th>S.N.</th>
<th>Name of VDC</th>
<th>Name of the System</th>
<th>Village Name</th>
<th>Water Source</th>
<th>Water Availability</th>
<th>Construction Year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Spring</td>
<td>Stream</td>
<td>River</td>
</tr>
<tr>
<td>1.</td>
<td>Mahat Gaun</td>
<td>Raulajiulo kulo</td>
<td>Ward No. 1-3</td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>Kattikshwami</td>
<td>Danasangu Kulo</td>
<td>Ward No. 1-6</td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>Taliun, Lamra</td>
<td>Arenti Kulo</td>
<td></td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>Pansayadara Kudari</td>
<td>Kudari Seri</td>
<td>Ward No. 1&amp;2</td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>Kattikshwami</td>
<td>Silam Kulo</td>
<td>Ward No. 2-8</td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>Chandannath</td>
<td>Sera Kulo</td>
<td></td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>7.</td>
<td>Chandannath &amp; Mahat VDCs</td>
<td>Gairam Kulo</td>
<td>Chandannath VDC 1 &amp; 8, &amp; Mahat VDC 1-6, and Kattikshwami 1&amp;2</td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>8.</td>
<td>Chandannath</td>
<td>Majh Kulo</td>
<td>Village of Chandannath</td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>9.</td>
<td>Chandannath &amp; Mahat VDCs</td>
<td>Talichaur Kulo</td>
<td>Village of those VDCs</td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>10.</td>
<td>Chandannath</td>
<td>Think Kulo</td>
<td></td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>11.</td>
<td>Hanku</td>
<td>Giddi Raj Kulo</td>
<td>Ward no. 1-9</td>
<td>-</td>
<td>-</td>
<td>3</td>
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<tr>
<td>12.</td>
<td>Kattikshwami</td>
<td>Upperkhet Kulo</td>
<td>Ward No. 1</td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>Diversion Structure</td>
<td>Length of Canal</td>
<td>Command Area</td>
<td>Topography</td>
<td>Present Condition of Canal</td>
<td>Identified Problem</td>
<td>No. of Users (in person)</td>
</tr>
<tr>
<td>---------------------</td>
<td>----------------</td>
<td>--------------</td>
<td>------------</td>
<td>-----------------------------</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>5 km</td>
<td>10 ha</td>
<td>3</td>
<td>Leakage &amp; decrease in fertility</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>7.382 km</td>
<td>50 ha</td>
<td>3</td>
<td>No maintenance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>4.8 km</td>
<td>18.75 ha</td>
<td>3</td>
<td>Can't get financial support from any sector</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>12 ha</td>
<td>3</td>
<td>3</td>
<td>Changing direction by the river no maintenance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>5.8 km</td>
<td>13.4 ha</td>
<td>3</td>
<td>Canal is earthen so it will be damage several time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>5.7 km</td>
<td>4.5 ha</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>31.25 ha</td>
<td></td>
<td>3</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>4.73 km</td>
<td></td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>4.4 km</td>
<td></td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>4.2 km</td>
<td>11 ha</td>
<td>3</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>11.8 km</td>
<td></td>
<td>3</td>
<td>-</td>
<td></td>
<td></td>
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<tr>
<td>3</td>
<td>1.9 km</td>
<td></td>
<td>3</td>
<td>Can't maintain by users</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting of Committee</td>
<td>Water Distribution</td>
<td>Water Right</td>
<td>Resource Mobilization for Condition of Maintenance</td>
<td>Agriculture Practices</td>
<td>Others</td>
<td></td>
</tr>
<tr>
<td>----------------------</td>
<td>--------------------</td>
<td>-------------</td>
<td>--------------------------------</td>
<td>------------------</td>
<td>--------</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Internal</td>
<td>External</td>
<td>Good</td>
<td>Average</td>
</tr>
<tr>
<td>If needed then call for villagers (no committee)</td>
<td>Kumthi</td>
<td>3</td>
<td>yes</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Kumthi's discussing each other in Jestha &amp; Ashad about the system (no committee)</td>
<td>Kumthi</td>
<td>3</td>
<td>yes</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Kumthi's discussing each other in Jestha &amp; Ashad about the system (no committee)</td>
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</tr>
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<td>3</td>
<td>yes</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
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<td>---</td>
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<td>---</td>
</tr>
<tr>
<td>For emergency, they call for users (no committee)</td>
<td>Kumthi's discussion</td>
<td>3</td>
<td>yes</td>
<td>3</td>
<td>3</td>
<td>3</td>
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<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>For emergency, they call for users (no committee)</td>
<td>Kumthis</td>
<td>3</td>
<td>yes</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>---</td>
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<td>3</td>
<td>yes</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
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<td>For emergency, they call for users (no committee)</td>
<td>Kumthis</td>
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<td>yes</td>
<td>3</td>
<td>3</td>
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</tbody>
</table>
This paper proposes to look into the factors for the multifunction of Water Users Associations (WUAs) for irrigation management. Most of WUAs in Nepal are single water related function organization. One of the objectives of this paper is to look into the causes and factors why only a few multifunction WUA are operating in Nepal. In Nepal, many of them remain single function organization. Some of the reasons might be that the farming system in Nepal is subsistence agriculture. The economics is that you consume what you produce. As the result, there is not much surplus to exchange. Secondly, the agri-inputs are also supplied from within the households like compost manure and cow dungs, which are usually collected at the household level. The application of chemical fertilizer and insecticides are very low. They do not undertake collective activity for procurement of these inputs. On top of that, the application of these inputs are way below the prescribed dose. However, they are very active in water related activities from intake repair to desilting of canal and water distribution, maintenance of the system, and resource mobilization. By and large, except a few examples of multifunction WUAs from Philippines, People’s Republic of China, Taiwan, Vietnam, Niger and countries in Eastern countries, there are many examples of single function WUAs in many parts of the world.

OBJECTIVES OF THE STUDY

• This study is to find out the factors which encourage WUAs for adopting multi-function vis-à-vis single function.
• The second objective is to prepare the case study of examples of multifunction WUAs in Nepal
• The third objective is to look at the experiences of multifunction WUAs from the examples of other countries like Philippines, Vietnam, Taiwan, Niger, People’s Republic of China, Sri Lanka and Eastern European countries.
• Fourthly, policy implications in Nepal for the multifunction WUA.
RATIONAL OF MULTI-FUNCTION WUA

The recent trend is that WUAS are taking up, besides irrigation and water management, other activities as well. They have to engage with the needs of the members for other services. As members of WUAs are engaged in many activities in the farming as well as for domestic work for decent income for themselves and to have a secure and enjoyable living in the community, irrigation and water management are not always the only problem for them.

Members of WUA are working in agriculture. The farming profession needs besides water service, such as supply of farm inputs and credits, transportation and marketing of products, processing of these products, settling of disputes among themselves, receiving services and assistance from outside agencies.

Farmers are also engaged in other economic activities, social undertakings and cultural affairs. These functions and activities are of minor concern. Attention is to be given on agriculture services in order to have farmer's need fulfilled. Many activities in the agricultural profession are done individually by the farm family. Other activities need joint actions of farmers to receive the desired and satisfactory results.

One of the services is water supply to the farm land. It needs cooperation with other water users, joint actions for Operation and Maintenance (O&M) as well as for small repair works. WUAs get established because proper irrigation management is the need of the farmers.

Other functions and activities may be taken up by WUAs because there is a need for such services to the members. This can be due to poor access to services, cost effectiveness of the delivery of services and lower cost to the members. The need for multifunction organization is due to institutional vacuum, increase in viability and profitability, need of leverage, credibility and legitimacy, limited managerial capacity in the village. These extra-services to the members of WUA are for effective agricultural production. How can members of WUA receive these services in time, effectively and sufficiently for agriculture production and marketing of produce? Which major bottlenecks or problems are there to receive these services effectively and sufficiently? Which agriculture services may be organized by WUA jointly and what are the advantages for WUA if they organize these services jointly by themselves? Favorable conditions for a farmer
organization to multi-functional and factors which make it more difficult for WUA to become multi-functional are to be looked into. What support is needed by a WUA?

**CONTEXT OF MULTI-FUNCTIONAL WATER USERS ASSOCIATIONS**

There are examples of multi-functional water users associations from African and Asian countries. There are reasons for them to adopt multi-function WUA. On the other hand, there are only single function WUAs.

Members of Irrigation Cooperatives in Niger described by Abernethy et al., 2000, specially those cooperatives which were remote from roads, wanted the organizations to undertake purchase and resale of fertilizers and other inputs. The promoting agency had not anticipated this objective. The financial rules imposed on the organization made it very difficult for them to respond adequately to their member's wishes without risking bankruptcy. A result of this was alienation of the members from the organization and increased dependency of it on the promoting agency.

The objectives selected by the members may commonly be in such areas as input supply, marketing and provision of credit. However, organization may adopt much wider arrays of objectives and consequently multi-functions: fishing, forestry, crop processing, building of community centers, child care facilities, contract farming, transport facilities such as refrigerated vehicles, even hotels can be found among the activities and assets of specific organizations of irrigation farmers. Such examples are usually found from the experiences of People's Republic of China.

However, functional diversification has many risks. Frederiksen and Vissia (1998) warn against these multi-functional activities of irrigators organizations. They have negative view of multi-functional organizations: "the function and skills required for operation and maintenance of water sector services are quite straight forward and quite different from those commercial activities that could earn funds of any consequence. One does not find long established, successful water service entities engaged in activities unrelated to their water sector services".

This is sound guidance but it may not satisfy the present needs, specially in those countries where the private sector is weak or immature. Hence, farmers face real difficulties in some of the areas just mentioned. The problem (such as, Vietnam, that have followed central planning and
control of the economy until recent times and are now endeavoring to foster and active private sector) is that it may to-day seem logical for WUA to enter into a business such as fertilizer supplies. However, in course of time, we should also expect that merchants will appear who will have better business skills and will offer the same or better supply services than the committee of irrigators organization can provide. Hence, some of these diversified activities should be regarded as temporary.

In the newly formed WUAs in Eastern Europe like in Romania, it is proposed to have the formation of multi-function water users association. WUA development activity will include marshalling business support services to help WUAs improve their practices and operations. Over a period of several years, as subsidies to irrigation gradually disappear, WUAs will have to sustain themselves from their members’ irrigated production and product marketing. WUA on farm water management is expected to improve the potential to produce for markets rather than subsistence. The support for commercial enterprise activity is expected to increase.

The same logic tells us that the organization will need rules to constrain the freedom of its leaders to engage in such business. Cases have arisen where committees have been so enthusiastic in pursuing the kind of essentially temporary business opportunities just described earlier. In such situation, WUAs would have to commit the finance of the organization's finances heavily. This might result into poor performance of the core tasks of operating and maintaining the water system.

It is important to look at the multi-function of WUA from financial points of view. The classical model of FMIS in Nepal did not have large needs for cash. Traditionally, they would collect fees from members in kind or labor. Office bearers and functionaries such as water guards might be remunerated in terms of quantity of paddy or labor exemption for maintenance. Resource mobilization might mean principally the mobilization of a labor force from among the member households, to repair head works after a flood and to remove silts from channels.

WUAs that are the objects of current management transfer programs often have more complex situation in the financial sense. They may have to meet energy bills every month in pumping systems. They are often expected to raise an irrigation service from their members, and may have to pass a proportion of this to a government agency in return for water
delivery or other services. Their members may demand that they work with banks or others to develop a credit service.

There is a substantial amount of literature about the irrigation service fee and other aspects such as the collection efficiency, the mode of calculation and degree to which an irrigation service fee can cover normal operational costs. But on the other hand, there is remarkably little literature on the question of start up capital that a new organization will require. Often it seems to be assumed that if the fee is computed to exceed the operation costs, a reserve fund will accumulate, and the organization will be able to undertake capital investments of its own after a few years.

This void in the literature is remarkable. A WUA, after management transfer, is a type of business organization and should be evaluated as such. A businessman knows that the excess of income over expenditure, while it is necessary condition of business success, is not sufficient. Without adequate capital, a business will always be weak and struggling and unable to generate enough activity or perform enough services to maintain the support of its own stakeholders. It is just the same with an irrigators organization as with any form of business activity.

The amount of start up capital that such organization need must vary widely and will rarely be as high as in Niger example (because these are pump system in a country where energy is virtually all imported at high cost). Research on these requirements and on the impact of different ways of furnishing them (from government, banks, or members, by loan, grants or share purchase) is an urgent need.

**EXAMPLES OF MULTIPLE FUNCTION WUAs**

How can WUA get mandate for multi-function activities?

**Vietnam**

Agriculture Cooperative is also made responsible for irrigation management and water distribution, O&M of the irrigation systems. An Agriculture Cooperative undertakes multiple functions like irrigation management, negotiation with River Basin authority for allocation of water to the irrigation systems, agriculture input supply to the farmers, rice mill operation as business proposition and dealership of fertilizer distribution. On the other hand, such activities are also undertaken by
private shop keepers. However, the shop keepers get the supply from those co-operatives.

**China**

People's Republic of China has developed a system where water charge collection is done by WUA itself. WUA also plays a role in determining water charge in the sense that it adds a percent to water charge after taking into consideration the O&M and improvement needs of the irrigation sub-system, which is under its management jurisdiction. There is no provision of government subsidy for O&M in China. In order to mobilize the required resources, WUA is allowed to look for number of alternatives for resource mobilization. They are encouraged even to undertake small enterprises for the resource mobilization in order to sustainably manage the irrigation sub-system, and make further improvement therein. Diversified resource generating activities would include raising of fruit trees, operation of fishponds and vegetable farms, and opening of the irrigated area for recreation and entertainment. Desilted clay from the canal for brick making and renting out the agricultural equipment such as tractors are other examples of income generating activities (**Box 1**).

**Box 1: Changtang Branch Canal WUA**

The Changtang Branch Canal WUA in Tieshan irrigation and drainage district in Hunan Province, which covers 5 villages, 44 village groups, and has 1693 households with 7723 farmers and command area of 6087 mu (405.8 ha.), was established in 1995 immediately after the establishment of China's first WUA in Hongmiao, Jingmen Municipality in neighboring Hubei Province. Nine more WUAs have been established since then and their number is increasing. There is a plan to establish 5 more WUAs to cover the entire command area of the Tieshan northern irrigation canal by 1998. The reported cause for this popular acceptance of WUA include, in addition to the similar benefits as reported by the Hongmiao WUA of Hubei: generation of resources by getting into the diversified economic activities such as operating fish ponds, running a rice mill, provisional goods shop and the renting out a part of WUA office building; expansion of irrigation to parts of dry land; and substantial saving in emergency canal repair cost that farmers used to bear. However, they seek support in terms of lining of their canal and advanced training on on-farm irrigation management, WUA operations and accounting.

Sri Lanka

Sri Lanka has program to make WUA as multi-function organization. Instead of WUA, they have given name as Farmers Organization and tie in the Farmers organization for increasing agriculture production for consumption within the country and at the same time, these farmers organizations have to be capable to interact with environment brought by globalization of economy.

Taiwan

Taiwan has most effective WUA. WUA is effective technically and economically. Extension activities would go through WUAs so it has been effective there. Secondly, WUA has undertaken business activities like operation of the Farmers Bank. Farmers have confidence with the co-workers so they deposited their savings in Farmers bank. They have become even politically powerful because they have accumulated enough deposit in the bank. They even channel their deposit for the investment in the industrial sector.

POLICY ENVIRONMENT FOR DIVERSIFIED ACTIVITIES OF WUA IN NEPAL

- How can policy promote multi-function WUAs?

As of now, WUA is considered as non-entity in Nepal. They are not considered as the organizational resource at the grass root level. It is equally important to know about the environment whether they are allowed to undertake multi-function activities. On many occasions, WUAs are formed by the government only for rehabilitation of the irrigation systems. After rehabilitation, the importance of WUA gradually diminishes. It is also evident from the organization of WUA federation where about 340 government registered WUAs are the members in the National Federation of WUAs. They either ignored the existence of other thousands of FMIS WUAs in Nepal or they do not want to recognize them. This federation is the government sponsored organization. It has government support organizations only.
• Registration Process of WUA

They are registered under Association Act of Nepal

There are other provisions for the registration of WUA. It can be registered at District Water Resources Committee or under the District Irrigation Office under the new Irrigation Regulation. It can be registered under Cooperative Act as well.

Decentralization Act does not recognize WUA at the grass root. It mentions that VDC as well as Municipality and DDC have jurisdiction over the management of the irrigation systems within their geographical areas. There is no provision of users group in the Decentralization Act of Nepal.

• How do other agencies of the government look at WUAs?

The Department of Agriculture does not recognize WUA. They form separate commodity based small groups and extension would be provided through such groups. Even under Second Sector Irrigation Project where provisions were made for agriculture development and budget was allocated in the project for this purpose. The agriculture extension activities were undertaken through the farmers group formation, not through WUA which was formed at the time of rehabilitation. So WUA was forced to confine its activities only on water related activities.

Nepal Food Corporation could be important motivating organization for WUA to undertake multi-function while procuring annual quota of paddy and wheat. They could have fixed a certain level of price and enter into contract with WUAs for the procurement of the amount of food from them. Such approach could bring tremendous change in the activities of WUAs.

Agri-Input Corporation could have developed its network for seed production as well as for input distribution through the Water Users Associations. However, such activity to encourage the multi-function of WUA has not been encouraged.
REFERENCES


PART IV: RESEARCH FINDINGS ON FMIS IN THE CHANGED CONTEXT
PART VI: FINAL SESSION
FARMER PARTICIPATION IN RAJAPUR IRRIGATION REHABILITATION PROJECT:
FROM CONFIDENCE TO CONFUSION

DUMAN THAPA

CONTEXT

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

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

Examples galore when development interventions have failed due to the inability on the part of the implementing agencies to internalize the concept of people's participation. One of the glaring examples is that of an irrigation project in Rajapur island, Bardiya district, Far-West Development Region of Nepal, managed by the farmers themselves with indigenous skills and technology and local resources. The systems

1 Director, Mountain Resources Management Group, Nepal.
gradually deteriorated when a government agency intervened. The deterioration was in terms of not only the physical infrastructures but also the institutional aspects. The farmers lost the sense of belonging, sense of ownership and the consequent sense of responsibility so important for the sustainability of any development intervention.

**BRIEF INTRODUCTION TO THE RIRP**

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

**BRIEF INTRODUCTION TO PDR ON THE RIRP**

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

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

**FARMER PARTICIPATION IN RIRP**

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

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

As a result of this effort, the farmers actively participated in the different phases of the project. The role played by the farmers vis-à-vis other project
actors and the contributions made by them as also other project actors are documented in each PDR report. The Project Office had even recognized the traditional customs and practices of the farmers and their organizations, such as Sekuwa Pakuwa (income earned by Desawar from any contract work within and outside the system. This money is spent on feasts during the gathering of all Desawar of the system) and had internalized them in the project scope of work. Due to active farmer participation, vital and necessary changes were made in the initial project design and scope of work. Because of their indigenous knowledge and skills, the farmers were able to share and contribute many invaluable ideas to the project officials, which were gratefully considered and incorporated by the project officials, even by making changes in the project's design and scope of work. Without farmers' support and participation it would have been almost impossible to accomplish many of the project activities.

**PROBLEMS EMERGING IN THE COURSE OF PROJECT IMPLEMENTATION**

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

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

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

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

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

Due to the weakness of the CFC, the farmers were unable to voice their opinions on the design and construction of the structures. Consequently, the farmers always raised such questions such as: what are the first priorities in the construction work? how will the farmers' problems and needs be incorporated in the design? What are the activities being implemented by the project, etc.?

Increasing Dependence Syndrome among Farmers

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

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

Central Farmers Committee

CFC is an executive committee which represents the farmers in project development. The objective behind the formation of CFC was that it should play an active role in representing the farmers' voice, demands, interests, requirements, knowledge and experience, and mobilize resources in the planning, designing and construction stages of project development. Initially, the CFC was very active in the project planning phase. For example, it held several farmers' meetings, disseminated the project information, entered into agreements with the DoI on cost-sharing, determining the roles and responsibilities of the various actors in the project development and future project operation, formed branch canal committees and mobilized farmers for the construction of roads.
However, when the Project entered the construction phase, the CFC relapsed into inactivity. It could have played an important role in maintaining quality of work in the regular supervision, observation, decision-making, information dissemination to the farmers resolution of conflicts between the Project Office, contractors and farmers during the construction work. However, the CFC didn’t renew its constitution for several years. It did not organize even one meeting for several years. There were several reasons for the weakening of the CFC. They are lack of transportation and communication facility, inexperience and ignorance of KPCs regarding irrigation, political polarization; workload, lack of remuneration/incentives, increasing involvement of the farmers’ irrigation office-bearers in politics and lack of capital build up.

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

**Farmers' Irrigation Organization**

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

The Rajapur Farmers' Irrigation Organization didn’t become capable enough to assume future O&M of the irrigation system.
DoI has no separate unit for institutional capacity building of the farmers or members of water users or irrigators' associations whereas institutional capacity building is an integral and complementary component of the participatory approach. It contracts out the task of institutional capacity building to private consultancies. In view of the own priorities of the private consultancies, and as these consultancies do not have long-term association with the water users' or irrigators' associations, the farmers do not have a long-term and continuing mechanism for institutional capacity building as and when need arises.

In Rajapur, instead of strengthening the existing traditional organization of the water users, a new organization was created. As a result, the farmers lost their confidence of operating and managing their system and confusions were created among the farmers. Before the KPCs were very capable; however, their capacity was not built up; so, they became irresponsible.

The new organization of the farmers, i.e. the CFC, too, was not viable. Meetings were not held regularly; no general assembly was held for several years and its Constitution, too, was not renewed for years.

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

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

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

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

Description of the Village

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

The land use pattern is given in Table 1.

Table 1: The Land Use Distribution in the VDC Area

<table>
<thead>
<tr>
<th>Types of Land</th>
<th>Area (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Khet</td>
<td>594.37</td>
</tr>
<tr>
<td>Pokho/Bari</td>
<td>272.91</td>
</tr>
<tr>
<td>Minaha</td>
<td>867.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1734.28</strong></td>
</tr>
</tbody>
</table>

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

There was some variation in the information published by the Cadastral Survey office, Kaski. The information shows that 501 ha is Khet, 284 ha is Pakho/Bari, 626 ha is Minaha-is the land covered by forest, foot trails, river and other public land. 185 ha is still to be registered with the office. Khet is irrigated land suitable for rice cultivation. Pakho/Bari is the upland, which is not suitable for irrigated agriculture.
The figure indicates that the irrigable area as indicated by Khet in the VDC area is substantial. It also shows the potential for irrigation development in the VDC area.

Population and Ethnicity

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

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

The Landholdings and Land Tenure

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

The Farming System and the Principal Crops

The type of soil in the irrigated area is alluvial which is suitable for rice
farming and vegetable production. The cropping pattern in the area is rice based. The main cropping patterns for Khet land in the Chaurasi Kulo are rice-wheat-maize, rice-wheat-fallow, rice-fallow-maize. Farmers plant both improved and traditional varieties of rice in the area\(^3\). Wheat covers 40 percent of the lands. The Lumle Agriculture Research Centre\(^4\) played a crucial role in the development of the agriculture in the VDC area. Lumle had an out-reach station in the area for 17 years (1979-1996).

**Migration**

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

**Physical Facilities**

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

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

\(^4\) The research center was established with the assistance from the British Government to support government of Nepal in agricultural research and extension.
Existing Social Relationships

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

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

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

ENVIRONMENT OF THE IRRIGATION SYSTEM

The Irrigation System

This Chaurasi Kulo is a river valley irrigation system. The Yamdi Khola is the source for irrigation water and the discharge capacity of the temporary canal intake was 1.4 m³/second. The length of the main canal is 4.30 km. There are 10 outlets at present, which delivers water to the field channels. There is no canal lining in the field channels. The field channels provide irrigation water to the terraced fields. The main canal has five foot bridges.
There are 8 culverts, two drain inlets and four aqueducts. The permanent headwork of the main canal was constructed in 1999. Before that the headwork was temporary. There is lining on some parts of the main canal. The construction of a new irrigation system at the tail end of this scheme in 1983/84 divided the scheme into two (see Figure 1).

**The Irrigated Land and its Distribution by Ethnicity**

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

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

<table>
<thead>
<tr>
<th>S.N.</th>
<th>Size of Holding (ha)</th>
<th>Brahmia</th>
<th>Chhetri</th>
<th>Newar</th>
<th>Gurung, Magar and other Castes</th>
<th>Occupational Castes</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>&lt;0.25</td>
<td>70 (62.5)</td>
<td>28 (25.0)</td>
<td>5 (4.5)</td>
<td>1 (0.89)</td>
<td>8 (7.14)</td>
<td>112 (32.1)</td>
</tr>
<tr>
<td>2.</td>
<td>0.3-0.5</td>
<td>89 (66.4)</td>
<td>37 (27.6)</td>
<td>4 (2.9)</td>
<td>3 (2.2)</td>
<td>1 (0.74)</td>
<td>134 (38.2)</td>
</tr>
<tr>
<td>3.</td>
<td>0.55-1.0</td>
<td>46 (68.6)</td>
<td>20 (29.8)</td>
<td>1 (1.4)</td>
<td>-</td>
<td>-</td>
<td>67 (19.1)</td>
</tr>
<tr>
<td>4.</td>
<td>&gt;1.0</td>
<td>28 (75.6)</td>
<td>6 (16.2)</td>
<td>3 (8.1)</td>
<td>-</td>
<td>-</td>
<td>37 (10.6)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>233 (66.5)</td>
<td>91 (26.0)</td>
<td>13 (3.7)</td>
<td>4 (1.14)</td>
<td>9 (2.5)</td>
<td></td>
<td>350</td>
</tr>
</tbody>
</table>

*Note: The figures in parentheses are percentages*
Figure 1: Layout of Chaurasi and Annapurna Kulo Irrigation System
The distribution of land holdings in the irrigated area is highly skewed in favor of the higher caste groups, mainly Brahmin. The occupational caste groups who constitute 25 percent of the village population hold only 2.5 percent of the irrigated land. The information also indicates that almost 90% of the farmers own less than one hectare of land. The majority of the farmers have between 0.3 and 0.5 hectare. Ethnically, the majority of the farmers holding more than one hectare are from the upper castes. Among this Brahmin caste group also, one particular clan group holds most of the land. This is because they are the descendants of the family who were the early settlers in the area. Thus, any decisions related to the irrigation cannot be implemented without their participation.

**THE PROCESS OF INTERVENTIONS AND CHANGE**

**Irrigation under the Ditthawal up to 1960**

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

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

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5 The Birta system was abolished in 1959 through the Birta Abolition Act. With the abolition of the Birta the ownership of the land was vested in the government (Regmi, 1978: 27). However, Birta abolition was not a land reform measure and the Birta holders were allowed to retain the land, but they had to pay land taxes (Regmi 1978:361), which was not required before the Act. In this context, it seems natural for the *Ditthawal* to claim the ownership of the land as he was entitled to the proceeds from it for a long time (see next page).
which was for managing the irrigation system. At present the Ditthawal has got the legal entitlement of the land. The abolition of the Birta system, the land reform designed to bring agrarian transformation in the country and politico-administrative changes were instrumental for the disintegration of their traditional institution. The issue of the legal ownership of the land and the problem in the management of the irrigation scheme at present was the result of these three interventions. There were no known serious management problems in irrigation scheme before these interventions took place and when the position of Ditthawal was in existence.

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

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

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

The VP formed a Kulo Samiti (Irrigation Committee) to manage the irrigation system consisting of Village Panchayat members according to the former Pradhan Pancha, after the Partyless Panchayat system won the referendum. The study conducted by Shivakoti (1992:18) confirms this fact. The study indicated that the Kulo Samiti consisted of 11 executive members and 30 members at the branch level. A Pale (water guard) was employed to allocate water to the branch canals. He used to work under the direction of the Kulo Samiti. The effectiveness of the VP was gradually
diminishing after the referendum as the village was politically divided, although the Kulo Samiti was functioning. Hence, the VP could not enforce the rules. However, it did manage the system till 1990. The introduction of the Multi-Party system in the country in 1990 brought changes in the local institution and the VDC came into existence in 1992 in place of VP. The Kulo Samiti during the time of the VP dissolved with the abolition of Panchayat system, since majority of the members of it were VP officials.

The Irrigation System under the VDC since 1992

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

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

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

\(^6\) At present each of the wards have five members including a woman since the amendment in local election by-laws in 1997.
report for *Jhara* (labor contribution)\(^7\). This was not strictly enforced during the time of VDC management. This shows that an authority of an institution was necessary to maintain social control, which could enforce necessary rules. The villagers gave the following reasons for the breakdown in traditional management practices.

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

**THE INTERVENTIONS IN THE IRRIGATION SYSTEM**

**The Intervention of 1962**

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

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

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\(^7\) People still call it *Jhara*, which in the past was compulsory labor contribution as demanded by the state. In Nepal three forms of compulsory labor - *Jhara*, *Beth* and *Begari* existed in the past. The labor was used for the public works such as maintenance of roads and bridges, reclamation of waste land and maintenance of irrigation canals. *Jhara* meant requisition of laborers from each family in the village for a certain number of days for public works. *Beth* meant the exaction of unpaid labor on a customary basis, while *Begari* denoted the requisition of casual laborers for emergency requirements (Regmi, 1978:504).
in transition. The VP, which came into existence in 1962, was not in a position to continue the old practices that were lost during the DIHM management. The Ditthawal also could not enforce the past norms as his position was not any more legally recognized. According to the opinion of some of the elders in the village, the traditional system of management was lost during this time. The changes in the interface between the existing institution and the users and the establishment of a new interface due to the emergence of new institutions were the causes for this situation.

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

The Intervention in 1998-1999

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

The VDC in consultation with the farmers had constituted a Users’ Committee (UC) in August 1998 comprising nine members, as it was required for the intervention. The VDC however, was involved in the negotiations with the DIO officials as the VDC was taking the lead. The intervention took place at the initiative of the VDC. It is important to note that the first VDC chairperson, who was elected in 1992, was able to persuade the Department of Irrigation (DOI) to conduct preliminary survey for the rehabilitation. It is learnt from the DOI officials that the government completed its part of the rehabilitation. However, the users did not fulfil their part of work that they have to do through labor contribution.
It is a general tendency that users would not like to contribute to the government program, as they feel that the government has an obligation to fulfill towards them. This is largely due to failure in following the processes required for the participatory approach of the development, in which the users and the implementing agency have a direct contact. The gap was fulfilled by the VDC as an intermediary between the DIO and the users. The involvement of VDC has helped in minimizing direct costs to local people but it became a disincentive for functioning of the irrigation organization, which is UC in this case.

MANAGEMENT OF IRRIGATION TASKS

Water Acquisition, System Development and System Water Allocation

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

User Allocation, System Operation and Water Distribution

The Ditthawal Period

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

**The VP Period**

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

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

**The VDC Period**

There were no allocation and distribution rules. The water availability at the tail end at present is not sufficient for all the land in planting period. This is largely due to the blockage established by the farmers in the middle of the canal. In that case it was natural that the farmers having land near the field channel would not allow it to flow to other fields unless there is enough for their land. Thus, the timely monsoon was very crucial for the farmers at the tail end. Therefore, physical presence is necessary for
getting water at the tail end during the peak period. The farmers at the beginning of the tail end use more water when there is an increase in the volume of water in the field channels. Others could not get the water that they needed. It is because there were allocation rules in the past that do not exist now according to the Pale. Users opined that the VDC was not effective in formulating and implementing the allocation rules.

CONFLICT MANAGEMENT

The VP Period

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

The VDC Period

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

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\(^8\) According to the estimate of the farmer the depth of the canal was 2.2 meter but now it is only 1 meter.
their misbehavior. This indicates that the social interface is important in applying social control. However, the episodic incident of this kind has not been effective for permanent solution of the disputes. The conflict at present was also due to the change in the hydraulic configuration of the scheme after the construction of Annapurna Kulo.

**RESOURCE MOBILIZATION**

**The Ditthawal Period**

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

**The VP Period**

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

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9 He is a messenger paid by the VDC and the farmers for his services. He communicates the VDC instructions by announcing them in a loud voice in main places in the village so that every one will know this.
signing the Panchayat register. The nature and extent of tasks determined the work load. Each ward would have to clean certain lengths of the canal. The division of work was proportionate to the use of irrigation water by the wards and the irrigated land holding of each farmer in the ward. A little more than two persons per ha were required for canal cleaning in the command area of 300 hectare. According to the villagers the VP was effective in carrying out necessary maintenance work but was not effective in the allocation and distribution of water. The institutional practices of labor mobilization further disintegrated after the construction of Annapurna Kulo due to the decrease in the number of users because the maintenance requirement did not change.

The VDC Period

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

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

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

SYSTEM MAINTENANCE

The VP Period

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

The VDC Period

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

GOVERNANCE AND PROPERTY RIGHTS

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

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

The organizational control in the irrigation system has undergone major
changes since the time of the Ditthawal and VP, which were discussed in
the previous sections. The formation of UC in the process of intervention
is likely to bring new organizational control. However, it is reported that the UC is not functioning at the moment. This shows that the UC could not maintain linkages with the users for regular operation and maintenance besides the irrigation office for emergency maintenance.

CONCLUSIONS

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

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

The political referendum of 1980 further undermined the position of VP
and it also contributed to the social division among the farmers along political lines. This affected the interface situation between the farmers and the VP, which was basically based on a confrontation of power. This shows that not only the government interventions in the irrigation system but also other political and social interventions affected the irrigation institution due to the changes in the roles of individuals and the VP. However, the VDC effectively controlled the management till 1990. This indicates that the political control is an important factor in strengthening the institutional capability for the management of irrigation system.

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

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

When in 1992 the VDC came into existence and replaced the VP, it also could not develop and implement the operational rules, as its position became weak due to being elected representatives. The farmers from the head and middle reaches continued to take benefits due to the weaker position of the farmers at the tail end due to the decrease in the number of users of Chaurasi Kulo at the tail end as many of them were now in the command area of the Annapurna Kulo. In addition, the majority of the
farmers at the head and middle are from one clan group, who has substantial influence in the village because they belong to higher socio-economic strata in the village. This is evident from the blockages they had put in the canal, which in the past led to conflicts between the farmers.
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INTRODUCTION

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

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

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

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1 Mr. Naeem Akhtar, Chairman water court of FO Hakra 4R; Mr. Abdul Hamid, Social Scientist, IWMI Pakistan and Mr. Abdul Wahid, President FO Hakra 4R Distributary.
they regularly maintain the watercourse. It contributes in more equitable distribution within the watercourse.

OBJECTIVES

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

BACKGROUND

Site Characterization

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

![Figure 1: Location Map of the Research Site](image)

The Hakra 4R distributary has a total discharge of 197 cusecs, and a total of 124 irrigation outlets serve a command area of nearly 18,000 hectares. The Distributary system has two minors, i.e., 1-RA Labsingh and 1-R
Badruwala, each discharging 22 and 43 cusecs, and with 15 and 33 watercourses, respectively. Both the minors and the distributary below RD 72+000 are lined.

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

Methodology

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

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

RESULTS

Performance of the Farmers Managed System

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

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

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

Equity in the Water Supply

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

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

Maintenance

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

Discouraging Informal Payment

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

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

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\(^2\) 1 US$ = 59.2 Pakistani Rupees
Assessment and Collection

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

Table 1: Assessment Area and it Value

<table>
<thead>
<tr>
<th>Time</th>
<th>Assessment (ha)</th>
<th>Value in Rupee(000)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Kharif</td>
<td>Rabi</td>
</tr>
<tr>
<td>Before IMT</td>
<td>13191</td>
<td>12088</td>
</tr>
<tr>
<td>After IMT</td>
<td>14361</td>
<td>13001</td>
</tr>
<tr>
<td>Percentage Change</td>
<td>8.9</td>
<td>7.6</td>
</tr>
</tbody>
</table>

Source: The FO records.

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

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

Accountability and Leadership

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

The Hakra 4R the FO first focused on adjusting the discharge to the common farmers. Only then leader farmers' outlets were adjusted. This was the reason that the outlets of the leader farmers are under drawing from their proportionate share (Hamid et. al., 2001). Leader farmers have to adjust the discharge themselves. Now they can not appropriate resources at the cost of others for fear of social pressure by the community. Among
the farmer leaderships a few were benefiting more before the FO. Besides such a development, the FO replaced its inactive leadership through the no-confidence move (Zaman et. al., 1998).

CONSTRAINTS

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

Agreed Share of Money

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

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

Lack of Capacity Building

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

Typical Evaluation Procedure

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

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

**CONCLUSION**

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

The farmer managed system is a step towards the poverty alleviation in rural areas so serious consideration is necessary to make it successful and sustainable.
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*Formalization of Water Users Association by Farmer Leaders of Hakra 4R Distributary.*
IRRIGATION TECHNOLOGY AND DEVOLUTION OF WATER MANAGEMENT TASKS

UMESH NATH PARAJULI

INTRODUCTION

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

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

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

In the mean time, to improve the management of these systems, policy tools like farmers’ participation and, more recently, transfer of irrigation management to users have also been introduced. In this process, in many irrigation systems, large numbers of sponsored users organizations were formed at several hierarchies of irrigation systems. Developments of these

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organizations for people’s participation were largely based on several theories of organization. It was believed that developing such community organizations and increasing people’s participation could solve all sorts of management problems. However, the viability of such organizations and people’s participation with respect to irrigation infrastructure were overlooked. As a result, in many systems, such community organizations and people’s participation remained active only as long as the external funding continued.

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

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

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

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

**DEVOLUTION OF IRRIGATION MANAGEMENT TASKS TO USERS**

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

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

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

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

TYPES OF WATER DISTRIBUTION SYSTEMS

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

\(^2\) Upstream control refers to a situation of supply driven irrespective of demand. This type of distribution system is used when the demand of irrigation water is more than supplies requiring it's rationing. Thus, an upstream control system imposes restrictions on unlimited delivery of irrigation water to synchronise the demand and actual limited supply.
A distribution system is said to be fully proportionate if all individual farmers (or a group of farmers at tertiary turnout) receive water continuously (but fluctuating) on a fixed proportional basis irrespective of their demand. A fully proportionate system is only practical for large farms or for field-to-field irrigation for paddy cultivation. In general, individual continuous delivery to small farm result in flows too small to handle and it is suitable only for paddy cultivation. As the cropping pattern in Nepal is changing rapidly from rice culture to more diversified crops, a fully proportionate irrigation system is unsuitable for irrigation development.

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

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

**TYPES OF PARTIALLY PROPORTIONATE IRRIGATION SYSTEM**

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

Fixed Proportionate at Lower End (Structured Irrigation System)

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

The lower section is divided into number of blocks varying between 250-2500 ha, the boundaries of which are defined largely by physical features such as roads and drains. A secondary canal supplies water to each block through an adjustable gated head regulator located at the interface. Within the block, all hierarchies of bifurcating canals up to tertiary intake, nomenclature of which differs from system to system, are equipped with several types control structures at their intake3, which deliver water to branching canals on proportional basis at full supply condition. Figure 1 shows schematic diagram of a structured irrigation system.

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3 Usually, for higher order branching canal proportional flow divider, with broad crested weir combined with a drop, is used. Depending on the situation, crest level of the weirs in the parent and in the branching canal may or may not remain same. For the lower ordered canals, Adjustable Proportionate Modules (APM) is also used.
Tertiary canal is the lowest order canal, whose service area is kept at about 28 ha. Each tertiary canal is designed to supply water to seven field channels through an open orifice, each of which irrigates a group of fields of about 4 ha.

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

**Water Management**

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

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

<table>
<thead>
<tr>
<th>Cropping Season</th>
<th>Rotational Groups</th>
<th>Block Number</th>
<th>Total Number of Blocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kharif (Wet season)</td>
<td>Groups A</td>
<td>1, 3, 5, 7, 9, 12</td>
<td>Six</td>
</tr>
<tr>
<td></td>
<td>Groups B</td>
<td>2, 4, 6, 8, 10, 11</td>
<td>Six</td>
</tr>
<tr>
<td>Rabi (Dry season)</td>
<td>Groups A</td>
<td>1, 4, 10, 12</td>
<td>Four</td>
</tr>
<tr>
<td></td>
<td>Groups B</td>
<td>2, 5, 7, 9</td>
<td>Four</td>
</tr>
<tr>
<td></td>
<td>Groups C</td>
<td>3, 6, 8, 11</td>
<td>Four</td>
</tr>
</tbody>
</table>

Source: DOI (1995)

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

Pre-designed Condition of System Operation

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

Operational Realities

It is to be noted that most of the irrigation systems in Nepal are of run-off-the-river type, where availability of flow fluctuates considerably over a short period of time. As a result, flow available in the main canals also fluctuates accordingly. Such fluctuation is further aggravated due to dynamics of weed growth/siltation in the canals, and poor maintenance of irrigation infrastructure. As an example, Figure 2 presents fluctuations of the incoming flows in the Narayani Irrigation System. It has been reported that in individual weeks the incoming flow in this system fluctuates even up to 50 per cent (World Bank, 1998). Such fluctuation has become a major concern in other irrigation systems too.
As mentioned above, one of the pre requisites of a structured irrigation system is that whenever the flow in the secondary canal is "on", it must operate at full supply condition. But, in a situation of fluctuating incoming flow, mode of operation at the interfaces (between the main and secondary canals) needs to be changed frequently for equitable distribution. This can be done in two ways. First, by changing the number of blocks in a rotational group to match the incoming flow, which in turn changes the pre-designed operational plan. This mode of operation however reduces the reliability of flow to end-users. Second, by equitably distributing the available flow to pre-designed number of blocks. With this method of operation, the secondary canals would operate at below the full supply condition, especially during the declining incoming flow. This mode of operation is against the designed principle. This suggests that in a structured irrigation system, irrespective of the above-mentioned mode of operations, the main system above the level of interface needs to be fully regulated and actively managed.

In a situation of scarce incoming flow, as farmers belonging to each block would like to see that their respective secondary canal be operated as per designed operational plan, competitions exist among different blocks for
getting more water. In such a situation, it becomes essential to have certain organization at higher level to coordinate users of different secondary canals and to manage water distribution. Thus, the operation of the entire system needs to be managed and coordinated by the agency or the main users’ committee. This suggests that in a structured irrigation system, water distribution management task tends to centralize upwardly.

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

- HR Wallingford (2001) and DOI (1995) note that in Narayani Irrigation System the pre-designed operational plan is never followed, and deliveries of water among secondary canals (blocks) are done on an ad-hoc basis based on the personal judgment of the operating staffs. Fluctuating incoming flow and poor maintenance of irrigation infrastructure are part of the technical reasons for this. As a result, the secondary canals operate at below the full supply condition and the actual coverage of irrigated area is much below than the designed value. Broken crest of control structures, informal cuts in canal embankments, abandoned tertiary canals, and jeopardized system operation are the end results. These studies further suggest that despite of great effort, there is no sign of farmer participation in maintaining and operating the system.

- In a review of the stage II area of the Mahakali irrigation project, NEDECO (2001) notes that although the cropping intensity and crop yields have increased considerably, WUA’s institutional development is lagging behind. This has limited the targeted development. As a result, some areas still have no irrigation water supply.

- World Bank (1998) notes that in a situation of unreliable water supply, the structured irrigation system will not work.

**Fixed Proportionate at Upper End**

In contrast to the structured irrigation system, in a partially proportionate system with fixed proportionate section at upper end, the interfaces of the upper section with several lower sections (blocks) are equipped with fixed proportional types of delivery structures. As a result, both the upper and lower sections operate continuously but with fluctuating flow. However, deliveries of waters to branching canals within a block are rationed through several types of control structures to synchronize the demand and
actual limited supply. The types of delivery system and control structures used within the block depend on cropping season and crop types. Figure 3 shows schematic diagram of a partially proportionate system with fixed proportionate section at upper end.

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

**System Operation**

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

As long as the system remain under operation, all secondary canals supplying water to different blocks of the irrigated area flow continuously with their fair share of water. Each of these block functions as an
independent sub-system within a larger system. This means that each of these blocks is self-contained and any irrigation problems could be easily isolated and overcome within such blocks. Thus, managing water within such block does not require centralized institutional arrangements. Farmers within each block can manage water according to their local conditions. This aspect facilitates devolution of water distribution management tasks to the users of each block.

COMPARISON OF DEVOLUTION OF WATER MANAGEMENT TASKS

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

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

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

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

Further, in a structured irrigation system, higher the location of interface larger is the block size and lesser is the management input required for operating the block. This is because, above the level of interface, an irrigation system needs to be fully regulated and actively managed, while below the interface (within the blocks) system operates on fixed
proportional basis when "on". Larger blocks means less internal regulation and easier management, but less flexibility in providing water needs of diversified crops.

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

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


CONTRIBUTION OF IRRIGATION TO SUSTAINING RURAL LIVELIHOODS

JOHN SKUTSCH

INTRODUCTION

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

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

METHODS

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

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

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1 Project Leader, Principal Engineer, Overseas Development Section, HR Wallingford, UK.
• Background analysis of existing reports and documentation

Criteria for Field Site Selection

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

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

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

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

Table 1: Characteristics of Selected Schemes in Nepal

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

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

On all three schemes, the distribution of land is skewed, over 80% of households irrigating lands smaller than two thirds of a hectare (median farm size ranges from 0.25-0.35 ha.). Even the largest farms (maximum size 1.35-4.40 ha, depending on scheme) are small by international standards. Most households own irrigated land, the number of tenants and sharecroppers being relatively small. Most of the latter seemed to own a small piece of land which was inadequate to support their family, and they therefore supplemented production by sharecropping on an area of 0.1 ha.
It is clear that they were poorer than those owning land. The direct benefits of irrigation development, in terms of improved productivity, will therefore have been realized by large numbers of poor farming households, and not disproportionately by large farmers or landlords.

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

The Bangladesh Agricultural University (BAU) is located in Mymensingh district, a more affluent area where agricultural knowledge and practices are relatively advanced. The selected study “clusters” are in neighboring districts Netrakona, Shirpur and Jamalpur, where standards of living are lower, consistent with Criterion 2 above. The clusters selected for the study are mentioned in Table 2.

Table 2: Selected “Clusters” in Bangladesh

<table>
<thead>
<tr>
<th>Village/Cluster</th>
<th>Borni</th>
<th>Talki</th>
<th>Mohanpur</th>
</tr>
</thead>
<tbody>
<tr>
<td>District</td>
<td>Netrakona</td>
<td>Shirpur</td>
<td>Jamalpur</td>
</tr>
<tr>
<td>Region</td>
<td>N.Bangladesh</td>
<td>N.Bangladesh</td>
<td>N.Bangladesh</td>
</tr>
</tbody>
</table>

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

SUMMARY OF ANALYSIS

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

IMPACTS ON THE CAPITALS (NEPAL)

Financial Capital

The main direct benefit of irrigation development for farm households is the increase in cropping intensity and opportunities from crop diversification. As show in Table 3. Prior to irrigation development, the majority of households could cultivate only one main staple crop a year, sometimes supplemented by a following drought-resistant pulse or oilseed

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2 A “cluster” of tubewells was taken to be 10 STWs, each serving some 6-10 acres (2.5-4 ha.) whose command areas are contiguous. Each cluster falls within the boundary of a single village. Cluster methodology has previously been used by e.g. Mandal et. al., 1996.
crop, and perhaps winter vegetables in small homestead gardens or low-lying plots. Households were thus mainly subsistence or semi-subsistence producers, rarely having significant surpluses to sell, with little participation in markets for inputs and outputs. Following irrigation, three crops a year are the norm where water supply is adequate, and higher and less variable yields are achievable. Evidence on crop yields also confirmed that higher and less variable yields are achieved with irrigation compared to rain-fed production.

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

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

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

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

The more intensive and higher value cropping system at Yampaphant represents an advance in irrigation development over the other two schemes. It shows that much higher gross and net incomes per hectare are achievable, but greater integration with input and output markets is required, as well as access to information and adoption of improved agricultural technology.
Irrigation has resulted in higher and more continuous employment for farm labor. Most farm households had surplus labor prior to the advent of irrigation, and irrigated agriculture has thus provided fuller employment to households’ own labor, possibly reducing the need for seasonal migration in search of work. There is also evidence of increased employment for marginal farming or landless households primarily dependent on agricultural work. This labor is drawn from the surrounding uplands, in the case of Kalleritar and Yampaphant and from gangs of seasonally migrating contract labor at Janakalyan.

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

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

**Physical Capital**

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

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

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

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

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

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

Irrigation Maintenance

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

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

All farmers at Janakalyan contribute to costs associated with desilting and
general maintenance, on the basis of land holding. Labor is also contributed in proportion. The system appears very similar to that adopted at Kalleritar.

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

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

**General Infrastructure**

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

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

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

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

**Human Capital**

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

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

**Social Capital**

The net impact of higher agricultural incomes on social capital is hard to measure. People tend to spend more on ceremonies, health and education, but affluence may reduce the need for informal help between neighbors.
On the other hand, improvements in education raise the potential for, and the effectiveness of, communication. Better levels of understanding and greater access to information encourage people to pull together to achieve their development objectives. As more girls are educated, allocation of responsibilities and benefits change, and should ultimately smooth some of the early distortions that may stem from the introduction of irrigation. In particular, crop intensification and year-round cultivation often disadvantage women to a greater extent than men. The improved individual skills resulting from formal and informal education have a community, as well as a private, value.

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

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

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

The social value associated with infrastructure such as roads, trails and bridges, schools and health posts, and cultural foci such as meeting halls, religious temples and ceremonies should not be underestimated. People are better able to support such projects on the proceeds of irrigation.
Cultural observance and ceremony is important: the emergence of catering committees and the increased ability of communities to fund ceremonies is a positive aspect.

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

Figure 2(b): Food Available to Farm Households (last five years)
*Source:* Questionnaire survey.
Figure 3(a): Foods Eaten before irrigation (General Merchants, Crafts and Trades People)

Source: Questionnaire survey.

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

Source: Questionnaire survey
Figure 4(a): Reasons Given for Improved Family Health (Farmers)

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

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

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

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

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

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

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

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

DISCUSSION OF ISSUES

The livelihoods perspective adopted in this study, and the insights gained from the field work, emphasize the complementary effects on social and economic development that arise from improvements in livelihood assets. For example, an increasing number of farming households receive remittances from a family member working elsewhere. The trend has increased over the last ten years, and could be one result of an improved standard of education, funded by increased income from irrigation.
Increased incomes appear to have led to a change in priorities for many farmers, who have encouraged their educated children to move from agriculture into higher paid, non-agricultural employment.

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

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

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

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

Fifty percent of agricultural goods and service providers had been farmers before entering the business. Moving with their farmer clients, the business opportunities offered by higher productivity levels and roads
were the main factors encouraging people to migrate to the schemes and/or set up in these businesses. Farmers on the irrigation schemes provide the majority of their customers, and most report that they have experienced improved demand for and profitability of their services with the process of irrigation development. The number of shops and services has increased over recent years across all schemes. This could also indicate an increase in the spending power as the income of local farmers has increased through irrigation.

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

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

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

The impact of irrigation on physical and other capital assets vary with these scheme conditions. Yampaphant and Janakalayan have a more
advanced and developed physical and social infrastructure than Kalleritar. There has been greater improvement in housing and more use of services, such as transport and healthcare. All these are clearly linked with the ability to pay and to the differences in farm productivity, market accessibility and levels of agricultural training and human capital development across the schemes.

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

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

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

Although direct comparisons with non-irrigated areas are not possible, irrigation development appears to have been associated with improved standards of housing and acquisition of physical assets such as biogas plants and improved water supply and sanitation. Irrigating farm
households are clearly better off in this regard than households primarily dependent on laboring. For all three schemes, the time required to reach facilities such as schools, health posts and banks is better than the national average.

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

CONCLUSIONS

1. On the selected schemes in Nepal, the distribution of the direct benefits of irrigation has been fairly equitable. Water is adequate, apart from some shortage at the tail block in Kaleritar, otherwise there are no important differences in supply between head and tail sections of the command areas. Although there are caste and ethnic differences within the communities, they do not appear to have been significant in influencing the gains from irrigation.

2. The increase in cropping intensity and improvement in yields resulting from irrigation have produced a substantial increase in gross income per hectare per year, of at least 100-160% in constant prices. Approximate calculations suggest that median size farm incomes before irrigation on all three schemes were below the published poverty line income for Nepal. After irrigation, incomes are estimated to have risen above the poverty line for Janakalyan and Yampaphant, but remained just below it for Kalleritar. Share croppers, who are in a minority on the schemes, have clearly benefited less than owner cultivators. A more detailed analysis of the significance of the increases for farm livelihoods is currently in hand.

3. It is generally believed that irrigation leads to higher and more continuous employment for farm labor. Except at Janakalyan, where use of contract labor for peak season operations has increased, households did not consistently report an increase in use of hired labor. However, most farm households had surplus labor before the advent of irrigation. Irrigated agriculture has provided fuller employment for family labor, in some cases removing the
need for a seasonal migration of males in search of work. The overall increase in labor associated with irrigation is confirmed by the responses from a small sample of laborer households, from group interviews and from inquiries by the Process Investigators.

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

4. Alongside irrigation, the most significant development common to all schemes is the construction of a main road, which provided improved access to markets and services. All three schemes sell produce to distant markets, including Kathmandu, and without the road the size of their markets would be significantly reduced. Farm households also visit market centers such as Kathmandu for shopping and health facilities. Road construction may have encouraged irrigation development itself by providing access for construction and materials. In a similar way, improved accessibility has encouraged other developments that have yet to reach more remote areas of Nepal such as electricity and drinking water. In each case the road has also provided a focal point and market place for local businessmen to open shops and provide services used by the farming communities.

5. Increased agricultural production, either directly, or by increasing incomes, has had significant, positive impacts on diet, health and education, not merely for owner cultivators but also for those involved in supplying goods and services to the farming community. Sharecroppers and laborers have benefited to a lesser degree.

6. Formal social capital in the irrigation communities has measurably increased in terms of active interest groups and complex committee arrangements for continued function. Although these changes are encouraged by a number of development initiatives acting together, irrigation seems to have been a major influence, allowing sufficient improvement in the general standard of nutrition and income to free people from the preoccupation of survival and allow them to attend to other development issues. People are working harder and longer than they did before the introduction of irrigation, but have the stamina to do so which was
not apparently the case before irrigation was established.

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

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

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

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

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

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

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

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

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

Addressing the problem, this paper explores gender related irrigation policy formulation and translation in a field reality of Second Irrigation Sector Project (SISP) in Nepal with empirical evidences from Tukucha Nala Irrigation System, Kavre. This paper is mainly divided into two sections. The first section gives short description on policy formulation and how gender concerns are inducted in the context of Nepal. The second section draws empirical evidence from the study conducted on Tukucha
Nala Irrigation System under SISP\textsuperscript{2}. It analyses the constraints for the policy implementation and places the argument in the present political web.

**GENDER CONCERNS IN NATIONAL IRRIGATION POLICY**

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

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

\textit{Women participation in the WUA will be encouraged and it...}

\textsuperscript{2} Second Irrigation Sector Project covers greater number of surface irrigation with large hectarage in Nepal. It targets to improve 41000 ha of land in Central and Eastern Development Regions of Nepal. The total budget of the project is 33.3 million US$ of which 75%, 13%, 12% is contributed by Asian Development Bank, Government of Nepal and the WUA respectively.
would be intended to increase by at least 20% in executive board of the WUA.

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

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

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

TRANSLATION OF POLICY: A CASE OF TUKUCHA NALA WUA

Background

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

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

4 Out of 68 CBOs appointed under SISP, at present only 5 CBOs are women. Source: SISP Tenth Progress Report.
of construction and at present it irrigates 71 households due to formulation
of single families from two joint families. The system irrigates three wards
out of nine in the VDC i.e. whole of ward number three and part of ward
numbers two and four. The head works lies at ward number four. The ward
number four is situated at highest altitude followed by ward number three
and two almost at base of the hill. Therefore, users at ward number four
are the head ender, followed by users at three two are the tail enders.

Caste and Community Structure

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

Female Headed Households

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

Cropping Pattern

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

5 Data based on Village survey and the WUA database. It is found that there is slight
difference in this data and socioeconomic survey of District Irrigation Office (DIO)
done for pre-feasibility study.
December, which is followed by another potato plantation in month of January to March. Potato is grown as a cash crop, and potato growing has helped increased farmers’ income. The majority of the farmers sell their potato as soon as they harvest from the field whereas some rich farmers store them to fetch higher prices during the off-season.

**Formation of the WUA and Process of Registration**

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

In case of Tukucha Nala, the villagers file petition to DIO in 1996 for system rehabilitation. The system was referred to Phanalphat irrigation system. The first president of Tukucha Nala WUA was an active local leader and he was also elected as ward president. The WUA constitution was drafted in the presence of two local leaders who became president and secretary of the WUA later. The process of formulation of the constitution and registration suggests only few WUA members (who were all men) and Irrigation Staff, (also only men) were involved in drafting the constitution of the WUA. Finally the WUA was registered in the month of October 1996 with District Water Resource Committee. The process suggests that how women members were excluded from the process of the WUA formation where they were recognized as the equal partners. Despite the specific policy of women participation, women were excluded in the process. A male AO called the first meeting of the WUA on behalf of DIO to discuss about the future WUA activities on 22 April 1996. None of the women members were present in the meeting according to the WUA records. It is simply because the villagers understood attending meetings
for irrigation is men’s responsibility as household head. The executive committee of the WUA was formed in the second meeting on 24 April 1996. In the meeting, eleven women were present out of 58 members who participated. Among them, one woman was selected to represent in 11 member executive committee. Selection process is the nomination from male local leaders and AO. It was not a voluntary candidacy by the women member who got selected in the executive committee. Finally the WUA was registered in District Water Resource Committee, Kavre in October 1996.

**Organizational Structure of the WUA**

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

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

6 Tukucha Nala Jal Upabhokta Samiti ko Bidhan, 2053 (The Constitution of Tukucha Nala Water Users’ Committee)
by family members in the WUA activities. This right is not mentioned in the constitution, but exists in practice.

**Women Participation in the WUA Activities**

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

<table>
<thead>
<tr>
<th>Time</th>
<th>Size of Executive Committee</th>
<th>No. of Women Present</th>
<th>% Women Representative</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996-4-24 to 2001-8-19</td>
<td>11</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>2001-8-19 onwards</td>
<td>11</td>
<td>3</td>
<td>27</td>
</tr>
</tbody>
</table>

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

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

Source: Filed survey and the WUA Records

Participation in System Maintenance

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

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

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

Source: Observation and secondary information available from the WUA

The women participation in the WUA meeting is found to be less than their role in canal cleaning activity. Of the seventeen women who participated in canal cleaning, only 8 were present in the meeting held to decide the date for the cleaning program. Their elders represent who ever
are not present in the meeting. The usual practice is that the elder males who are the head of the households participate in the member where the labor contribution for maintenance is done by the females usually the daughter-in- laws or the daughters. The practices suggest the reason why there is a low participation of the women in the meetings but comparatively more in the works that demands hard physical labor laden on women. The male members who represent the household prefer to attend meetings, which restrict the opportunity for the women to attend the meetings. One does the decision-making and others carry the real work in this case. To strengthen the WUA, actual members who participate in the WUA activities should be encouraged to participate in the decision making process in the WUA.

**Reasons for Lower Women Participation in Decision-making Forum**

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

**Heterogeneity of Women Group**

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

**Societal Attitudes**

In Tukucha Nala WUA, women participation in the WUA is also hindered by the prevailing general attitudes in the society and understanding about women. One of the perceptions about women in the village is that ‘women are uneducated, do not know official matters, and are poor in accounting.’ The role and the activities of the women were considered to engage in the
indoor household activities besides the reproductive activities. These understandings are being internalized by the women and they themselves feel low among others at the time of their participation in public domain.

Figure 2: Intra-household Relationship and Access to Resource
The policy formed at national level needs to be translated at field level. Though the quota system as a policy tool has been implemented to increase women participation in the executive committee, none of the women members and many of the men members are not aware. The
implementers at district level, regional level and central level are also not serious about the gender issues. The seriousness of the implementers are very much guided by their social norms and values towards women. For example, women of 35 years who came from a village to make inquiry on availability of iron mesh at DIO got the question from Chief District Engineer “Is there no male persons in your village who can come for this work?” Asking this question to a woman is not to embrace her, it’s a politeness that he could offer as if he is concerned about her hard work. But in other hand, the women will be discouraged to come next time with the same statement. To change this attitude of implementers, there is an urgent need to design strategies for policy implementation in such a way that will help make the implementers aware on the ways to encourage women to participate. One of the important tools to achieve the objective is designing the best ways to transfer the information from the central to the regional to the district level and then to the users.

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

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

To achieve this objective, female sociologists, AOs, field organizers and consultants will be hired by DOI to assist in the formation and strengthening of WUAs in each sub project. DOI, Department of Agriculture and the WUA officials will be trained in gender awareness and in recognizing the needs and role of the women in the community Training packages for women will be prepared by DOI. An appropriate provision concerning women’s participation in the project implementation will be included in the memorandum of agreement between DOI and each WUA and linkages between ongoing projects and women in development
While the MoU is explicit about its objective in increasing women participation in WUAs, the same objective is not found in the Project Procedural Manual (PPM). This is important, since District Irrigation Officers work on the basis of PPM for implementing projects. If the gender component would have been clearly mentioned in Project Procedural Manual and would have explicitly provided the guidelines, the implementers would be sensitized more to implement the policy.

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

CONCLUSION

The gender issues in FMIS in the present changed context demands equal participation of women in formal WUA functioning to secure their right to irrigation water. Government effort to increase women participation in the WUA meeting by imposing quota system has not been achieved as targeted in the last eight years. However it has provided space and opportunities for women to physically represent in the WUA meetings instead of the social norms and values that hinder their participation. Introduction of the quota system as a policy tool only is not enough to increase women participation in the WUA activities. A holistic developmental planning is required to achieve the policy objective. Strategies made to implement the policy objective should aim to create proper channel to flow the information from central level to the field level.
and from bottom to top. It helps individuals who are involved in policy process to sharpen their ideas and understanding about the local realities. At village level since the local leaders are the key actors for information flow, they can be used as a tool to disseminate the information to users, especially women. The conscious efforts to increase the women participation in FMIS are a future challenge for all of us who are involved in policy making and implementation.

Figure 4: Socio-political Process Filtering Women Activities in Water Users’ Association
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COMPETING FOR WATER: THE IMPLICATIONS FOR AGRICULTURE IN VIEWING WATER AS AN ECONOMIC GOOD

SYNNE MOVIK

INTRODUCTION

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

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

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

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

ALLOCATING WATER AS AN ECONOMIC GOOD

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

In the book ‘The Allocation Imperative’, written by Richard Lee of the UNDP, a passage runs thus: ‘the most serious issue among the many matters which water management has to consider, is that of the allocation of water among competing uses and users. The issue of allocation overshadows all other aspects of water management, including the difficulties of managing water quality, controlling flows, and all the remaining myriad questions involved in managing water.’ The allocation process is defined as ‘deciding who should receive how much water’ (Uphoff, 1986, cited in Meinzen-Dick & Bruns, 2000). Lee goes on to argue that failure to allocate water efficiently stems from the lack of proper
economic appreciation of the water in the different sectors. Water cannot continue to be treated as having a ‘unique importance’, but must take its place as an economic good among other natural resources. And, as most economic goods, the best way to manage water efficiently is through the market. The increasing private participation in water management has brought with it as a corollary the wider opening of water management to market forces. It has also greatly augmented the interest of directly employing prices and markets as the main tool for allocating water among different uses. The amount of literature discussing the experiences in the few places where such an approach has succeeded reflects this interest (Lee, 1999).

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

Consequently, the IMF and the World Bank have advocated the increased participation of private actors and corporations in the water sector. The ‘water sector’ in this respect refers primarily to delivery of drinking water, often coupled with sanitation services. The argument is that public utilities in general have a history of bad management practices, resulting in poor delivery routines or failure to deliver at all. The remedy, it is hoped, is to involve the private sector to a much greater degree. However, even though there are successful examples of privatized water utilities having improved service delivery and cut costs, there are several problems with this line of action to increase efficiency. One problem obviously relates to the ability of poor customers to pay for services, and concerns have been raised that low-income communities will be deprived of access to affordable water. The World Bank’s claim that cost recovery will provide the resources necessary to expand services to poor areas have yet to be documented empirically, and thus remains a belief rather than a truth. Another problem is that governments often view privatization as a way of getting rid of their debts – by handing over all responsibility and assets to private entrepreneurs, they also absolve themselves of the responsibility of having to guarantee customers a stable water supply at the expense of the public coffers. Hence, privatization may be primarily regarded as a means of balancing national budgets. Thirdly, a private corporation, whose aim is to
generate profit for its shareholders might not be the best institution to manage what many view as a ‘natural’ public good. Water is crucial for public health, social equity, food production and the environment, to mention a few issues that indicate the ‘publicness’ of this resource. The involvement of corporations may cause fragmentation and a loss of overview of the entire resource, an overview that would be desirable in terms of making sensible management and allocation decisions, especially regarding intersectoral management. Hence, government agencies should, in one way or another, be held accountable to the broader public interest in matters concerning water management and allocation.

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

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

Contrasting the views of Briscoe, Desmond McNeill observes that, although being an economist readily recognizing the economic value of water, he views the ‘increasing tendency for more and more decisions to be left to the market with deep concern’ (McNeill, 1998). He believes that the heated debates on whether or not water should be regarded as an
economic good mainly to stem from fundamental misconceptions and differences in perspectives. He contends that to view water as an economic good does not imply that it should be allocated according to market mechanisms – it simply means that water is scarce, and therefore a valuable resource that should not be wasted.

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

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

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

THE CASE FOR ADMINISTRATIVE ALLOCATION OF WATER TO AGRICULTURE

Some basic facts about irrigated agriculture - irrigated agriculture accounts for 18% of the world’s farmland, but has double the output of non-irrigated agriculture, and provides 1/3 of food production. Add to these facts that roughly ¾ of irrigated agriculture is located in developing
countries (Ceña and Fereres, 1997), and the picture emerges of a sector that serves as a means of survival for many poor countries.

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

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

Bhatia, in his paper on irrigation systems in Haryana, has attempted to develop a method to fix valuations on non-agricultural uses of irrigation water by using conventional economic methods. He argues that farmers should not be charged the full costs of irrigation, precisely because the
other uses of irrigation water possess a societal value. Hence, only the amount needed to cover Operation and Maintenance (O & M) costs should be incurred, not capital costs or opportunity costs. That latter view runs counter to what others have advocated, namely that opportunity costs should be reflected so as to provide incentives to use water more efficiently. Ceña and Fereres (1997) also argue along the same lines as Bhatia, offering the statement that ‘if water is only considered as an economic good, the impacts on agriculture would be very negative in the short run’, and thus, farmers should not bear the economic costs alone.

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

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

Another issue of overriding importance relates to food security. Given that people’s food needs are likely to double within the year 2025, assuming current population growth rates, it seems foolish not to pay closer attention to rural agriculture. Research done by the International Water Management
Institute (IWMI) suggests that the agricultural sector would need 15-20% more water in order to meet the projected demand, although the researchers also point out that improved crop husbandry and water management may go some way in meeting needs. It is plain to see that there is an enormous productivity challenge facing the agricultural sector. Increasingly, urban competition for water is forcing water transfers from the agricultural sector to the rural sector, resulting in declining agricultural outputs.

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

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

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

TO IRRIGATE OR NOT TO IRRIGATE: WHOSE RIGHTS PREVAIL?

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

Access to water is crucial for the livelihoods of individuals, households and communities, and is threatened in many contexts. Water rights may be informal, embedded in local practice, or formally framed in water permits
(Bruns, 1997). However, customary water rights often make little or no provision for reallocating water. Strengthening access rights to water represents one way to gain control over a valuable resource - hence there is increasing pressure on governments to formalize water rights.

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

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

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

In view of the escalating contestation by other parties of water used for irrigation, irrigation farmers must increasingly involve themselves in negotiation of rights with strangers. One of the key tasks of governance is to create an institutional framework within which strangers can peacefully agree to co-operate and co-ordinate their actions (North, 1990; cited in Bruns & Meinzen-Dick, 2000). A fact which is often overlooked, is that such negotiations is not always an ‘us’ against a ‘them’. Often,
stakeholders may derive part of their income from irrigated farming, and part from working in the industrial sector. Not much research has yet been done on how rights between competing uses, rather than users, are sorted out.

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

CASES OF ALLOCATION CONFLICTS

India

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

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

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

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

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

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

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

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

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

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

Hydroelectricity is crucial to the Tanzanian economy, generating over 60% of the indigenous commercial energy production. The government’s aim is to completely replace thermal power plants with hydroelectric power. However, there are problems related to the development of hydropower, including the increased siltation of dams due to deforestation and erosion, and also due to abstraction of water for agricultural purposes from the rivers that feed the hydroelectric reservoirs. For example, the Pangani River, which supplies the Nyumba ya Mungu dam, is regularly affected by abstractions of water for irrigation, leading to nation-wide power rationing. Many of these abstractions are illegally performed, i. e. by farmers without any water rights. The Tanzanian Electric Supply Company demanded that
all irrigation projects upstream of the dam be closed. But the Government did not oblige, as so many farmers were dependent upon irrigation for their income.

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

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

South Africa

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

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

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

Agriculture is by far the biggest consumer of water, with mining, industry and power generation consuming about one-quarter of available stock. In
many places, irrigated agriculture is already overshooting limits, and interventions are called upon to secure the ecological needs.

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

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

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

**DISCUSSION**

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

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

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

However, the case is not always a clear-cut one, and one should beware of becoming a dogged advocate of irrigated agriculture at whatever the cost. In the case of Tanzania and South Africa, for instance, the energy and mining sectors are undoubtedly at loggerheads with rural farming. Given that, in South Africa’s case, rural farming is on the decline, and cannot compete with industry neither in terms of value generated nor jobs created, is it wise to continue supporting it? The answer should be a tentative ‘yes’, but with a strong preference for smallholder and communal irrigation systems that stimulate rural activity, rather than large commercial holdings. In the case of Tanzania, farming may be to the detriment of electricity production, with the consequence that some alternative solutions should be sought, such as e.g. compensations to farmers who
have to cease tilling their land, if other solutions cannot be arrived at. But for such negotiations to work out, the farmers have to be vested with use rights to water in the first place, and the farmers as a group need to recognize their common interests in confrontation with representatives from the electricity industry. A ‘one-to-one’ negotiation procedure, whereby individual farmers are brought to the negotiating table and agreements are made without the support of a peer group will probably result in unfair settlements and a feeling of deprivation on the part of the farmers.

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

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

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

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

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

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

All this points towards the necessity of negotiating water rights at the sector level, whereby representatives of different user groups meet as equal partners. But for such a process to be facilitated, the notion that water is a public good needs to be accompanied by access rights, as is the case in the new water act of South Africa. Without such rights, the negotiating power of small-scale farmers will be nil, and they will be subject to the greater clout of government agencies and private actors who
have more to gain in economic terms from supplanting the needs of the farmers. Ideally, such an arena for negotiating water uses should be overseen by an independent body. The benefit of such an approach as compared to free water markets is that the representatives, acting on behalf of their interest groups, are representing the interests of whole groups rather than that of an individual (Huggins, 2000). By acting as groups, it is easier to show the detriment to society at large if irrigated agriculture were to succumb to water uses of greater economic value, as the increased income generated from using water in industry would often be accompanied by declining living standards in the countryside, and increasing inequalities.

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

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

Hence, methods that help to define ‘optimal’ trade-offs should be developed. Again, it is not sufficient only to gather data and disseminate them, they must also be interpreted. GIS tools present powerful ways of producing data sets that may then be analyzed, but they are first and
foremost tools of representation, not of data analysis. For example, the benefits accruing from stimulated rural activity as a result of allocating water for rural farming should ideally be presented in such a manner as not only to reflect the economic value of the products/foodstuffs that are actually produced, but also the benefit to society of invigorating its rural areas where typically most people reside. Bhatia has tried to do just this, but more research is needed in order to develop models that could produce empirical data that could prove useful in allocation decisions.

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

CONCLUSION AND SUGGESTED RESEARCH NEEDS

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

In the poorest countries of the world the agricultural sector remains the most important in terms of both employment and income generation. Increased productivity in subsistence and smallholder agriculture is a powerful engine of growth, income improvement, and better access to food. However, the agricultural sector is also viewed as a ‘wasteful’ and low-value use of precious water, in comparison to other sectors, and
proposals to allocate water according to market mechanisms in order to ensure that it is put to the highest-valued use are gaining ground. This paper has argued strongly in favor of administrative support allocation of water to ensure that goals of social welfare and equity are met. However, there are many unanswered questions relating to the impacts of allocating water to the most high-value uses, and more research needs to be done at the macro and sector level, as well as at the household and community level.

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

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


INTRODUCTION

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

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

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

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BACKGROUND OF THE VILLAGES STUDIED

Village Karani

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

Village Petivakkam

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

Land

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

Crops Grown

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

Community Structure

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

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

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

NEEDS OF VILLAGERS FOR IRRIGATION WATER

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

Genesis of the Problem

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

- Open Well irrigation;
- Channel irrigation;
- Community run and rain water-harvesting method;
- Drip irrigation; and
• Bore well irrigation.

EVALUATION OF THE OPTIONS BY FARMERS

Well Mode of Irrigation

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

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

Cost/Benefit Analysis

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

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

- Opportunity cost of the land allocated for constructing the well.
- Break up of the community inter-dependence for individual betterment.
- Cost of setting up the infrastructure.
- Incremental costs in agriculture such as additional expenditure on fertilizers, pesticides etc.

Channel Irrigation

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

Cost/Benefit Analysis

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

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

This mode of irrigation helps the farmers to share the water with other farmers along the channel thereby increasing the interdependence and commitment amongst the farmers.

Costs

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

Community Run and Rain Water-harvesting Methods

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

Drip Irrigation

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

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

The reasons for popularity are:

- Independence: Farmers claim that the relationship, cooperation and interdependence amongst the farmers do not continue to exist now. Farmers also feel that due to urbanization, the new generation do not like to continue with farming for their livelihood. This necessitated seeking independence in their operations. There is no commitment from them towards agriculture as the prime occupation but they continue farming because they have land or their family were involved in farming. So, the farmers in this locality have opted for bore well irrigation. They feel that this mode of irrigation helps them to operate independently.

- Intensive farming: Historically, farming was dependent on the monsoon. The green revolution of Indian agriculture and increase in population have demanded for productive operations. Intensive agriculture needs more water. Farmers claim that the only possibility of assuring round the year water supply is either through bore wells or through digging wells.

- Political dynamics: One of the key reasons for increasing use of bore well irrigation is due to the tension that prevails between the politicians in these two villages. The genesis of the problem was traced to be in the late 50’s when the states have been separated on linguistic basis. The politicians in these two villages have tried to impress their respective vote banks by devising strategies to block the water from flowing into other state or through the river. The politicians have employed their influence on their respective government in getting grants for building check dams, reservoirs, and artificial channels that result in blocking the water flowing along the river. This resulted in creating a shortage water supply in the villages that fall along side of the river bank. So the people in these villages switched over to other modes of water supplies to meet their demand.
Economics of Bore Well

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

CONSEQUENCIES

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

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

LAYA PRASAD UPRETY

THE RESEARCH PROBLEM

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

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

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

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

In order to understand the functioning of irrigation, anthropological studies on common property resource management have also to be carried out focusing on the social relationships of the irrigators because the notion of interdependence (embededdness) has not been given central importance in Nepal. The effective management of common property by a 'collective' is not the theoretical problem that it is asserted to be, simply because the theory assumes that economic behavior is played out as if it were a game disembedded from social relations in general. The reason why people conform to practices which are against their short-term economic interest is that they have other interests besides narrowly defined economic ones, including the desire to maintain social relationships. Anthropologists can
contribute to a greater understanding of common property by going back, to some extent, for a key concept of their discipline -- the notion of embededness (like Malinowski explained cooperation of people in primitive societies in terms of reciprocity which occurs in the context of religious, kinship and other obligations) (Fisher, 1994: 74). Though Fisher emphasizes the need to focus on the notion of embededness while carrying out the researches on forests as common property, it is equally important in the water sector because of the dearth of such irrigation—related studies in Nepal.

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

OBJECTIVES OF THE STUDY

General Objective

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

Specific Objectives

- To analyze the past and existing social structures of the irrigators based on kinship ties, caste/ethnic relations and class relations with a view to drawing their implications on managing water for irrigation as a "commons",
- To analyze the roles of social subjectivities such as social values, ideas and leadership in managing water for irrigation as a "commons", and
To analyze and explicate the institutional arrangements for irrigation management as culture vis-à-vis water use activities, control structure activities and organizational activities.

REVIEW OF LITERATURE FOR THEORETICAL MODELS

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

Substantivist Theory in Economic Anthropology

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

Two separate tendencies are seen while looking at the relationship between anthropology and economics. On the one hand, there are scholars who argue that economic anthropology is best understood within the framework of political economy (i.e, economic historicism and institutionalism or Marxian economics), with its scope encompassing the description and analysis of all economic systems of record (i.e, extinct and extant preindustrial and industrial system). On the other hand, there are those who are impressed with the success of neoclassical economics in formulating principles to explain and predict processes of resource utilization in general. They conceive economic anthropology as the study of social relations concomitant of the process of resource utilization (i.e, economizing), and providing the description and analysis of the specific ways in which this process is patterned in various socio-cultural settings (ibid-800).
The first view is essentially historical, arelativistic and substantive in orientation, relies heavily on a taxonomic/typological method and is concerned primarily with the structure and functioning of contrasting institutional and organizational types. The second view is essentially a historical (synchronic), analytic and formal in orientation, relies heavily on a method of applying general abstract (logico-deductive reasoning) principles. It is concerned primarily with the systematic analysis of the conditions and dynamics of social performance in contrasting cultural settings (ibid-800). While there is still substantial controversy and disagreement among economic anthropologists over a variety of issues. There are certain unifying themes in the contemporary literature. There is the use of comparative strategy that consists of both a synchronic and a diachronic search for relationships between (1) economic organization/performance in two or more social situations in the same society or in two or more different societies; (2) economic organization/performance and non-economic organization/performance (e.g., political, religious, kinship) in one society or in two or more societies; and economic organization/performance in a given sample of societies and non-economic organization/performance in the same sample society (ibid-801).

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

One of the unifying themes in contemporary anthropological inquiry is “functional contextualization”. An anthropologist discovers and analyzes the interrelationships of the economic and other fields of activity in the socio-cultural systems under study. This reflects an adherence to the functionalist strategy that has been applied in economic anthropological studies since the contribution of Malinowski, Mauss and Thurnwald emphasized the holistic and interdependent nature of human social life (ibid-802).
One of the root causes of sectarian conflict in economic discourse in general and in economic anthropology in particular is a genuine difference in the epistemology of its contributors. Two dominant and opposing orientations may be isolated: materialism and idealism.

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

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

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

Distribution implies a reward system in which produce is channeled out among individuals or groups by reason of their control over the factors of their production or for the labor they extended in the productive process.
Exchange refers to the various processes by which goods and services move between individuals or groups, for example, between producers and consumers, buyers and sellers and donors and recipients (Scoot, 1997).

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

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

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

Post-Newtonian Social Science Perspective

Norman Uphoff, a noted American social scientist, has recently developed post-Newtonian social science perspective on the basis of longitudinal field experience in the Gal Oya irrigation system in Sri Lanka in 1980s and 1990s. Prior to shedding the light on the perspective, it would be contextual to provide the scenario of the social setting where the newly observed social realities contributed to shaping the new contemporary social science perspective. In 1980, the government of Sri Lanka did
request the Agrarian Research and Training Institute in Colombo and Rural Development Committee in Cornell University to introduce water users’ associations in Gal Oya. The system was diametrically replete with a host of structural and managerial problems. Put in other words, it was the most difficult and poorly managed irrigation system. The system has the command area of 125000 acres (1 ha. = 2.475 acres) and structurally the most complex. Water distribution was the main problem. The management by the government was also highly unreliable and the irrigation officials had the antagonistic attitude towards the farmers. Conflict among the farmers over the scarce water supply triggered the breakage of structures, problem of channel maintenance and irregular distribution. Farmers were unruly and highly uncooperative. Water distribution had an ethnic dimension; the conflict between the Sinhala-speaking farmers in the head location and the Tamil-speaking farmers in the tail location. Thus, there were a myriad of problems. Uphoff, with the support of 32 college graduates who were trained to live in the communities to act as catalysts, worked as a social consultant to form the farmers’ associations and mobilize them for the sustained irrigation management. Gradually, the outside assistance contributed to altering the chronicity of the aforementioned problems. Later, when the outside assistance was withdrawn, the new farmers’ organizations continued to be active and effective. These organizations contributed to altering the socio-economic ambience of the irrigation command area and an impetus to national program for participatory irrigation management was proffered. The prolonged fieldwork with longitudinal dimension of Norman Uphoff and his unparalleled academic skill triggered a new publication entitled “Learning from Gal Oya: Possibilities for Participatory Development and Post-Newtonian Social Science” in 1996. This treatise has been the milestone of post-Newtonian social science perspective that can be potentially used for analyzing both the subjective and objective aspects of the social realities. Though the book is also focused on how participatory development can be fostered and institutionalized, only post-Newtonian social science perspective has been reviewed here.

Norman Uphoff (1996) holds the view of the durability of the institutional and behavioral innovations – a function of the method of participatory development. Though many of his earlier experiences about the participatory development were validated by the interventions in Gal Oya irrigation system, the found a few other broader implications too. Uphoff (1996) writes that “it (the intervention process) challenged my understanding of individual and collective motivations and capabilities. Farmers did not calculate their advantage simply in self-serving terms, nor
they did place greatest weight on material benefits...Hence, rethinking is required on the ontological and epistemological assumptions on which most social sciences are grounded; a worldview that privileges the individual over the collective, the material over the ideational and the mechanistic over the organic...Current social science perspective is pervasively influenced by the concepts of classical physics, (associated with Sir Isaac Newton). Such concepts have been immensely productive for several centuries across the wide range of phenomena. But in this century, we have discovered that these are not only concepts and privileges for understanding the material realm...There is a valid post-Newtonian view of the world that is shaped more by concern with energization than with equilibrium, and oriented towards evolution than entropy. It frames relationships in terms of open systems than just closed systems...Promoting participatory development will be more successful and effective with a more contemporary understanding of the nature of social as well as material realities. Post-Newtonian social science understands reality as embracing both objective and subjective factors in less linear and less deterministic way...Values and personal factors find a legitimacy in post-Newtonian considerations which is denied them in any scheme modeled after classical physics where objective and subjective factors are considered entirely separate (Uphoff, 191:viii-xii).

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

He also emphasizes social energy, strategy of cooperation and altruism for the sustainable irrigation development. The social energy, being a soft variable, is the people’s self-directed and creative effort. The strategy of co-operation has more advantages over the longer period of time than the opportunistic exploitation of others. Altruism attaches some positive values to others’ well-being concurrently with one’s own. This work
extends the conceptual analysis for those who call into question the validity of narrow self-interest, materialistic models of behavior and explores alternative systems of interaction based on valuing mutual welfare. People can be selfish in private, but it is hard to be selfish in public. But this does not mean that objective factors are excluded.

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

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

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

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

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

The concept of common property-a catchword associated with 1980s and 1990s development theory - centers on the concentration of ownership or control of the resource base within a group of resource users who are expected to manage the resource as a collective undertaking. In other words, the resources under collective control are barred from access by other individuals and groups; that is, it is a way of excluding some potential users and thereby controlling impact on the resource... The success or failure of common property institutions is strongly related to the extent of communal ownership as well as the kinds of property falling under communal control. That is, the more pervasive the common property system, the stricter the sanctions and control mechanisms for governing behavior and productive activity .... (Bennett, 1996: 167-68 and 187).
Water as a resource moves; it is a transient substance. This means that whenever people wish to utilize water in one place, they must capture and store the water when and where it is available. Since water that flows past is not captured and may be used by others in the downstream, water use for agriculture or human consumption automatically imposes problem of sharing and, generally, of water as a form of property. Sharing of a fluid resource requires co-operative relationships. However, in most cases, the specific forms of sharing will depend on co-operation displayed by the water users in Thailand may be inter-village and kinship-based while the cooperative mechanisms of ranchers in the American West involve ordered competition for water through an individual water-rights system administered by courts... Co-operation and competitions become alternative ways of exploiting the hydraulic "commons". The nature of water as a transient resource argues for co-operative sharing because if each user maximizes his use, the finite supply diminishes and other users are deprived. If this point is reached, either co-operative measures to distribute the goods or a third party empowered to penalize those who violate the rules of sharing will emerge (Bennett, 1996: 233-34-36).

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

Water is one of a class of natural resources that are termed "fugitive". "Fugitive" resources are mobile and must be captured before they can be allocated to individuals or groups. Since such capture and allocation poses the problem of exclusion, institutional regulation of these resources tends to develop early. Common property institutions are the most important means of regulation of "fugitive" resources. A 'commons' is a resource that is exploited by a group, a group that has certain membership criteria. There are group rights and duties with respect to the resource. The group will try to exclude non-members from using the resource, and it will regulate the members' use of it. On the basis of this description of common property, a farmer organization can be thought of as an owner and manager of
common property. The water is managed by the groups with individual farmers being the ultimate consumers. There are definite criteria for membership in the group. Property rights in irrigation centers on a comparison of the "riparian" and "prior appropriation doctrines" of water rights. The "riparian doctrine" states that every proprietor of lands on the banks of a river has naturally an equal right to the use of water that flows in the stream adjacent to his lands. This doctrine defines a collective ownership of water by owners of the adjacent land. This treats water as a free one. The "riparian doctrine" has been retained mainly in the region where water is relatively plentiful and where irrigation is not essential for agriculture and thus, not a primary use of water. Under the "doctrine of prior appropriation", water rights belong to those individuals or groups who first put the water for beneficial use. It allows individuals to acquire water on land without regard to its location relative to the stream from which it is feasible. Anyone who first began to work has the "prior right".

A FMIS exhibits the characteristic of common property, and the irrigation organization and the institutional arrangements (the rules and procedures) by which it operates can be seen as endogenous responses to the problems of the management of common property. The term "common property" refers to a distribution of property rights in resources in which a number of owners are co-equal in their right to use the resource (Martin, 1985, Cirivey-Wantrup and Bishop, 1975 and Furubotan and Pejvoich, 1972). Questions related to water rights and who owns the water has to be addressed properly prior to the design, development and implementation of comprehensive water resource management programs. Absolute ownership of the water by the state or private individuals must be sorted out (Water International, 1998).

Prachanda Pradhan, in his research work, entitled 'Patterns of Irrigation Organization in Nepal; A Comparative Study of 21 Farmer Managed Irrigation Systems' (1989) has elaborately discussed water as 'community property'. Once the resource becomes the 'community property', the group must organize to preserve it and distribute benefits to the members of the community. This requires a viable community-based organization as has emerged in most FMIS in Nepal. The effectiveness of irrigators' organization can be placed on a continuum ranging from anarchic to well-organized, depending on the degree of collective interest in irrigation water. Non-compliance with rules for water acquisition, allocation and distribution and resource mobilization results in anarchic application of irrigation water, where individual interest prevails over collective interest. In a well-organized system, irrigation-related tasks are performed collectively by the beneficiaries or group agreements are carried out by the
individuals. Simply put, management and decisions related to irrigation are based on the premise that water is 'community property' (Pradhan, 1989: 18-19).

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

RATIONALITY OF THE STUDY

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

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

LIMITATIONS OF THE STUDY

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

Rationale of the Selection of Study Site

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

Research Design

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

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

Design, Size and Selection of Sample

The sample would be selected at two levels as follows:

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

Data Collection Methods

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

Ethnographic Method

Ethnographic method is conventionally an important one for data collection in cultural anthropological study. Ethnographic method in this study generates qualitative data on social structure and irrigation management and may also generate a few quantitative data. Using the method of field observation (a foundation of anthropological research), the
researcher will observe, listen to and converse with informants in as free and natural an atmosphere as possible. The assumption is that the most important behavior of individual farmers in groups is a dynamic process of complex interactions for irrigation management and consists of more than a set of facts, statistics or even discrete incidents. The strength of this kind of method lies in the observation of natural behavior of irrigation user in real life settings. The researcher will participate in the meetings of the users’ committee and seasonal, periodic and annual rehabilitation/maintenance activities. Another assumption is that human behavior (i.e. water use behavior) is influenced by the setting in which it occurs. The researcher will understand that setting and the nature of social structure; its traditions, values and norms of behavior. It is important for the researcher to observe and interpret the collected facts using etic approach but emic perspective will also be taken into consideration (Bernard, 1988 and Best and Kahn, 1992). While conversing with the irrigation functionaries and other key informants, a checklist will be developed and used.

**Participatory Rural Appraisal Techniques**

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

**Well-being Ranking**

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

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

Focus Group Discussion

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

Social Map

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

Key Informant Interview

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

Mode of Data Analysis and Interpretation

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


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

GANESH P. SHIVAKOTI

INTRODUCTION

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

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INFORMATION ON THAILAND AND VIETNAM MONTANE AGRICULTURE

The total land area on Thailand is about 513,000 sq. km. with the total population of 60.3 million. Thailand is divided into six major regions; the central plain, southeast coast, northeast plateau, central highlands, north and west continental highlands, and peninsular Thailand. The physiological conditions vary significantly among regions. Northeast Plateau comprises of several small watersheds and two large rivers, namely, Chi and Mung which drain into Mekong river. The Mekong river is a major river system of South-East Asia passing through six countries originating in China and passing through Thailand, Myanmar, Lao, Cambodia and Vietnam. Central highland is situated in between northeast plateau and central plain with various landforms. Pasak river valley is the largest one that divides the region longitudinally. Water comes in this region from north, east and west sides. North and west continental highlands can be divided into the two main sub regions i.e. western mountain range and northern hills and valleys.

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

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

Vietnam, on the other hand, is officially classified into seven zones. These include Red River Delta, Northern Mountain and Midlands (which are further classified into the Northeast and Northwest regions), North Central
Coast, South Central Coast, Central Highland, Southeast and Mekong River Deltas. The Northern Mountain and Midlands Provinces comprise the sixteen provinces. Together they occupy an area of approximately 10.2 million ha (Statistical Publishing House, 2000). The montane region of Vietnam in the north-eastern area is located upstream of two major river systems; the Bang-Kycung and the Red-Thaibinh Rivers. The Bang-Kycung River has a catchment area of 39,680 km.², originating in Vietnam and flowing into China, where the catchment area occupies about 68% of total basin area. The Red-Thaibinh River, originating in China, has a total catchment area of 169,000 km.², out of which 87,400 km.², including 17,000 km.² in the delta, are in Vietnam (World Bank, 1996).

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

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

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

The historical perspectives of water development in Thailand differed from region to region. The country was not unified and regions were under several colonial regimes. Only in 1939, the north and northeast regions were released from colonial power. Hence, the name of the country
changed from Siam to Thailand. The FMIS, also referred to as traditional or people’s irrigation systems, were mostly found in northern part of the country. The northern part of the country was established as early as seven hundred years ago (1296), during the period of king Mengrai (RID, 1970). The king had instituted some detail and rigid legal code for proper use and management of the irrigation systems. In the early days, more than two thousand FMIS existed in the northern parts of Thailand alone (Suraraoke et. al., 1980). These systems were classified into two categories based on systems capacity; small system of the mountain type with a coverage area of less than 1000 rai (160 ha.) and the large systems with coverage area between 1000 to 10,000 rai mainly found in plain area.

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

**FMIS BEFORE THE ESTABLISHMENT OF RID IN THAILAND BEFORE 1900**

Irrigation organization was considered an essential institution for ensuring sustainable water development for agriculture and for providing legitimate social control and conflict resolution in contemporary northern Thailand until the beginning of 20th century. The irrigation institutions before the state intervention in northern Thailand were fully autonomous unit of farmers group. They came together and performed activities to achieve common goal i.e. water development for irrigation. The FMISs were typically developed, operated and maintained communally by groups of water users (farmers). The systems were mostly of small scale, optimum to maintain (100-1000 rai). The organizational objectives were; (a) to provide water for good harvest of main rice crop, (b) to prolong water available period so that second rice or other crops could be grown during dry season, and (c) to expand cultivated areas.
In the organizational process of the committee, first the district head arranged meeting with different sub-district heads and discussed the possible and feasible way for supplying water to different sub-district and villages. The sub-district head then discussed with village head and finally worked out strategies for implementation. In order to operate and maintain the system, farmers were organized and formed water user committees, based on canal network. In most cases, a FMIS committee was divided into two levels for efficient management of water resource i.e. at system level and at canal level. The former organization was the main body for operation and maintenance of the entire systems, while the later consisted of small group of members mainly responsible for the management of individual canal (secondary canal – muang soi). There were several canal level organizations that performed under co-ordination with a system level organization comprising 10-20 villages depending upon the distance of the river. The district head was the chief of the system level organization and the sub-district heads become deputy chiefs at village level. Village heads worked as assistants to the sub-district head. At all levels, there were some other positions such as messenger and water man.

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

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

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

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

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

- Proportionate Relationship between Labor Contribution and Landholding Size

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

- Proportionate Relationship between Tools Contribution and Landholding Size

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

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

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

**Role of FMIS Committee Members**

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

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

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

The assistant on the other hand kept and maintained account books for various expenses of the systems, assisted water headmen to allocate water and served as representative of the chief in asking water from other systems.
The main responsibility of Messenger was to deliver messages from chief or deputy chief of Weir Community to water users and report back to the chief. The messages were in relation to scheduling of meeting, water delivery, repair and maintenance and amount and type of equipment to be brought by each household.

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

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

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

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

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

The first attempt of participatory intervention of government started in 1962. The government emphasized Common Irrigators’ Organization framework to integrate local people (beneficiaries) into the irrigation systems. Then, it was followed by the model of “head irrigators”, which was borrowed from indigenous irrigation systems of Northern Thailand.

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1967, RID introduced the concept of the Water User’ Association (WUA) in Northeast Thailand and in 1968 in Central Thailand. During the time, it was expected that farmers were to take control over operation and maintenance activities at farm level.

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

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

The issue of property right, particularly land title, holds significant role in the past. It has impact on and present political and economic stability of the country. Previously, all land was regarded as government property and Thai law recognizes three classes of land; (a) title deed, (b) exploitation testimonial, and (c) reserve license. People first had to apply for reserve license to have claim over public land. After getting and making satisfactory use of the land, they had to apply again for exploitation testimonial, which was more permanent in right, at the district office. Finally, they had to apply for title deed in provincial office which gave them full, permanent ownership. However, it took long time, sometime
generations, to get full title on land due to bureaucratic procedure. Household, therefore, holds different titling over land and upgrading the title is still a major issue. Despite such titling systems, there persisted socially accepted principles of land inheritance from one generation to another. In most cases matrilineal inheritance of land prevailed i.e. from parents to daughters, in many kinship communities. Sons inherited only movable properties such as money, livestock etc. (Ganjanapan, 1994). The system of inheritance gradually changed. At present, land is shared equally among both male and female children in the family. There are still several unwritten traditional principles of land inheritance in the country.

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

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

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

A Case Study from Northern Thailand

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

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

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

<table>
<thead>
<tr>
<th>Irrigation Activities</th>
<th>Participation (Percentage)</th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building of weir</td>
<td>86.4</td>
<td>10.7</td>
<td></td>
</tr>
<tr>
<td>Allocation of water</td>
<td>74.4</td>
<td>74.0</td>
<td></td>
</tr>
<tr>
<td>Diverting water into paddy field</td>
<td>97.0</td>
<td>95.0</td>
<td></td>
</tr>
<tr>
<td>Reconstruction or repair &amp; cleaning of weir</td>
<td>93.2</td>
<td>73.8</td>
<td></td>
</tr>
<tr>
<td>Membership of water management committee</td>
<td>4.8</td>
<td>1.9</td>
<td></td>
</tr>
<tr>
<td>Participation in the resolution of conflict about water use</td>
<td>8.7</td>
<td>2.9</td>
<td></td>
</tr>
<tr>
<td>Meeting to elect weir leader</td>
<td>93.2</td>
<td>73.8</td>
<td></td>
</tr>
<tr>
<td>Requesting water from another weir</td>
<td>1.9</td>
<td>1.9</td>
<td></td>
</tr>
</tbody>
</table>
Table 2: Participation of Farmers in Paddy Cultivation Activities before and – after Intervention

<table>
<thead>
<tr>
<th>Activities</th>
<th>Participation (in Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before</td>
</tr>
<tr>
<td>Clearing and repairing the ditch</td>
<td>98.0</td>
</tr>
<tr>
<td>Offering to the spirit of weir</td>
<td>37.9</td>
</tr>
<tr>
<td>Preparing seed bed of rice</td>
<td>99.0</td>
</tr>
<tr>
<td>Allocation of water</td>
<td>74.4</td>
</tr>
<tr>
<td>Plowing for transplanting paddy</td>
<td>98.0</td>
</tr>
<tr>
<td>Sowing</td>
<td>87.4</td>
</tr>
</tbody>
</table>

Table 3: Involvement in the Systems Management

<table>
<thead>
<tr>
<th>Variables</th>
<th>Response (before) in Percentage</th>
<th>Response (after) in Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Position hold in committee</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Household head</td>
<td>66</td>
<td>4</td>
</tr>
<tr>
<td>- Relatives</td>
<td>17</td>
<td>11</td>
</tr>
<tr>
<td>Participation by Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Male</td>
<td>67</td>
<td>4</td>
</tr>
<tr>
<td>- Female</td>
<td>16</td>
<td>11</td>
</tr>
</tbody>
</table>

LAND AND IRRIGATION WATER USE AND MANAGEMENT IN VIETNAM

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

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

Soon after the defeat of the French colonial forces, the socialist model of economic management was introduced. Central planning system dominated the entire country after reunification. In agriculture, this was the period of capital socialization as well as land and farming collectivization. Cooperative farming started in 1959/1960. In the beginning, “lower-level” producer cooperatives were formed. This was followed by a transition to
“higher-level” cooperatives, which went on until the late 1960s. A second phase lasted till the late 1970s. Both category of cooperative were amalgamated, leaving only 5% of land being owned privately by the farmers. The early cooperatives were often organized according to hamlets and villages. The same basis was used for the production brigades at the commune-level cooperatives of the 1970s. The village was no longer an autonomous unit as in the past (Tuan, 2001).

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

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

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

Centralized planning and administration were effective during the war period. However, it had casted a serious negative impact on farm incentives and constrained the nation’s development in the post-war period. Agricultural production became unstable and declined in the late 1970s. Since the beginning of the 1980s, as measures to free the country from economic stagnation, economic restructuring with market orientation policies were launched (Tuan, 2001).
In the agricultural sector, land had been redistributed to farm households for private production. The forced procurement system was replaced with a unified “contract price” system in 1984. The modified system has been successfully applied since 1988. Under the new policy, the farmers owned the land for a long period of time. They were obliged only to pay taxes for the land. The cooperatives are gradually turning into a service organization due to loosing its right in land and production management along with reduced roles and tasks. In the newly introduced private production, the farm household became the basic economic unit. Agricultural production revived with investments from the motivated and eager farmers. In contrast, the management of many common resources, such as water, worsened (Doan, 1998).

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

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

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

As a result, deforestation is increasing. In 1990s, approximately 20% of the country was covered with forests (compared to 48% in 1945). In 1988, forest fires destroyed 2,133 ha of forests in the Northern Mountain and Midlands (Statistical Publishing House, 2000), leaving barren hills to occupy more than 60% of the total land area. The steep slopes, heavy rainfall, deforestation and shifting cultivation practices have led to heavy
soil erosion, which is estimated to be 1-1.5 cm, or 150-250 ton/ha, of soil loss from the cultivated area every year.

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

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

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

The farmers’ primary concern is to minimize the negative effects of sediment and run-off on paddy lands in the downstream areas while
maintaining the fertility and productivity of the uplands. The scale at which water supply has to be sustained and soil erosion controlled is beyond the individual farmer’s capacity. Therefore, a new form of common resource management such as irrigation systems at the watershed level is emerging, and villages have begun to play important roles in managing the common resources in the Montane areas of Vietnam.

A Case Study from Northern Vietnam

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

CONCLUSIONS AND IMPLICATIONS

While the process of public intervention in FMIS in Northern Thailand started nearly a century ago, the traditional customary practices and indigenous management regimes were incorporated in the intervention process. This helped the FMIS to maintain the community character of mutual and communal resource mobilization for operation and maintenance of the irrigation systems. Due to major emphasis of government investment decision in the productive flood plains and river basins to increase export crop production, little attention was paid on the improvement of small-scale FMIS in Northern Thailand. But with the focused targeted poor area and people development plan implemented a participatory mode of intervention in FMIS which started during early
80’s. But with the consolidated land titling project of 1986 and new economic opportunities, there are both positive and negative visible impacts on the organization and management of FMIS in Northern Thailand. While the price of land has increased due to secured land titling, there are several alternative uses of land and water identified in the production of cash crops. The change requires high capital which fetches high price. Similarly, there are changes in resource mobilization criteria from labor based mobilization to cash based mobilization. This leads to less availability of man-days for repair and maintenance of system as compared to earlier. There is reduction in the cultural activities. There are less arena now for social gathering where conflict resolution takes place in different forms. There are more formal cases than earlier. Due to availability economic opportunities other than farming, many people are moving of farming out and new people have come in with diverse interest and less concerned about community resource such as water and its use in irrigating the field. Due to multiple and conflicting uses of water, irrigation activity becomes less profitable and individual economic benefits are gained at the cost of FMIS (Shivakoti, 2000).

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


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INTRODUCTION

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

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

INDIGENOUS KNOWLEDGE AND PRACTICES IN SHRINGIGHAAT SIMUNIYA SAATGAON IRRIGATION SYSTEM

No one can clearly say about the beginning of Shringighaat Simуниya Saatгаon Irrigation System (SSSIS). An elder member of the main committee of the Water Users' Association (WUA), Mr. Tribeni Tharu (from indigenous community) knows the system since his childhood. Mr. Shiva Chandra Acharya, a knowledgeable person in the Village

1 M. Sc. student, Indian Institutes of Ecology and Environment, New Delhi, India
Development Committee (VDC), is sure that the system was started in the beginning or before the Rana regime as his grandfather migrated here in 1940 BS, while the system was in operation. Mr. Kul Chandra Aryal, a founder teacher of a local high school says “the indigenous Tharu people were the innovator of the system and this system is being operated using their indigenous knowledge and practices.” Due to the non-availability of written documents, the early history of the system is obscure but it is clear that it is in operation from generations using local knowledge, tradition, practices and organization and resources.

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

The change in the composition of the society has influenced in the irrigation system activities. The number of people in the command area has increased but land has been fragmented into smaller plots for agriculture and also used for other purposes likes houses, roads, schools, shops, mills, public market systems and so on. So the real command area has decreased. More importantly the Tharu population is decreasing. They are out migrating from the area, causing the knowledge gap owned by the Tharus. Now the migrants from surrounding districts mainly the Brahminis, Chhetris, Magars, Kami, Damai, and the Tharus are the stakeholders of the system. The SSSIS serves water for irrigation in the VDC for major agricultural production i.e. rice in the rainy reason and wheat, mustard, flax, lentil, pigeon pea and others in the winter. The users' participation in the irrigation system activities can be understood within the context of local cultural norms and values and their indigenous knowledge, practice, techniques and perception in the local environment for the sustainable water management system.
Figure 1: SSSIS in Motipur VDC
WATER USE ACTIVITIES

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

Water Acquisition

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

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

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

\(^2\) Aana and Paisa are the units of land (1 ha = 19.5 Ropani, 1 Ropani = 16 Aana, and 1 Aana = 4 Paisa)
time on the basis of the land area as the same as the division of water in rainy season.

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

**Water Allocation**

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

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

**Water Distribution**

Water distribution means the physical delivery of water to a crop land following the water allocation decision. Water distribution process is the most important in the system. Farmers become pleased to see water in their fields. Water is distributed on the basis of the land area in the branch canals for different Maujas. Within a branch (Mauja), farmers get water by their turn for which the branch canals have been divided into several sub-canals to irrigate each and every plot of land. The farmer leader (*Badghar*) and his assistant are responsible to distribute water to the proportion of land. The farmers trust *Badghar*. "The *Badghar* means to be impartial and he is of all" is their belief. The *Badghar* is ranked in higher social status equal to local government and respected by all.
Table 1: Water Allocation Pattern

a) At Source River

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

b) In SSSIS

<table>
<thead>
<tr>
<th>S.N.</th>
<th>Branch Canal Systems</th>
<th>Allocation of Water</th>
<th>Percentage Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Dhodekol</td>
<td>2 Aana</td>
<td>12.5 %</td>
</tr>
<tr>
<td>2.</td>
<td>Chappargaon</td>
<td>2 Aana</td>
<td>12.5 %</td>
</tr>
<tr>
<td>3.</td>
<td>Bandeuli</td>
<td>1.5 Aana</td>
<td>9.4 %</td>
</tr>
<tr>
<td>4.</td>
<td>Motipur</td>
<td>4.5 Aana</td>
<td>28.1 %</td>
</tr>
<tr>
<td>5.</td>
<td>Bangain</td>
<td>3 Aana</td>
<td>18.7 %</td>
</tr>
<tr>
<td>6.</td>
<td>Mormi</td>
<td>3 Aana</td>
<td>18.8 %</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td><strong>16 Aana</strong></td>
</tr>
</tbody>
</table>

Source: Field Visit

**Water Drainage**

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

**PHYSICAL SYSTEM ACTIVITIES**

**Maintenance**

Maintenance means the repairing and cleaning of the system to make water acquisition and distribution smoothly and efficiently. In SSSIS maintenance work starts before growing saplings of paddy in the first week of June. Cleaning canals by cutting unnecessary weeds, shrubs and digging out stones, sand, gravel etc (Dhule Kulai) is completed first in every branch canal. The time period is fixed by the main branch
committee. The branch canal committees by rotation select one committee as a chief to lead other systems in all activities of system. During maintenance within the branch system or whole system, labor and material resources are mobilized on the basis of the area of land that a farmer owns. All the maintenance works within a branch canal are completed by the farmers of that canal using their own resources. In the past, wooden aqueducts were used to convey water which have been replaced by concrete structures.

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

**Operation**

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

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

If the Mukhya Badghar finds any disputes among the branches or any irregularities from the branches, he calls a meeting of main committee.
The main committee decides for all irregularities and takes an action against irregularities. All the operational work in water acquisition, allocation, distribution are deeply associated with the tradition of this systems managed by the farmers.

**Construction**

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

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

Construction of canal from head to tail reveals a scientific knowledge among farmers that they have divided canals into many veins to irrigate all the corners. Water division devices of wooden planks or the cemented floor are the result of their intimate knowledge to allocate water equitably without any prejudice to all branches.
Figure 2a: A Temporary Brushwood Weir

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

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

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

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

ORGANIZATIONAL ACTIVITIES

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

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

Resource Mobilization

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

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

Because of changed socio-economic condition, many people have changed their profession or changed their system in agriculture. So the number of Kulara is decreasing, this has also created a problem in the system.
Finally the canal and the river have been wide and become shallow. Therefore, the system has become more damage prone area. The quantity of human and material resources are decreasing. The two-tiered SSSIS organization is shown in Table 2.

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

<table>
<thead>
<tr>
<th>a. The Main Registered Committee</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Chairperson</td>
<td>Mr. Dilli Raj Gnwali</td>
</tr>
<tr>
<td>2. Vice-chairperson</td>
<td>Mr. Gita Ram Bhandari</td>
</tr>
<tr>
<td>3. Secretary</td>
<td>Mr. Ambar Bahadur Basnet</td>
</tr>
<tr>
<td>4. Treasurer</td>
<td>Mr Bishnu Prashad Basnet</td>
</tr>
<tr>
<td>5. Member</td>
<td>Mr. Nitya Nanda Belbase</td>
</tr>
<tr>
<td></td>
<td>Mr. Ram Bahadur Tharu</td>
</tr>
<tr>
<td></td>
<td>Mr. Dukhe Tharu</td>
</tr>
<tr>
<td></td>
<td>Mrs. Guna Panthi</td>
</tr>
<tr>
<td></td>
<td>Mr. Ghana Shyam Bhandari.</td>
</tr>
<tr>
<td>6. Advisors</td>
<td>Mr. Netra Giri</td>
</tr>
<tr>
<td></td>
<td>Mrs. Shiva Chandra Acharya</td>
</tr>
<tr>
<td></td>
<td>Mr. Ravi Raj Achary</td>
</tr>
<tr>
<td></td>
<td>Mr. Tribeni Tharu</td>
</tr>
<tr>
<td></td>
<td>Mr. Chulai Tharu</td>
</tr>
<tr>
<td></td>
<td>Mr. Lokhari</td>
</tr>
<tr>
<td></td>
<td>Mr. Babu Ram Tharu</td>
</tr>
<tr>
<td></td>
<td>Mr. Dharma Raj Bhatraii</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>b. Branch Committees</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Motipur Branch</td>
<td></td>
</tr>
<tr>
<td>(i) Badghar</td>
<td>Mr. Chhabilal Bhatraii</td>
</tr>
<tr>
<td>(ii) Assistant Badghar</td>
<td>Mr. Chulai Tharu</td>
</tr>
<tr>
<td>(iii) Chaukidar</td>
<td>Mr. Dhan Bahadur Damai</td>
</tr>
<tr>
<td>2. Mormi Branch</td>
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<tr>
<td>(i) Badghar</td>
<td>Mr. Tuk lal Bhatraii</td>
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<tr>
<td>(ii) Group Badghar</td>
<td>Mr. Bhima lal Neupane</td>
</tr>
<tr>
<td>(iii) Group Badghar</td>
<td>Mr. Nil Kantha Pandey</td>
</tr>
<tr>
<td>(iv) Chaukidar</td>
<td>Mr. Yam lal Ghimire</td>
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<td></td>
<td>Mr. Mukti Ram Bhatraii</td>
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<td></td>
<td>Mr. Nokhai Tharu</td>
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<td>Mr. Shambhu Tharu</td>
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<td>3. Dhodekol Branch</td>
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<tr>
<td>(i) Badghar</td>
<td>Mr. Tribeni Tharu</td>
</tr>
<tr>
<td>(ii) Assistant Badghar</td>
<td>Mr. Pardeshi Tharu</td>
</tr>
<tr>
<td>(iii) Chaukidar</td>
<td>Mr. Solari Tharu</td>
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<tr>
<td>4. Bandeuli Branch</td>
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<tr>
<td>(i) Bagdhar</td>
<td>Mr. Ghana Shyam Bhandari</td>
</tr>
<tr>
<td>(ii) Chaukidar</td>
<td>Mr. Indra Bahadur</td>
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<td>Bangaim Branch</td>
<td>Mr. Rum Bahadur Thapa</td>
<td>Mr. Ram Prasad Tharu</td>
<td>Mr. Dan Bahadur Badi</td>
</tr>
<tr>
<td>Chappargaon</td>
<td>Mr. Bishnu Prasad Paudel</td>
<td>Mr. Top Lal Gaire</td>
<td>Mr. Krishna Paudel</td>
</tr>
</tbody>
</table>

Source: Field Visit, February 2002

**Communication**

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

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

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

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

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

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

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

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

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

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

CONCLUSION

The study has following findings:

1. The SSSIS is an example of FMIS. This system was started by the local Tharus using their indigenous knowledge and practices in designing, construction, operation and maintenance activities for water acquisition, allocation, distribution and drainage.
2. The farmers have developed the qualities of organizing, leading, decision making, conflict resolution and overall management of the system.
3. The constitution of the main committee of the Water Users’ Group has no provision to function the branch committees
4. All the branch committees have their own system of operating their committees and branch canals.
5. Water users of this system or the farmers in general do not know that there is a registered main committee of their own.
6. The canal has been widened and become shallow thereby washing away a large area of cultivated fertile land because of entry of uncontrolled volume of water into the systems that have no control mechanism.
7. Widespread flooding is affecting large area of the VDC as it has primitive irrigation system and is surrounded by rivers from all sides.
8. Shortage of natural resources like brushwood, stones and manpower (as they have engaged in other profession) has created problems in construction and maintenance of weirs.
9. The temporary brushwood weir and lining of canals are frequently damaged during monsoon. So, the farmers are always under pressure. This hampers their agricultural practices.
REFERENCES


PART V: COUNTRY REPORTS
HILL IRRIGATION IN VALAIS (SWISS ALPS):
RECENT EVOLUTION OF COMMON
PROPERTY CORPORATIONS

EMMANUEL REYNARD

INTRODUCTION

The Swiss Canton of Valais (Figure 1) is situated in the central part of the Alps. It is drained by the Rhone River, that flows from East to West and is boarded by two high mountain ranges: the Penninic Alps in the South and the Bernese Alps in the North. Because of rain shadow effects, the climate is relatively dry and annual rainfall is not more than 600 mm at 500 m AMSL and 800 mm at 1600 m AMSL (Figure 1). On the southern facing lateral valleys, the dry climatic conditions are accentuated by high insulation and evaporation.

Figure 1: Situation of Valais and Principal Areas with High Concentration of Channels

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Because of these climatic conditions, irrigation has been carried out almost since the 13th century (Mariétan, 1948; Ammann, 1995; and Reynard D., 2002). A network of mountain channels that transport water from naval or glacial rivers to cultivated fields was gradually constructed. These channels are called Bisse or Rayes in the French- speaking part of the valley and Suonen in the German-speaking part (Casanova, 1995). In this paper, we use the term bisse in a generic form. The channels are normally 5 to 10 kilometers long and the longest one is 32 kilometers long. The smaller ones are not more than one kilometer long. The principal channels derive water to secondary and tertiary channels. Sometimes, the channels transport water to small artificial lakes that allow the water to be stocked during the night or on Sundays. The channels are normally cut directly into the valley side (Figure 2); in some sectors, because of the presence of high rock cliffs, wood channels (Figure 2) were constructed along the cliffs (Högl, 1995; and Bratt, 1995). These wood channels are emblematic of the Valais irrigation system, but they are no longer in use and are replaced by galleries. Until the 19th century, irrigation was limited mainly to the meadows. In the 19th century, it was extended to vineyards and orchards. Meadows are irrigated by aspersion or gravitational techniques; only aspersion is used to irrigate orchards and vineyards (Reynard, 1995). Micro-irrigation is quite limited. In the main valley (the Rhone alluvial plain), irrigation is carried out by pumping from the phreatic nappe. Since the first decades of the 20th century, in relation with the decrease of mountain agriculture, channel irrigation has been in regression. The bisse network is currently about 600 kilometers long (SAT, 1993). It was more than 1400 kilometers long at the end of the 19th century (Rauchenstein, 1908:11; Lehmann, 1913:43; and Papilloud, 1999:28). Recently, the channels were integrated into the tourist industry as paths for hiking.

In this paper, we study the recent evolution (the last 50 years) of irrigation in the Valais and the correlated transformations of infrastructures and management institutions. We also analyze the impacts of public policy change, especially agricultural policy, on such evolution. In the next section, the analysis framework is presented. The property rights system of irrigation is analyzed in the third part. In the following section, we analyze the recent transformations of social and economic conditions in Valais. The fifth part is dedicated to the analysis of major changes of public policies concerning bisse management. We then study the impacts of social and economic change and policy change on bisse management institutions. In the last section, a synthesis and some perspectives are elaborated.
ANALYTICAL FRAMEWORK: THE INSTITUTIONAL RESOURCE REGIMES

The comprehension of the management organization of an irrigation system is necessary in order to evaluate its degree of sustainability. Our framework analysis is based on Elinor Ostrom’s works on common-pool resource management (Ostrom, 1990). In this section, we recall the problem of Tragedy of the Commons. We then present the concept of Institutional Resource Regime (IRR).

When Garrett Hardin published his famous paper on the tragedy of the Commons (1968), he argued that his model of unsustainable management could explain management of common-property natural resources such as oceans, air, forests, water, etc. The rapid degradation of this type of
resource is due, according to Hardin, to their property characteristics that allow each user to access the resource and to use it freely. Hardin concluded that collective management of such natural resources was not possible and that only privatization or State control could preserve the resource from degradation. Several scholars, like Netting, 1981; Berkes et. al., 1989; Feeny et. al., 1990; Ostrom, 1990; Stevenson, 1991; and Becker & Ostrom, 1995, then criticized Hardin’s model and showed, from multiple case studies, that renewable natural resources like forests, water, meadows, etc. are managed sustainably by endogenic collective self-organized management structures. Numerous irrigation systems in various parts of the world are studied and presented as cases of the robustness of management structures (e.g. Boelens & Dávila, 1998; Bruns & Meinzen-Dick, 2000; and Shivakoti & Ostrom, 2002). Swiss mountain irrigation is sometimes presented as an example of a success-story of local management (Netting, 1974), as well as alpine meadows management (Netting, 1981; and Stevenson, 1991).

In this type of study on common-pool resources management, it is presupposed that property regime is the main explicative factor of sustainable or unsustainable management. Only the “local scene” is analyzed, independently of the general political framework (State political structures, federalist or centralized state, for example), macro-economic tendencies (e.g. globalization, global markets, etc.) or social changes (modernization, tertiarization of society, etc.). Moreover, only one type of resource use (e.g. irrigation) is analyzed, independently of the other complementary or competitive uses of the same resource. For these different reasons, we propose here a larger framework analysis, that we have called IRR (Kissling-Näf & Varone, 2000; Knoepfel et. al., 2001; and Varone et. al., 2002).

The IRR concept considers that a renewable natural resource is generally exploited by more than one type of use. Forests are for example used for various wood exploitation (e.g. fire, construction), other material exploitation (e.g. mushrooms, litter, leaves), protection (e.g. against rockslides and avalanches), leisure (e.g. walking) and biodiversity conservation. Water is used for consumption, irrigation, industrial production, energy production, pollutant absorption, support for navigation, fishing or gravel extraction, recreation (e.g. water landscapes such as lakes, glaciers, waterfalls or sport activities), medical uses (mineral and thermal waters), religious uses, reserve against fire and biodiversity conservation (Reynard et. al., 2001). Natural resources are therefore defined as the components of the natural system that are used by societies
to satisfy their needs (Siebert, 1983:2) and it can be considered that they create goods and services for the society. Renewable natural resources are formed by two components: the stock, that is auto-reproduced (e.g. in the case of water, the reproduction is made by the water cycle), and the fruits that are produced by the stock (Ostrom, 1990:30f). Goods and services are produced by the stock as well as by the yield (Kissling-Näf & Varone, 2000 and Figure 3). Management of such high heterogeneous resource use systems needs efficient institutional regulations and we postulate that sustainability of resource management highly depends on institutional framework. The IRR concept allows the analysis of all the components of such institutional conditions.

**Figure 3: Examples of Goods and Services Produced by the Water Resource**

An institutional resource regime is defined as the combination of the property regime and public policies that regulate the natural resource management (Knoepfel et. al., 2001:35f; and Varone et. al., 2002). The property regime is analyzed through three types of property rights (formal property titles, disposition rights and use rights) and two categories of public policies are considered: exploitation and protection policies. Evaluation of public policies is made through the analysis of various
components (objectives, causality model, target groups, instruments and actors) of the policy design of such policies (Bussmann et. al., 1998). Two complementary dimensions are also considered: the extent and the coherence. The extent describes the numbers of goods and services explicitly regulated by the IRR. The coherence concerns the degree of coordination of the actors’ network. The IRR are then classified into four regime types: no regime, simple regime, complex regime and integrated regime (Knoepfel et. al., 2001:38f). In this paper, the IRR analysis framework is partially used in order to analyze the transformation of the irrigation management institutions in the Valais.

PROPERTY REGIME

In Switzerland, water rights are currently regulated by the Swiss Civil Code (SCC) in use since 1912. Property rights on water are based on two principles: the principle of accession (art. 667 SCC), which considers that underground property is linked to soil property (springs and underground water property are therefore linked to soil property) and the principle of state sovereignty, which restricts private property for predominant public interest. The Swiss Civil Code considers therefore that surface water (rivers, lakes, glaciers) are public water (art. 664 SCC) and underground water bodies and springs are private water (art. 704 SCC). In fact, large phreatic water bodies are now considered public water as well. It has to be noted that the civil code did not cancel all the former historical rights and there still exist several cases of private property of rivers or glaciers, especially in the Alps.

The public property of surface water means that the State can dispose of the water and give concessions (e.g. for energy production), authorizations (e.g. for sport activities), licenses (e.g. for fishing) to users or user groups. Some uses, like bathing, are free. Because of the federalist structure of the Swiss political system, public property is organized on three levels: the Confederation (central State), the Cantons (26 regional, relatively autonomous states) and the Communes (local municipalities). In the Canton of Valais, the principal river, the Rhone, is property of the Canton, whereas the other rivers are property of the communes. During the Middle Ages, the period when most of the current bisses were constructed, surface waters were property of land Lords, principally the Duke of Savoy and the Bishop of Sion (Reynard D., 2002). Irrigation systems benefit from access or use rights (“concessions”) to river water accorded by the Lords (Middle Ages and Ancient Regime) or by the communes (in more recent times). Very few channels use spring water. The duration of these use rights is
generally unlimited (the so-called droits perpétuels in French) and most of these rights were preserved and reallocated when the rivers of Valais began to be used for the production of electricity (end of the 19th century - beginning of the 20th century). Because of the high costs of construction and maintenance, there are nearly no private bisses. The channels were therefore constructed by the entire local community or by corporations of farmers called consortages. In a village, various specialized corporations could be created for managing a specific resource (e.g. alpine meadows, forests, dairies, fountains, etc.). Even now, new consortages are emerging, for example for irrigating lawns in villa allotments. The relationships between the entire community (the so-called comunitas) and the economic corporations during the Middle Age is not well documented. It seems that corporations were created and managed by the richest people of the community (Reynard D., 2002). Irrigation systems could also have been constructed by the local community and more recently by the local administration (municipality). Transfers from common systems to public systems are also documented.

The consortage is an example of common-property regime. The members of the association are common owners of the infrastructure and they benefit from rights on the use of the resource (e.g. water rights) or on the products of the association (e.g. wood, cheese). In the case of irrigation, the water division and allocation is normally organized into the form of a cycle (the so-called tour d’eau). Netting (1974) showed that the allocation was not always equitable. In Valais, 52.5 % of the channels now in use are managed by farmer associations and 42.5 % by local municipalities (state property), and the last 5 % are private bisses (Reynard, 1995:58). In the case of public management, the municipality is responsible for the capture, the transport and the distribution of water, and for the maintenance of the infrastructures. The farmers are responsible for the maintenance of the networks on their fields and pay a tax for the water allocation, generally based on the surfaces they irrigate. Their decision power is indirect by electing the municipal council and by participating in the local legislative assemblies. In the case of common management by a consortage, all the rights and obligations are in the hands of the association’s members. The maintenance is carried out by the members themselves in the form of workdays (the so-called corvées). Rights and obligations are generally calculated according to the surfaces to irrigate. Sometimes water rights are independent of surface (personal rights). The members, called consorts, elect their own committee and people for various specialized functions like the allocation of water, the control, the responsibility of maintaining works, etc.
Ostrom (1990) showed numerous cases of natural resources sustainably managed by this type of common-property system. The reason Hardin’s “tragedy of the Commons” is avoided is the presence of precise use rights that allow the exclusion of non-members, strict and precise internal regulations that organize access to the resource and high mutual control that limits practices of free-riding (Ostrom, 1990:45; and Feeny et. al., 1990:11). Numerous case studies of irrigation consortages in the Valais show evidence of these features and the long history of these associations. The robustness of the self-organized associations and the sustainability of irrigation water management by farmer corporations and common-property systems are therefore well documented in Valais.

SOCIAL AND ECONOMIC TENDENCIES

As outlined above, more than half of the total length of irrigation channels has been abandoned during the 20th century, especially during the period 1920-1970. Moreover, most of the remaining channels were transformed and modernized (replacement of wood channels by galleries, replacement of traditional open channels by concrete tubes, etc.). The reasons for such an evolution are multiple (Reynard & Baud, 2002). First of all new engineering techniques (e.g. use of explosives) allowed tunnels to be built to replace dangerous sectors along cliffs. The rapid modernization of agriculture after the 1950s (increasing productivity needing more water, aspersion needing “pure” water, not charged with sediments, use of chemical fertilizers replacing the natural fertilization by sediments transported by water) induced use of concrete in order to reduce infiltration and sediment transport. The concurrence of lowland agriculture and the general tendency of farmers to leave agriculture for secondary (chemical and metallurgic industries since the end of the 19th century) and tertiary (tourism and administration since the 1950s) activities provoked a rapid decrease of mountain agriculture and rearing. Intensive building of hydropower dams during the 1940s-1970s also reduced farming activities in the high valleys by reducing labor for agriculture. Entire sectors, formerly farmed as meadows, are therefore now being replaced by forests. Numerous agricultural surfaces are also replaced by the extension of urbanized areas, especially in the valleys where mass winter tourism is developed. Water needs for irrigation are therefore highly reduced in respect to the last decades of the 19th century. A lot of former water rights of consortages members are no longer in use because the owners of these rights do not practice agriculture any more or because the former farmed surfaces are now forested or urbanized.
If water needs for irrigation rapidly decreased during the 20th century, general water exploitation of the watersheds highly increased (Reynard et al., 2001). Domestic water uses increased until the beginning of the 1970s before stabilizing. Since the end of the 19th century, nearly all the major watersheds, and especially the ones highly covered in glaciers, were progressively exploited by the electrical industry. Several private companies obtained concessions from the communes (generally for a duration of 80 years) for the exploitation of hydropower. Natural discharge of the rivers was therefore highly reduced (frequently in the order of more than 80%). More recently, since the 1980s, water is also used for artificial snowmaking. At the same time, the tourist industry, formerly oriented mainly to winter activities (skiing), is now trying to diversify the offer, principally by proposing estate tourism based on walking and “green” natural activities. Demand for preserved natural landscapes, for example “hydrologic” landscapes like natural lakes, rivers with high discharge, waterfalls, etc., is increasing. There is therefore now a high competition between different water uses that can provoke conflicts, especially in tourist areas (e.g. Reynard, 2000, 2001) and in watersheds with a high range of goods and services produced by the water resource (Reynard et al., 2001).

A third tendency has been observed since the beginning of the 1980s: the tourist use of the irrigation channels (Reynard 1998; and Reynard & Baud, 2002). Numerous paths boarding the bisses for their maintenance are now used for hiking and integrated in the official walking paths network managed by the communes and the Canton. Various sectors with former wood channels are also renovated (e.g. Bisse d’Ayent; and Reynard, 2002a). Some channels no longer in use are reconstructed and refilled with water, sometimes only for tourist purposes. In several places, pedagogic boards are installed along the channels and numerous guides and booklets are edited by tourist offices or other organizations. In the inventory of the Cantonal Territorial Survey Office (SAT, 1993), 50% of the 190 listed channels have only an agricultural function, 37% have an agricultural and tourist function, 8% have only a tourist function and 5% have no function any more (Reynard, 1995:58). The local population also seems to be rediscovering the patrimonial value of the network and local conferences on the theme of bisses always attract a large public. The bisses may therefore not only be considered as pure agricultural infrastructures but as multi-functional objects at the interface of agriculture, culture and tourism (Reynard, 1997). It is to be noted that this tendency towards the multi-
functionality of the channels does not exist in other channel-irrigated regions of the Alps, like the Aosta Valley (Italy) or the French Alps.

PUBLIC POLICIES

The current multi-functionality of the bisse induces that the management of the channels is now concerned with three groups of public policies: water policy, agricultural policy, and tourist, nature conservation and territorial management policies. In this section, we rapidly analyze the recent transformations of these three groups of policies and their impacts on the channel management.

There is not one water act in Switzerland but numerous legislative texts, which are the result of a complex legislative history that began at the end of the 19th century and that can be summarized in four stages (Reynard et. al., 2001:118f); (1) the last decades of the 19th century developed a policy of protection against floods provoked by large deforestation in the mountainous watersheds of the country; (2) since 1908, the central State has been regulating the hydropower production (Law on the Use of Water Power, 1916); (3) since the 1950s, a sophisticated policy has been developed to fight against water pollution; (4) in 1991 a new Water Protection Act was adopted, that aims to protect the quantitative, qualitative and dynamic natural features of water resources. The main innovation of this law is the adoption of the principle of residual minimal flows in rivers exploited by hydropower industry or irrigation. In 1991 as well, a new River Act was adopted, that introduced the principle of revitalization of rivers in order to reconstruct the natural hydrological processes.

The agricultural policy changed its objectives at the beginning of the 1990s, as well. From World War II, agricultural policy has followed three main objectives (Sciarini & Von Holzen, 1995): (1) insuring the food security for the country (strategic function), (2) producing in the interest of the national economy (economic function) and (3) insuring a decentralized occupation of the country by maintaining the rural population in the campaigns (social function) (Agricultural Act, 1951). The 7th Report on the Agriculture (1992) is a turning point in the agricultural policy development in Switzerland and introduces a new objective for Swiss agriculture: the protection of nature and landscape. The objectives of the agricultural policy are now the insurance of food security (strategic function), the production in relation to the market demands (economic function), the conservation and sustainable use of natural resources (ecological function),

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the management of rural landscapes (tourist and landscape function) and the decentralized occupation of the Swiss territory (social function) (Agricultural Act, 1999). The main instruments of the new policy are the ecological direct payments, that aim to pay the indirect services offered by the farmers to the whole society (landscape and nature management) and therefore to complete the direct revenues coming from food production. These direct payments are provided by the Confederation and by the Cantons and they are normally calculated on the basis of the surfaces that are farmed with respect of natural processes (e.g. few entrants). No subsidies however are provided to linear infrastructures like traditional *bisses* or stone walls (terrace cultures) that still play an important function in rural landscapes and nature conservation. The Canton of Valais policies are now trying to develop direct ecological payments for this type of infrastructure as well. A traditional instrument that was introduced by the agricultural policy in 1951 is the subsidies for the so-called *améliorations foncières*, that means all the technical innovations aiming to improve agricultural productivity, especially allotment reshuffling. In the Valais, where irrigated agriculture had a strategic importance, this type of subsidy was introduced in 1924 already, to improve the *bisses* productivity by replacing wood channels by galleries or concrete channels. Until the 1980s the policies of the agricultural cantonal administration was to improve the productivity of the *bisses* without any consideration for tourist or patrimonial aspects. Since then, technical improvements that respect historical and natural features of the infrastructures are used.

The *bisses* are also concerned by the tourist policy because of their use as hiking paths. The *bisses* can also obtain subsidies in relation with the cantonal Nature and Landscape Conservation Act (1998) for their patrimonial and historical interest. In the same order, they are considered in the cantonal Territorial Management Act (1987) as object to being preserved.

The recent transformations of the social and economic framework, shown in chapter 4, and the new ecological objectives of various public policies, presented in this section, have great impacts on the functioning of the irrigation corporations and on the structure of the actors’ networks interested with the *bisses* management and conservation. These impacts are analyzed in the next section.
OLD AND NEW ACTORS OF BISSES MANAGEMENT

Irrigation consortages are highly concerned by social, economic and policy change. As these changes are spatially differentiated, consortage transformations are differentiated as well. The aim of this section is to analyze how the consortages react to outside impacts and how their internal characteristics transform. The analysis is based on the results of various case studies (Crettol, 1998; Reynard, 2000; Reynard & Baud, 2002; and Reynard, 2002).

Two tendencies can be seen. Some corporations conserve a high dynamism. Their internal structure (committee, specialized functions) is conserved and they finance their activities (maintaining, technical investments, tourist valorization) without any problems. Part of the financial income sometimes comes from the hydropower industry that buys water no longer used for irrigation because of the decreasing agricultural needs and that is preserved as former water rights in the hydropower concession acts. In the case of tourist investments, these corporations promote the valorization themselves, like the consortage d’Ayent (Reynard, 2002). Other corporations, often situated in tourist or suburban areas, have a lot of functioning difficulties. Because of agriculture reduction and urbanization, the consorts do not participate in the consortages’ activities any more. Very often, the committee is composed of old farmers that have difficulties being replaced by younger ones. The assemblies are sometimes patronized by less than ten members. There is also a reduction of the “official” functions in the consortage and sometimes the committee is composed of only one or two persons. Because of the effective water rights reduction, these corporations often have financial difficulties. Because of low dynamism of the committee, these consortages often do not ask for subsidies for patrimonial conservation. Some consortages are not associated with tourist or patrimonial projects. The maintenance of the infrastructures is also being reduced, which means that potential risks induced by channel breaking increase. This problem is even more acute where the channels cross urbanized areas. The consequence is a difficulty in taking out insurance (Crettol, 1998) and the problem of the responsibility of the committee, and especially of the president, in case of flooding induced by channel degradation. Most of these consortages are now trying to be dissolved and to transfer their infrastructures to public administrations. This is clearly a tendency to a transfer from common-property management to public management.
Disposition rights on Swiss Alps rivers were highly transformed when the Hydropower Act (1916) precisely organized the concession of water to hydropower companies. Preservation of former water rights for irrigation was clearly mentioned. That means that in the concession acts, irrigation water rights are preserved, and generally quantitatively calculated. As irrigation needs are now lower than the discharge conserved for irrigation, some corporations sell the water surplus to the electrical companies (e.g. Bisse d’Ayent and Reynard, 2002) and therefore receive interesting financial incomes. Other consortages concede water free to the hydropower companies.

Because of a general decrease in mountain agriculture, the conflicts between consortages occupying the same watershed, that were very common in the past centuries (SHVR, 1995), are now very scarce. Several scholars (e.g. Lehmann, 1913; Mariétan, 1948; and Netting, 1974, etc.) described very precisely the sophisticated internal regulations that organized water rights distribution between the members and the water allocation (irrigation cycles). These regulations are now often no longer in use. Water access is very often free. Exclusion of non-members is also beginning to disappear, and non-members can often use the channel water freely, as was shown in the Ayent area (Reynard, 2002a). Selling water rights to non-members is possible, as well. In the past, such a practice was forbidden. In some valleys, irrigation water use is completely free (e.g. Bagnes Valley) and infrastructure maintenance is paid by the whole population (Reynard, 2002b). The argument is that irrigation participates in the maintenance of meadows and indirectly to rural landscape conservation: it is therefore logical that this service is paid to the farmers by all of the inhabitants of the valley.

Patrimonial and tourist valorization of the bisses induce an enlargement of the actors network (Reynard, 1998). Until the 1970s, three groups of actors were concerned by the bisses management: the consortages, the local administration and the cantonal agriculture administration (for technical support and subsidies). The new interest for patrimonial conservation and tourist valorization of the channels has enlarged the circles of actors interested by bisse management. At the local level, new actors are emerging from the tourist industry (e.g. tourist offices) or simply from society (e.g. associations for patrimonial conservation, association for the conservation of one particular bisse, etc.). Very often, these new circles are animated by one or two strong individualities that promote the conservation and valorization of the channels. Sometimes, their actions are not coordinated with the consortages that manage the channels.
CONCLUSIONS AND PERSPECTIVES

This presentation of the recent evolution of the *bisses consortages* of Valais show a very high diversity of situations. Some corporations are dynamic and their financial situation is good. They promote the irrigation improvements themselves and the tourist valorization. Other associations are losing speed. Their internal structures are weak and they have an unhealthy financial situation. They often do not promote the tourist valorization of their infrastructures and other specialized associations are emerging. The public policies concerning the *bisses* management have diversified. The general evolution of the social and economic framework is towards a decrease in mountain agriculture and to a tertiarization of the society. The tourism sector is diversifying its offer, by promoting estate activities. The analysis showed however that *consortages* situated in tourist sectors and suburban areas have more difficulties than corporations acting in more rural regions, because of progressive disinterest of their members for agricultural activities and progressive reduction of effective water rights. The principal transformations are presented in the table in Table 1.

Table 1: Principal Transformations of Irrigation and Channels Management in Valais (1950-2000)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Situation in 1950</th>
<th>Situation in 2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social and economic framework</td>
<td>Regression of mountain agriculture. Lowland agriculture (Rhone valley). Tendency towards a tertiarization of society (emerging winter tourism). Construction of large hydropower dams.</td>
<td>High tertiarization of society. Full-time agriculture occupied only by 3.5 % of the active population. Tourism is diversifying the estate offer. Political willingness to promote sustainable development of the Canton of Valais.</td>
</tr>
<tr>
<td>Irrigation infrastructures</td>
<td>Tendency to abandon or technical transformations (concrete tubes, galleries). New irrigation sectors in vineyards.</td>
<td>Conservation of traditional channels. New channels are very rare.</td>
</tr>
<tr>
<td>Irrigation</td>
<td>Transfer from gravitational techniques to aspersion, especially in vineyards and orchards.</td>
<td>Transfer from gravitational techniques to aspersion, in the meadows as well. Reduction of vineyard irrigation.</td>
</tr>
<tr>
<td>Institutions</td>
<td>Consortages and local administrations.</td>
<td>Consortages and local administrations. Tendency: transfers from consortages to local administrations.</td>
</tr>
<tr>
<td>Property regime</td>
<td>Corporations’ water rights to rivers preserved in the concession acts for hydropower production. Strict internal regulation of the consortages is evolving. Regulated access to water (irrigation cycles).</td>
<td>Corporations’ water rights still in use but not always effectively recognized. Internal regulation often weak or non-existent. Tendency to free access to water.</td>
</tr>
</tbody>
</table>
### Public policies

| Bisse management concerned by water and agricultural policies. | Greater ecological focus in water and agricultural policies. Enlargement of public policies concerned by channel management. New subsidies for the preservation of patrimonial aspects of the channels and for their tourist valorization. No subsidies for their landscape conservation function in the sense of agricultural policy. |

### Actors network

| Consortages, local municipalities, cantonal agricultural office | Enlargement of the actors network: tourist industry, local society, other cantonal and federal administrations (tourism, environment). |

### Consortages

| Corporations generally well organized. Some consortages no longer exist because of channel abandon. | Differentiated evolution of the consortages. Some conserve their dynamism; others are losing speed. |

The question is now to know if the robustness of the irrigation corporations of Valais, that are sometimes five to six centuries years old, is intrinsic to their common-property characteristic or if other reasons to their long-term activity have to be found. The answer is varied. Several consortages are very old and it is certainly a sign of a certain robustness or almost a capacity to adapt to changes. The consortages are also models of participation management (cf. Ostrom, 1992). But, this paper shows that internal pressure (competition between irrigators, mutual control), that is one reason for the efficient functioning of such corporations (Ostrom, 1992), is hardly decreasing. On the other hand, external pressure (increasing water demand for new uses like drinking water, hydropower production, artificial snowmaking) is increasing. The consequence is that several consortages are weakening and some have almost disappeared. One could therefore ask if consortage robustness is not intrinsic to the property regime, but a consequence of favorable external conditions like a non-globalized economic context, based on agricultural production, and the absence of interventionism of the central state. Current decrease of common-property management of irrigation in Valais would then be explained by new economic conditions, characterized by a high tertiariization, globalization of the food markets, transformation of agriculture objectives, transformations of the channel functions (new tourist uses) and apparition of new actor groups. Only the consortages that are situated in areas with high agricultural activity or the consortages that can adapt to the new economic conditions (new types of subventions for ecological agriculture, financing of tourist services, etc.) will survive.
REFERENCES


IRRIGATION MANAGEMENT TRANSFER
EXPERIENCE OF LAO PEOPLE’S
DEMOCRATIC REPUBLIC

PHALASACK PHEDDARA¹

BACKGROUND

Lao People’s Democratic Republic (PDR) is near the top in the list of the world poorest countries. Lao PDR, located in South- East Asia, is one of the Indochina countries, bordered in the North by China, in the East by Vietnam, in the South by Cambodia, in the West by Thailand and Myanmar.

Since 1996 irrigation infrastructures were being rapidly developed in Lao PDR. Table 1 and Figure 1 show the status of irrigation achievements of Lao PDR.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry Season (Thousand ha)</td>
<td>26</td>
<td>28</td>
<td>45</td>
<td>75</td>
<td>124</td>
<td>197</td>
<td>214</td>
</tr>
<tr>
<td>Wet Season (Thousand ha)</td>
<td>150</td>
<td>156</td>
<td>164</td>
<td>217</td>
<td>258</td>
<td>296</td>
<td>300</td>
</tr>
<tr>
<td>Flood Protection (Thousand ha)</td>
<td>25</td>
<td>27</td>
<td>29</td>
<td>35</td>
<td>40</td>
<td>45</td>
<td>50</td>
</tr>
<tr>
<td>Investment (Million US$)</td>
<td>5.5</td>
<td>2</td>
<td>9</td>
<td>19</td>
<td>37</td>
<td>27</td>
<td>24</td>
</tr>
</tbody>
</table>

¹ Director of Planning and Cooperation Division, Ministry of Agriculture and Forestry, Lao People's Democratic Republic.
The evaluation by the government in 2000, four years after the start of implementation of the rapid irrigation development program, has found that some changes have occurred. Some of them are positive and others as negative. They are shown below;

The Positive

− Both farmers and government are happy; and
− Rice production rapidly increased.

The Negative

− High investment;
− Not ready for O&M;
− Poor extension service system;
− No market;
− No quality control;
− Limited government staff;
− Lack of experience; and
− Limited budget.

However, the government of Lao PDR has attached high importance to this program. This importance is shown not only by the government
approving about 30% of the total Public Investment Plan for irrigation development in 1996-2000, but also many laws, regulations, guidelines were adopted as follows:

- Prime Minister's Order No. 26/PM, dated December 18, 1998, approved the policy of irrigation management transfer from the government to the farmers' community;
- Announcement by the Central Party Office No. 616/CPO, dated December 17, 1999, stated the result of the Politburo Members decision on irrigation management transfer development concept and modality;
- Ministerial Regulation states the full irrigation management transfer to the water user association (No. 149/MAF 2000, dated 27 June 2000); and
- Announcement of the Ministry of Finance No. 94/MF regarding the Tax of Irrigation Management Transfer (IMT), dated 12 January 2000.

The government has also requested many external financing agencies to assist in the improvement and strengthening of irrigated agriculture organizations and institutions. Some of them are listed below;

- Sustainable Irrigated Agriculture Project (SIRAP) funded by the Netherlands Government through the Mekong River Committee (MRC);
- Strengthening and Restructuring Irrigation Development Project (SRIDP) funded by ADB;
- Farmer Irrigated Agriculture Training (FIAT) Project funded by UNDP;
- Eco-development and Irrigation (EDI) Project funded by UNCDF;
- Master Plan Study on Small Scale Irrigation Development along the Mekong River funded by JICA;
- Small Scale Community Managed Irrigation (CMI) Project Loan from ADB;
- Decentralization Irrigation Development and Management (DIDM) Project Loan from ADB;
- Irrigated Agriculture Infrastructure Development Project Loan from World Bank; and
- Also mobilized many grants, assistances and supports from different NGOs, bi-lateral and international organizations such as; Luxembourg, Vietnam, France, Germany, Japan, Korea, FAO, IHF, American Friend Service (QUARKER), CAA, Concern, etc.
At present, Lao PDR has a total of irrigated agriculture land of 300,055 ha in 19,279 schemes. The types and sizes are given in Table 2, 3 and 4:

Table 2: Number and Area of Irrigation Schemes by Type (2001)

<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
<th>Wet Season (ha)</th>
<th>Dry Season (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weirs</td>
<td>716</td>
<td>53188</td>
<td>26218</td>
</tr>
<tr>
<td>Reservoirs</td>
<td>172</td>
<td>22698</td>
<td>13281</td>
</tr>
<tr>
<td>Pumps</td>
<td>3435</td>
<td>159589</td>
<td>136260</td>
</tr>
<tr>
<td>Gate &amp; Dike</td>
<td>65</td>
<td>6948</td>
<td>2020</td>
</tr>
<tr>
<td>Traditional</td>
<td>14787</td>
<td>54497</td>
<td>35609</td>
</tr>
<tr>
<td>Gabion</td>
<td>104</td>
<td>3135</td>
<td>972</td>
</tr>
<tr>
<td>Total</td>
<td>19279</td>
<td>300055</td>
<td>214360</td>
</tr>
</tbody>
</table>

Table 3: Number and Area of Irrigation Schemes by Sizes (2001)

<table>
<thead>
<tr>
<th>Type</th>
<th>Small</th>
<th>Medium</th>
<th>Large</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weirs</td>
<td>538/13450</td>
<td>174/35086</td>
<td>4/4652</td>
<td>716</td>
</tr>
<tr>
<td>Reservoirs</td>
<td>127/6373</td>
<td>43/11825</td>
<td>2/4500</td>
<td>172</td>
</tr>
<tr>
<td>Pumps</td>
<td>3125/62775</td>
<td>2986/5228</td>
<td>12/31586</td>
<td>3435</td>
</tr>
<tr>
<td>Gate &amp; Dike</td>
<td>47/1245</td>
<td>185705</td>
<td>-</td>
<td>65</td>
</tr>
<tr>
<td>Traditional</td>
<td>14787/54497</td>
<td>-</td>
<td>-</td>
<td>14787</td>
</tr>
<tr>
<td>Gabion</td>
<td>104/3135</td>
<td>-</td>
<td>-</td>
<td>104</td>
</tr>
<tr>
<td>Total</td>
<td>18728/141473</td>
<td>533/117844</td>
<td>18/40738</td>
<td>19279</td>
</tr>
</tbody>
</table>

Table 4: Irrigation Schemes Sizes Definition

<table>
<thead>
<tr>
<th></th>
<th>Small</th>
<th>Medium</th>
<th>Large</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 100 ha</td>
<td>100 - 1000 ha</td>
<td>More than 1000 ha</td>
<td></td>
</tr>
</tbody>
</table>

Irrigation Management Transfer

The objectives of Irrigation Management Transfer (IMT) in Lao PDR are:

- To promote community ownership in irrigated agriculture management;
- To promote sustainable irrigation agriculture development;
- To promote effective and appropriate government support;
- To promote and contribute the government decentralization program; and
- To promote the operation of the Village Development Funds.
The IMT Strategy

Long Term: The long term strategy is full transfer of all constructed irrigation schemes (Irrigated Agriculture Management) to the farmers' community.

Short Term: The short term strategy proposes to;

- Improve and rehabilitate and failed irrigation schemes;
- Strengthening of Water User Organization (WUO);
- Transfer automatically newly constructed (Small and Medium) irrigation schemes;
- Transfer step by step the big irrigation schemes; and
- To promote development based on community incentives.

The community incentives mean that the farmers take lead and show the ownership to develop the irrigation facility by themselves. The government through DOI networks will only provide technical support on the request. With the assistance of DOI, the local government will decide case by case the amount of government contribution for project development. This is one of the difficult tasks of the Department of Irrigation. The reasons is that the government has limited budge, but there is demand for irrigation development. The priority is given to those communities which really need and are willing to develop irrigation by themselves. Therefore, the approval process is to be considered case by case. However, no standard is developed. The burden to DOI is increasing. For last five years many thousand irrigation schemes were developed with farmer participation. They have contributed between 15-85% is shown in Table 5.

Table 5: IMT Situation

<table>
<thead>
<tr>
<th>S.N.</th>
<th>Province</th>
<th>Total Need</th>
<th>Up to 2001</th>
<th>In 2002</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>No.</td>
<td>Area</td>
<td>No.</td>
<td>Area</td>
</tr>
<tr>
<td>1.</td>
<td>Municipality</td>
<td>107</td>
<td>24371</td>
<td>53</td>
<td>12469</td>
</tr>
<tr>
<td>2.</td>
<td>Phongsaly</td>
<td>14</td>
<td>1600</td>
<td>3</td>
<td>520</td>
</tr>
<tr>
<td>3.</td>
<td>Luang Namtha</td>
<td>29</td>
<td>2010</td>
<td>6</td>
<td>509</td>
</tr>
<tr>
<td>4.</td>
<td>Oudomxay</td>
<td>16</td>
<td>3536</td>
<td>36</td>
<td>1433</td>
</tr>
<tr>
<td>5.</td>
<td>Bokeo</td>
<td>50</td>
<td>5491</td>
<td>17</td>
<td>1391</td>
</tr>
<tr>
<td>6.</td>
<td>Luang Prabang</td>
<td>138</td>
<td>4126</td>
<td>2</td>
<td>97</td>
</tr>
<tr>
<td>7.</td>
<td>Suyabury</td>
<td>17</td>
<td>9324</td>
<td>35</td>
<td>1150</td>
</tr>
<tr>
<td>8.</td>
<td>Houaphan</td>
<td>59</td>
<td>7250</td>
<td>6</td>
<td>750</td>
</tr>
<tr>
<td>9.</td>
<td>Xiengkhouang</td>
<td>91</td>
<td>6960</td>
<td>24</td>
<td>2348</td>
</tr>
<tr>
<td></td>
<td>Province</td>
<td>Pop.</td>
<td>Area</td>
<td>Area %</td>
<td>Res.</td>
</tr>
<tr>
<td>---</td>
<td>-------------------</td>
<td>------</td>
<td>-------</td>
<td>--------</td>
<td>------</td>
</tr>
<tr>
<td>10.</td>
<td>Vientiane</td>
<td>167</td>
<td>45500</td>
<td>69</td>
<td>5911</td>
</tr>
<tr>
<td>11.</td>
<td>Bolikhamsai</td>
<td>95</td>
<td>11000</td>
<td>75</td>
<td>5750</td>
</tr>
<tr>
<td>12.</td>
<td>Khammouane</td>
<td>138</td>
<td>20000</td>
<td>75</td>
<td>8110</td>
</tr>
<tr>
<td>13.</td>
<td>Savannakhet</td>
<td>265</td>
<td>25000</td>
<td>96</td>
<td>8114</td>
</tr>
<tr>
<td>14.</td>
<td>Saravane</td>
<td>123</td>
<td>12000</td>
<td>77</td>
<td>9400</td>
</tr>
<tr>
<td>15.</td>
<td>Champasak</td>
<td>208</td>
<td>14733</td>
<td>87</td>
<td>6177</td>
</tr>
<tr>
<td>16.</td>
<td>Sekong</td>
<td>22</td>
<td>914</td>
<td>2</td>
<td>121</td>
</tr>
<tr>
<td>17.</td>
<td>Attapu</td>
<td>10</td>
<td>1280</td>
<td>2</td>
<td>165</td>
</tr>
<tr>
<td>18.</td>
<td>Special Region</td>
<td>57</td>
<td>1600</td>
<td>3</td>
<td>80</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1806</strong></td>
<td><strong>196735</strong></td>
<td><strong>668</strong></td>
<td><strong>64495</strong></td>
<td><strong>37.0</strong></td>
</tr>
</tbody>
</table>

At present, about 1800 irrigation schemes which cover about 200,000 ha of irrigated land need to be transferred. There are about 17,600 small irrigation schemes covering about 100,000 ha of irrigated land. They do not need to transfer, because they are too small. Most of them were built traditionally by farmers themselves.

**Water User Organization**

- Water User Association (WUA), registered with the Provincial Finance Service Office.
- Water User Group (WUG), registered at the District Governor Office.

WUO is usually established during the pre-construction stage in order to mobilize farmers contribution for the development of the irrigation scheme. The mobilization work takes place with assistance of the provincial and district extension workers. A standard structure is proposed;

**Before Operation:** The WUO consists of;

- Chairman
- One or two Deputy Chairman
- Three Committees for 1) Labor, 2) Quality/Quantity and 3) Finance/Procurement

When system is in operation, following officials will be elected;

- Chairman
- One or two Deputy Chairman
- Three Committees 1) Labor, 2) Water Management and 3) Administration

365
Basic regulating instruments for establishment of WUO are as follows:

- Ministerial Decree No. 156/MAF, dated 17 March 1997 on Irrigation Water User Association;
- Departmental Guideline on implementation of the Ministerial Decree on Irrigation Water User Association;

**Irrigation Service Fee (ISF)**

An ISF is proposed which would support the full cost of routine operation and maintenance. The amount payable for ISF will vary from site to site depending on site specific needs. The WUO would set the rate of ISF on an annual basis, with the assistance of the Irrigation District Technicians. ISF requirements are expected to range from US$25 to US$100 per ha per year or equivalent to 250-1000 kg/ha/year.

**Village Development Fund (VDF)**

VDF should be established at village level on voluntary basis, WUO have not established VDF. With the new IMT process the WUO must establish a VDF. The VDF can be owned by the WUO or shared between WUO and Village authority.

The recommended payments to VDF are in kilograms of rice per hectare per year. The following amount is proposed;

- For a gravity irrigation system, 200 kg/ha/year
- For an electric powered pumping irrigation system, 150 kg/ha/year, and
- For a diesel powered pumping irrigation system, 100 kg/ha/year.

85% of VDF collection remain for the use of WUO and the remaining 15% will be contributed to the District Technicians for the sources provided. No portion of these funds would go up to a higher level.

The main objective of VDF is to mobilize all potential local resources for multi-purpose use for village development activities. With WUO, the main
Objective of VDF is to make funds available for operation and maintenance of the irrigation system.

Basic regulating instruments for establishment of VDF are as follows:

- Prime Minister Order No. 01/PM, dated 11 March 2000, on decentralization program.

O&M activities for which the WUO is responsible are:

- Running cost (electricity, diesel, etc.)
- Administration
- Services (water distribution, cleaning)
- Maintenance (spare parts, fixing, repairing)
- Rehabilitation

The Ministry of Agriculture and Forestry through its provincial and district representatives was assigned to help and guide the WUOs on the use of VDF. The Chief of District Agriculture and Forestry Service Office becomes the adviser of the WUOs. All decisions are made by the WUOs themselves. The Ministry of Finance should be responsible for the auditing of VDF.

Lesson Learned (goodness/weakness)

Good Lessons

- Party and Government strongly support and give importance to VDF as a high priority;
- Solving the problems of food security, food sufficiency, increased work availability, reduction of poverty, reduction of shifting cultivation.
- Reduction of government allocation for O&M;
- Increase community ownership, support the government decentralization program;
- Participatory development and management;
- Getting support from NGOs, bilateral and international organization.
Bad Lessons

- Ideological conflict between the old and new development concepts;
- Limited qualified and experienced
- Limited extension fund and facilities;
- Not ready for implementation;
- No preparatory study for the Rapid Irrigation Development Program.
SOME EXPERIENCES AND LESSONS ON THE ROLE OF COMMUNITY IN PARTICIPATORY IRRIGATION MANAGEMENT IN TUYEN QUANG PROVINCE VIETNAM

NGUYEN XUAN TIEP

CONTEXT

Tuyen Quang is a poor mountainous northern province of Vietnam with its natural land area of 580,090 ha. in which 65,017 ha. is cultivated agricultural land, making up 11%. 447,761 ha. is the forestland, making up nearly 80%. The population of Tuyen Quang is 700,000 belonging to 22 different ethnic groups. As a monsoon and tropical climate area, high percentage of slopes are downgraded by rivers and streams. Annually, Tuyen Quang suffers from fiercer floods and inundation during rainy season, especially the flash flood and accumulated flood. Sunshine and hot weather contribute drought in summer. Biting cold, dry and low humidity in winter affect agricultural production and economic life. Many hydraulic works, mainly small-scale structures, have been constructed with the support of the government in Tuyen Quang.

Before 1996, there were 1,342 structures in the whole province. Out of them, 152 were managed by the State under Irrigation Management Company (IMC). Local people manage the remaining structures.

The irrigation fee collected annually from the state-managed structures was 450-500 tons of paddy rice which is only enough for salary of management staff. Due to lack of funds for annual maintenance, rehabilitation and upgrading of most hydraulic works in Tuyen Quang were seriously degraded. Some of them even stopped functioning.

Issue for Consideration

Annually, a large amount of fund is required to invest for repairing and rehabilitating the existing structures in Tuyen Quang. The requirement for
maintaining system is estimated to be about 10 billion Vietnamese Dollar (VND)\(^2\)/year (= 700 000 US$). While the irrigation fee collected was 500-600 million VND (=35-40 000 US$), the State invests in an average of 300 million VND/per year (= 20 000 US$). If the investment is only at the level mentioned above (nearly 1 billion VND/year (= 70 000 US$), accounting approximately 10% of requirement), then the question remains when will the hydraulic works system in Tuyen Quang be completely optimizing its design capacity?

Officials and farmers in Tuyen Quang recognized that individual households could not carry out hydraulic works construction. Even if efforts were made, it was ineffective, therefore the community participation was needed. As benefits come along with responsibilities, the management transfer of local hydraulic works to farmers would achieve the most effective result. With the above consideration in order to overcome the existing lack of fund, the People’s Committee of Tuyen Quang province decided to assign the farmers the management responsibility of hydraulic works through the Cooperative established by them.

**Achievements after Transferring the Structure Management to Farmers**

In the past, many people were afraid of the transferring of structure management to farmers' thinking that it would make the structures more quickly degraded.

**But the Results are Positive**

Nearly 100% of hydraulic works of various types in Tuyen Quang have been assigned to the farmers for management with three different categories:

- Inter-district structural management board (managing the structures which serve irrigation for 2 districts)
- Inter-commune structural management board (managing the structures which serve irrigation for at least 2 communes)
- Cooperative (managing the structures which are located totally in a commune with many hamlets)

\(^2\) 1 US$ = 15273 VND (Dong).
Important results of management transfer are;

- The structures formerly had no owner. After transfer, the farmers have been the real owners. The farmers have been trained so they gained knowledge to use water economically. No tension on water related conflicts occurred. Cutting channel banks for getting water and destroying structures have been reduced. The responsibilities of farmers have been clearly defined.
- Farmers have contributed financial resources to build structures (equivalent to 30-37% of the cost)
- Number of structures increased from 1,342 to 1,443.
- The farmers have participated in discussion through their cooperatives on financial income and expenditure, protection duty, structure maintenance and irrigation fee collection.
- Farmers contributed their financial resources to set up irrigation structures: In 1997, the total invested capital was VND 7.454 billion, in which share of farmers was VND 2.71 billion (nearly 37%). In 2000, total invested capital increased to VND 86.3 billion, in which share of farmers was VND 24.8 billion (nearly 30%)
- Due to the saving of irrigation water, the irrigated area has been increased. Paddy cultivated area was 41,600 ha in 1996 whereas in 2000 it was 44,500 ha. Similarly, rice yield has also increased from 7.6 tons/ha/year in 1997 to 9 tons/ha/year in 2000. In some areas, it was reported to be 12 tons/ha/year.

Irrigated areas of others crops, such as maize, peanut, vegetables, tea, sugarcane are not included in the paper.

There was also their use of water.

- Fresh water was provided to 100,100 people in 1997. In the year 2000, receiving fresh water was 192,000.

The irrigation fee is increased to 749 kg/ha/year from 200/kg/ha. The fund is enough for operation and maintenance of the structure. Following figures show the increasing trend of fee collection.

- In 1996, 748 tons of paddy rice was collected
- In 1997, 2,470 tons of paddy rice was collected
- In 1998, 3,200 tons of paddy rice was collected.
The increment is 4 times higher in comparison to the fee of 1996. Cooperatives collected 100% irrigation fee is kept by the Cooperative. Out of that, 20% is used for managerial expenses and 80% for structure repair and maintenance.

During 1999 – 2000, farmers contributed construction materials and labor to construct 710 km canals of all types. The cost is equivalent to 48.5 billion VND (nearly 3.5 million US$).

Irrigated area, productivity, and yields have increased. Many places have registered the rice yield of 12 ton/ha/year increase from 6 ton/ha/year.

The farmers are very pleased with the benefit of their participation so they have paid attention to the protection of their structures in their local area.

It is said that the rate of irrigation fee in Tuyen Quang is too high, especially for the people living in the poor mountainous area. During interview on the irrigation fee, the farmers said: “We do not care much about whether the irrigation fee is high or low but we really care of whether the water is supplied enough and timely by the cooperative”. In some cases, due to repairing of headworks, water could not be supplied adequately and timely. This resulted in lack of water. Hence the irrigation fee was given back to the farmers.

In the State managed structures, the farmers had to pay irrigation fee in cash or paddy rice. The collection would be used to pay salary for persons in charge of managing, repairing and maintaining the structure. However, the farmers were short of both cash and paddy rice while their labor force was abundantly available. Since the structure management has been transferred to the farmers, they can pay irrigation fee by their labor force for repairing channels and structures, exploiting construction materials (rock, brick, sand and gravel and so on). During 1999-2000, as mentioned above, farmers contributed construction materials and their labor force to construct 710 km canals which is equivalent to 48.5 billion VND (nearly 3.5 million US$). This is a huge irrigation fee source that has been achieved by mobilizing local people. By this way, many communes even have contributed irrigation fee for some coming years. For example: the Yen Nguyen commune has contributed irrigation fee up to the year of 2005 (5 years in advance), the Binh Xa commune has paid
irrigation fee up to 2007 (7 years in advance) with these contributions, many head works have been upgraded, repaired and reinforced.

LESSONS LEARNT FROM THE PRACTICE OF TUYEN QUANG PROVINCE

Consciousness of Officials and People

The key officials at all levels have to well understand the trends for making proper decisions, proposing appropriate policy mechanisms, giving guidelines to farmers in implementing effective hydraulics works operation and management. If training is provided, farmers would act effectively.

It is noted that the provincial officials have to understand the process. Then provincial officials guide to the district officials. The district officials provide guidelines to commune officials to transmit to the farmers.

The experiences have shown that the key provincial officials play decisive roles in such success.

Policy Mechanism

Policy mechanism has to be unified from up to down. This is an important aspect for local actions. In order to implement such program, there should be appropriate policy mechanism corresponding to practice of localities and establishing a legal corridor for operation (as the decision on establishing cooperatives, irrigation fee levels, land and investment policies…). These policies have to be adjusted in accordance with the practical demands of farmers. If farmers pay irrigation fee in advance (at least one year), 15 % irrigation fee will be reduced. A special concern was raised regarding transfer of the State managed structures to people. The transfer also includes the human resource transference. Thus, it is necessary to have strict and reasonable policy mechanisms for transferring labor force in order to assure stable jobs for the employees. Being different from other provinces, Tuyen Quang has not been fully dependent on State. On the basis of policy frame issued by Center, it has forcefully issued suitable, creative policy mechanism in response to local condition.
The Role of Community

Paying attention to the role of community is very important. Based on community participation, mobilization of internal forces is of further significance. Tuyen Quang has mobilized the community force through the following conditions:

- **Communes and villages are linked by blood-relationship** so they are willing to foster the cooperation, financial support (lending money/fund), labor support to contribute in hydraulic works management and operation, equal land allocation and water delivery which create a real union. When conflicts occur, they themselves can solve their problem satisfactorily and sustainably.

- **Job relationship is expressed by cooperatives.** These organizations are established by themselves to protect their benefits, creating sustainable communities, and supportive assistance for rural development.

In Tuyen Quang, not only the direct beneficiaries but also all people in community contribute money and labor force. This is the powerful force to assure the successes.

Some channel parts in Tuyen Quang have consolidated by the contributions of factories, association organizations that located in province (as the channel routes of War Veteran Association and Cement Production factory…)

- **Gender Relationship**

Gender plays an important role in promoting the participatory irrigation management and operation.

Women should be taken into account. Women in Tuyen Quang play important roles. They participate and take the key position in State authorities as Deputy Secretary of the provincial committee, Vice-Chairman of the provincial people’s committee, Chairman of district people’s committee and Directors, Deputy Directors of Departments. More than 35 female officials are in charge of key positions at provincial level excluding many female officials who are taking leading role at district levels and communes. They have brought into play their patience, careful, strict, and openhearted characters to work perfectly.
Ms. Nguyen Thi Dinh (Deputy Director of Department of Agriculture and Rural Development) is a female official, who participated some training course organized by DSE organization, participates directly in giving directions for hydraulic works management and operation. She is the person who proposed positive solutions to implement the transference of hydraulic works to farmer. Obviously, this issue has been approved by leaders of province including support comments of Ms. Ha Thi Khiet (Provincial Committee Secretary). Apart from Ms. Dinh, many female officials who are leaders of districts (Chairwoman, Vice-chairwoman of the People’s Committee) and concerned sectors (directors, deputy directors of Departments, Farmer Association, Woman Union Association, Youth Union) in province have taken united actions. Their actions express persuasively the role of women and make the management transference of hydraulic works in Tuyen Quang to farmers more effectively.

**Collaborated Organization**

It must belong to farmers. It must be established under their voluntary spirit and the organization should be self-reliant and financially sound. Its operation should be consistent with the State rules and regulations.

**The Role of Sector**

Implementation of the Resolution No 06 dated 10 November 1998 of the Vietnam Communist Party Politburo on “some issues for agriculture and rural development” provides guidelines in this sector. It includes issuing policies to encourage people to participate in hydraulic works investment and operation”. The agricultural sector of Tuyen Quang has well carried out the function of proposing policy mechanism for targeted implementation on the base of united will and action of sectoral leaderships, staffs and other concerned sectors in the province.

**Role of Officials**

At the beginning, the implementation of the management transfer program of the hydraulic works to farmers faced the biggest obstacle that the officials did not conceive adequately and fully understand the program. They were not ready for action. They were afraid of resistance of people, “loss of power, benefits, finance, property” that they were managing and also “having additional work with undefined results”. However, as through the seminars, workshops and consultation meetings, officials at all levels
from different sectors were provided enough awareness of soundness and necessity of this program. They gave guidance to the farmers in carrying out the program successfully.

**Setting up Pilot Models**

Due to different features of irrigation systems in numerous areas, it is necessary to set up pilot models. It is possible to draw lesson through these models in order to develop and expand as well as ensure their sustainability.

**Training and Improving Knowledge**

The farmers were exposed to the program and policy mechanisms (law, decree, decision, regulation, and statutes) through mass media. By doing so, the awareness of farmers is raised. Their roles are brought into play. Their benefits and responsibilities in hydraulic works management and operation are defined more clearly. Therefore, the farmers are ready to participate in discussions. Once they agree, they will implement effectively.

Tuyen Quang paid more attention on training. The provincial program is to strengthening capacity of officials at all levels (province, district, commune, cooperative) by short training courses, workshops, study tours or establishing on-site training courses or sending officials for training in central university and colleges. At present, the cadre of Tuyen Quang has been trained basically. They are in charge of important work including hydraulic management and operation. Some staff of Tuyen Quang had been trained through DSE programs which were organized at Tuyen Quang and some places in Vietnam as well as Lao PDR.

**Infrastructure**

Hydraulic works have to be assessed and plans are proposed for upgrading the structure by different funds (State budget, people’s contribution).

**Government Role**

In spite of the successful results achieved in Tuyen Quang in Irrigation Management Transfer (IMT), Participatory Irrigation Management (PIM) have not been extended to other provinces and even nation wide. One of reasons for this delay is that the government has not issued a united
program. There is no timely and appropriate policy and framework or positive measures for supervising, speeding up the roles of local authorities. There is need to have working mechanism, policy framework, proper solutions to carry out PIM and IMT in order to bring into play the highest efficiency of hydraulic works located in local areas as well as to assure the balance on direction from “up” to “down” and vice versa.

**Role of VNPIM**

VNPIM network has recently set up in September 1998. Despite of financial difficulties and limited numbers of members, the network is functioning effectively. There should be formulation of proposals for development and orientation of PIM, writing PIM relevant documents, carrying out training programs, compiling guidance documents, exchanging experiences of external and internal bodies in implementing PIM and IMT.
INTRODUCTION

General

Cambodia is surrounded by Laos and Thailand to the North, by Thailand to the West, by the Gulf of Thailand to the South and Vietnam to the East. The total area of the country is 181,035 km\(^2\), consisting of 24 provinces, including 2 municipalities. The forest area is 67%, equal to 12.1 million ha. The cultivated area is approximately 21%, equal to 3.78 million ha. In 1999, the rice was cultivated in 2.08 millions ha, occupying 91.2% of the total cultivated area.

The population is estimated to be about 12 million. The annual average growth rate is 2.8% with the population density of 51 persons per km\(^2\). It is notable that there is sex imbalance, 52.2% are female and 47% are male. The agriculture sector in Cambodia has been the top earner of the national economy, contributing 75% employment. 45% of the GDP comes from agriculture in 1994. Cambodia is a typical rice-producing and exporting country with favorable natural condition for paddy cultivation.

Rainfall

The rainfall distribution varies among regions, with an average of 3000 mm per annum in Western coastal regions, between 1800 - 3000 mm per annum in the East areas of the Mekong River and around 1200 mm in the Central area.

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1 Mrs. Sona Chy, Under Secretary of State, Ministry of Rural Development (MORD); Mr. Mao Sanay, Director of Rural Water Supply, (MORD); Mr. Te Ouvkim, Director Irrigated Agriculture Development Department, Ministry of Water Resources and Meteorology (MOWRAM); Mr. Sin Vuthy, Director Administration and Human Resources Department, MOWRAM; and Mr. Pang Peng, Deputy Director, Water Supply and Sanitation on MOWRAM.
Temperature

The temperature across the country ranges from a mean minimum of 19°C in January to a mean daily maximum of 35°C in April. There is very little variation across the region with differences of the order of about 32°C. The mean annual temperature varies from 26.9°C to 27.8°C.

Available Water Resources Development in Cambodia

The water sector contributes to many development activities in Cambodia. They are;

- Irrigation contributes to agriculture, and therefore to the achievement of food security, poverty reduction and socio-economic development.
- Water supply and sanitation meet the needs of the urban and rural populations, as well as their health requirements, and contribute to the achievement of better living standards.
- Drainage and sewerage, also, contribute to better health and living standard.
- Hydropower development aims at socio-economic development. They include;
  - Inland navigation serves to move goods and passengers from one place to another, and to facilitate tourism in general.
  - Water contributes to the livelihood and food supply of the population by providing fish, animal protein and aquatic plants.

BACKGROUND OF IRRIGATION SYSTEM IN CAMBODIA

Irrigation and Land Use Development

Modern irrigation systems were developed at the time of French colonial period during 1930 to 1953. These included the Bavel project in Battambong (30,000 ha supplementary irrigation), a number of storage reservoirs, including Kompong Sne in Prey Veng (100 million m³), Bat Rokar and Lom Chang in Takeo (30 million and 6 million m³ respectively), and several colmatage (flood recession) canals.
Following independence, between 1953 and 1960, eleven major schemes were constructed with the assistance of the United State, including partial rehabilitation of Bavel Irrigation project.

A number of new projects were constructed. With completion of these projects, the area under formal irrigation amounted to 74,000 ha (MOWRAM).

The events during the years of 1975 - 1979 period created a major impact on agricultural systems throughout Cambodia. Recognizing the importance of irrigation, the Cambodia Government undertook the construction of diversion works, reservoirs and other structures, supplying a rectangular grid of canals across a large part of the rain areas. In many cases, however, the works were designed and built with little regard to basic hydrological and engineering principles. In many instances, traditional water distribution and drainage patterns were disrupted so the performance was below expectations and structures were damaged or destroyed by floods.

An inventory of irrigation systems carried out in 1993 - 1994 by the Mekong River Commission (MRC) listed some 920 schemes totaling 310,000 ha in the country. In rainy lowland systems, the distinction between irrigated and rainy area is not clear. However, water is not supplied through a formal distribution irrigation system in the rainy low lands.

**Donor Assistance in the Irrigation System**

In Cambodia, the donor assistance to the development of the irrigation sector has been substantial. Many bilateral and multilateral institutions are involved in irrigation development. The Mekong River Commission Secretariat (MRCS) prepared an inventory of potential hydropower, irrigation project and the emergency rehabilitation of key irrigation structures damaged by flood in 1991. They have also initiated a longer-term countywide irrigation rehabilitation study. The Asian Development Bank (ADB) provided funds for a Special Rehabilitation Assistance Projects that included irrigation. ADB is planning to finance the Stung Chinit Water Resources Development Projects, one of the large-scale of irrigation projects in Kampong Thum. To generate employment, ILO has instituted a labor-intensive infrastructure rehabilitation program. In the irrigation sector, rehabilitation of canals and minor structures are being undertaken on the Bavel (Battambong) and Barai (Siem Reap) schemes.
Funds are being provided by UNHCR, UNDP/CARE, WFP and the Netherlands.

The JICA is providing US$ 10 million for the development of flood plain areas and colmatage rehabilitation. The World Bank is extending a technical assistance grant of US$ 2 million to increase the capacity building of MOWRAM staffs. The Food and Agriculture Organization (FAO) funded a pilot project on water control technologies. The European Union, as part of the program de Rehabilitation au Secteur Agricole du Cambodge (PRASAC), is developing local capacity building of farmers association in the provinces close to the Phnom Penh. The GTZ has been providing support for investigation and study of small and medium scale irrigation schemes in Kampot and Kampong Thom provinces.

The World Bank assisted Agricultural Productivity Improvement Project (APIP). The hydrological component focuses on capacity building within MOWRAM and at the provincial level of Kampong Thom and Kratie provinces. APIP will provide training, technical assistance, vehicles equipment and staff allowances.

NGOs have been providing assistance to the agricultural sector since the early 1980s. Currently, 20 NGOs are involved in irrigation, providing materials, equipment and technical assistance channel directly to central and provincial authorities. The work has focused on the rehabilitation of existing irrigation systems including repair of reservoir bunds and outlets works, pumps and rehabilitation of canal networks. The selection of schemes has not been in conformity with the national plan. NGOs have been involved in organizing and promoting farmers' organizations in particular for water user groups since 1991. Water user groups are to encourage the farmer's participation and involvement in the planning of operation and maintenance of irrigation systems.

FIELD EXPERIENCES OF IRRIGATION MANAGEMENT

Policies and Strategies in Irrigation Management

The irrigation system contributes the water for many purposes. The Government has recognized the socio-economic developments in April 2000. The formulation of the farmer water user community for the participatory irrigation management is very important. The Farmer Water User Community (FWUC) is a mechanism established by farmers. It has duties to manage water in irrigation systems by obtaining due recognition
from the Royal Government of Cambodia. The FWUC under the board of FWUC performs as the facilitator.

The irrigation development program shall be implemented only on the basis of the feasibility and demand of the majority of the farmers. During the planning and implementation of irrigation projects, participant-farmer's roles have been recognized at all levels from the beginning. Upon the completion of the project, the responsibility of operation and maintenance of emergency repair shall rest with FUWC, according to the government policy: The schedule is as shown in Box 1.

<table>
<thead>
<tr>
<th>Year</th>
<th>Responsibility Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year one</td>
<td>government 80% and farmers 20%</td>
</tr>
<tr>
<td>Year two</td>
<td>government 60% and farmers 40%</td>
</tr>
<tr>
<td>Year three</td>
<td>government 40% and farmers 60%</td>
</tr>
<tr>
<td>Year four</td>
<td>government 20% and farmers 80%</td>
</tr>
<tr>
<td>Year five</td>
<td>government 0% and farmers 100%</td>
</tr>
</tbody>
</table>

In the first year, 20% of responsibility for operation and maintenance shall remain in the bank account of FWUC as fund to cover the emergency repair and maintenance expenditure in the modernization of irrigation systems.

The government's objectives of the participatory irrigation management is as follows:

- To receive efficient, sustainable, reliable and environmentally friendly irrigation systems.
- To promote irrigated agriculture ensuring food security and growth of the national economy.
- To increase gradually the role and responsibility of organized farmer users in every stage of program implementation including repair, operation and maintenance.
- To enhance the capacity of the farmers and FWUC in the irrigation management system.
- To promote the awareness of the management, responsibilities on irrigation schemes and expedite the transfer process to FWUCs.
- To encourage the international financing agencies for increased funding in the irrigation management and development.
On-going Irrigation Management Programs

The Ministry of Water Resources and Meteorology (MOWRAM) are involved in many types of irrigation systems in Cambodia. There are two other Ministries concerning the irrigation activities such as Ministry Rural Development and Ministry of Agriculture, Forestry and Fisheries.

There is a beginning of national program as the demonstration pilot areas on participatory irrigation management with FWUC. The initial operation and maintenance cost provide to the FWUC in the first phase of this program is for 5 years. The national program will cover in 11 places. The executing agency of this program is the Ministry of Water Resources and Meteorology under the financing of ADB Loan No. 1445. The major objectives of this program are such as:

- To formulate the FWUCs in the existing irrigation systems in provinces around the Great Lake and along the Mekong and Bassac Rivers.
- To properly operate and maintain the existing irrigation systems for increasing the agricultural production, reducing the poverty, and improving the food income security.
- To establish the support team for FWUCs.
- To strengthen the capacity building of MOWRAM on Participatory Irrigation Management (PIM), Irrigation Management Transfer (IMT), National Policy for FWUCs, Monitoring and Evaluation on the performance of the irrigation systems.
- To implement the Circular No. 1 on the implementation policy for sustainable irrigation systems in the FWUCs formed in the project areas.

FWUC Responsibilities on the Irrigation Management System

There are two FWUC in Cambodia. One of them is called FWUC for domestic water supply for clean water use and another is called FWUC for agricultural irrigation water user as irrigated water.

The responsibilities of FWUC on the irrigation management system are as follows:

- To comply with government laws and regulations
To use and preserve irrigation infrastructure consistent with transfer agreement
To promote productive, efficient, equitable and sustainable use of water for agriculture and other basic needs of all water users
To follow FWUC constitution, by laws and transfer agreement
To follow democratic principles of openness, honesty and fairness
To protect the environment

CONCLUSION

In the case of Cambodia, the investment in irrigation or drainage and land in the Special Program for Food Security (SPFS) is limited. Thus, there is a less impact of SPFS on agricultural productivity improvement. The Food and Agriculture Organization has a beautiful idea to start the SPFS in Cambodia. The FWUCs must be established before the irrigation rehabilitation and construction of the system. All irrigation management systems must have the involvement of the FWUCs. All members of FWUCs know and understand how important is water fee for O&M the irrigation systems.
INTRODUCTION

In some countries, such as Nepal, participation of farmers in irrigation is common practice. In other countries there is now a lot of talk about participation of direct stakeholders in water management, but in practice there is still a long way to go. Water management in general takes place in a rapidly changing context, as acknowledged in the title of this conference. This paper highlights the dynamic theoretical and practical context of stakeholder participation in water management in Bangladesh.

The government of Bangladesh has recognized that people are central in water resource management. Its National Water Policy (NWPo) (Ministry of Water Resources, 1999) stresses this again and again. This policy calls for guidelines and manuals to be developed to ensure that the policy is implemented. One of the first such guidelines to be approved is the Guidelines for Participatory Water Management (GPWM) (Ministry of Water Resources, 2001). This paper then deals with people, participation and water management in general and with the GPWM in particular.

Before dealing with the core issues, the next section first clarifies the key terminology, i.e. what ‘people’ and ‘participation’ mean. The third section looks at the dynamics of the process of producing these guidelines and at the actual guidelines drafted before the GPWM. On the basis of this context the strengths and the weaknesses of the GPWM are highlighted. In the final section conclusions are drawn on how the guidelines may contribute to improved water and wetland management.
CLARIFYING TERMINOLOGY, COSTS AND BENEFITS

Nowadays everyone is in favor of more ‘people’s participation’. But what do financiers, bureaucrats, consultants, NGO workers, policy makers, politicians and local people mean when they say they support ‘people’s participation’? When these groups have to work together to implement participation, it usually does not take too long before they realize they actually mean rather different things. This confusion about what we mean is one of the reasons why grassroots people have seen so little of what participation means in practice. We will therefore first clarify what ‘people’ and their ‘participation’ might mean and what the costs and benefits to the various stakeholder groups are.

People?

In the 50s and 60s ‘community development’ was the approach. All the big donor agencies were involved in community development and the expectation was that it would improve life for billions in villages worldwide. The results were disappointing. Research showed that a major reason for this failure was a simplistic understanding of village life. Community development was the brain child of specialists living in cities, educated in universities following a western type of education. Financiers were from a similar, middle class background and themselves came mostly from the West. Those who designed such project and programs shared a simplistic and often idealistic view of rural life in the Global South. To them villages seemed ideal, almost romantic places, with people living in harmony with each other and their surroundings. With a little help from the outside, some scientific knowledge and infrastructural development, the villagers were expected to come out of poverty.

At the end of the 60s and early 70s alternative worldviews and social research presented a different picture; villages were not inhabited by a single, homogeneous group of people, but by a variety of people related to each other through various networks of power. Concepts such as ‘class’, ‘interest and target group’ and ‘gender’ became common ground. The NGO sector in Bangladesh developed relatively successful approaches based on this new understanding. Later development financiers and the government moved from the community development towards a much more targeted approach.
The trend away from a homogeneous community approach can also be seen in water management in Bangladesh. In the 60s and 70s project design was based on the understanding that all villagers were farmers. If water management could be improved to suit them, then development would occur almost automatically. In the early 80s, first in some of the smaller schemes, it became clear that rural life was more complicated than that (Datta, 1999). From then on social analysis slowly got a foothold in water resource management. In the early 90s the need for a much more comprehensive understanding of rural society was put firmly on the agenda, mainly through the extensive studies of existing schemes done under the Flood Action Plan (FPCO, 1992a and FPCO, 1992b).

Nowadays, the concept of community development has lost most of its appeal. However, no other single term or approach has replaced it. For instance in the National Water Policy of Bangladesh the following words are used: people of Bangladesh (7 x); women (7x); stakeholders (4x); individuals (4x); people’s participation (2x); people at large (1x); public as a whole (1x); public participation (1x); public support (1x) and farming community (1x). The term ‘community’ is found 17 times, ‘beneficiary’ is used seven times, ‘target groups’ are mentioned three times and there is one reference to ‘rural poor’ and to ‘project affected persons’. Fishers or fishermen are not mentioned at all.

These different terms can be grouped into three different categories. Generally speaking it may be assumed that terms like the people, the public, villagers, etc. come from a worldview and an understanding which sees villages from a global perspective and as undivided units. It is similar to the view that gave birth to the ‘community development’ approach. The same top-down perspective applies to the word ‘beneficiary’. The second category is of very specific terms such as women, farmers, fishermen, target groups, etc. These terms come from an understanding of society as full of different interest and therefore conflicts. The third category of words is that which acknowledges differences in society but without being specific, such as in ‘stakeholder’ and ‘interest group’.

There are signs from the NGO scene in Bangladesh that the stress on heterogeneity and conflicts between the various interest groups may have gone too far. For example, some of those who champion the rights of women and have therefore targeted them to the exclusion of men, now say they must also involve men. After all many of the problems faced by women are caused by men and solving these problems will require the active cooperation of men. However, those involved, usually stress that they are not moving back to a simplistic community-based approach.
Participation?

In the next section we will return to stakeholders and interest groups in relation to participation in water management. But first we will turn to what people mean when they use the word ‘participation’. Participation has many definitions. One definition that captures the main elements is the following:

- Participation is a process through which stakeholders influence and share control over development initiatives and the decisions and resources which affect them. (World Bank, 1996:1)

While the definition is quite clear, the words ‘influence and share control’ raise the questions to what extent stakeholders can participate. Other questions are how stakeholders can ensure that their voice is heard and at what stage of an intervention they participate. To start with the extent of participation, Pretty (Pretty et. al., 1995), as quoted in Bron, describes 7 types of participation:

I. Passive Participation
- People participate by being informed about what is going to happen or what has already happened. It is a unilateral announcement by an authority.

II. Participation by Giving Information
- People participate by providing factual information asked for in the formal context of a prepared questionnaire or similar techniques for data collection.

III. Participation by Consultation
- People's views are solicited by external agencies who defined the problem. The extent to which these opinions are considered when formulating the solutions remains the prerogative of the external professionals who are under no obligation to take on board any of the people's views.

IV. Participation for Material Incentives
- People participate by providing resources -usually labor-in return for a reward.

V. Functional Participation
- People participate by forming groups to meet predetermined objectives. These objectives are defined by the external professionals who already have made the Initial major decisions and who continue to retain final authority.
VI. Interactive Participation
People participate in joint analysis and decision-making with the external agencies. The people, through their groups or representatives, take control of local decisions and assume a range of responsibilities.

VII. Self-mobilization
People participate by taking initiatives independent of external agencies. They mobilize and organize themselves around common needs and decide how their Environment should be developed. External agencies may provide resources and Technical assistance, but the people retain full control (Bron, 1998:16-17)

From this quote it is clear that participation can mean anything from being the passive recipient of say government information to complete independence and self-control. While one can debate the details (is IV, being paid to do work, ‘participation’?), two things can be said. The first is that there are a number of levels, or intensities in which one can participate. Secondly, based on evaluations of water management interventions (Soussanm, 1997 and Datta, 1999), etc., there is a need to move from the more passive towards the more active types of participation.

The next element of participation to look into is how local people can make sure their opinions are taken into account. The most comprehensive form is the kind of one-man-one-vote practised in referenda in some countries such as Switzerland. While being the most comprehensive form of participation, it may not always be necessary nor possible. A second form is that of participation through representation or delegation. Stakeholders appoint people to represent them and they have to report back on what happens. This too is a fairly active form of involvement. Finally participation may be through those who hold positions of leadership and as such act on behalf of the people.

Which form of participation is appropriate in a particular situation depends on who you ask. Outsiders may point out that the more unequal and less transparent a society is, the more there is a need to get as many stakeholders as possible, actively involved. In the water sector in Bangladesh this would mean developing mechanisms to ensure that not only the elite, but also less powerful and vocal groups are heard. This desire is reflected in both the National Water Policy (Ministry of Water
Resources, 1999:8, 9, 18) and the GPWM (Ministry of Water Resources, 2001:2, 4, 5). However local stakeholders may have a different perspective. They may prefer a form of participation than ensures them the best chance of getting what they want from the government bureaucracy. They may therefore prefer to participate through individuals, often the elite, with experience in dealing with government agencies.

Finally two more facets of participation need to be looked at; the level and the stage at which local stakeholders are involved. There is general agreement that decentralization is necessary to enhance development. Here the concept of subsidiarity comes into play, namely that decisions should be taken at the lowest level possible. In water management this means that local stakeholders should participate and decide on all local issues unless there are external impacts that require involvement of a higher authority. The question of what stage local stakeholders should get involved is also undergoing change. In the tradition top-down approach outside authorities decide on (national) objectives, define the problem involved, select a preferred solution and then inform those directly affected. In such a case it is easy to understand the indifference, if not hostility, of the local stakeholders. However, if those directly affected are involved in identifying the problem as well as potential solutions and in weighing of the pros and cons of each of those, then participation is likely to be meaningful. This early involvement of local stakeholders is slowly becoming part of the government led development initiatives in Bangladesh (Ministry of Environment and Forest, 1995; and WARPO, 2001:1).

Costs and Benefits of Participation?

Although participation is now widely acclaimed as necessary and worthwhile, it might be helpful to briefly recollect what possible costs and benefits of participation are. Oakley, in his classic book, summarizes the cost as follows:

- Many planners would argue that there are potential risks and costs implicit in greater people's participation. These could include:
- Project start-up delayed by negotiations with people;
- Increases in staff required to support participation;
- The possibility that, when consulted, people might oppose a project;
- Unpredictable participatory methodologies;
- Over-involvement of less experienced people. (Oakley, 1991:14)
Experience in the water sector in Bangladesh suggests the following additional difficulties and costs:

- Potential for 'leakage' of project resources as interest groups demand a share for themselves;
- Possible reduced accountability/transparency as more groups are involved in a project;
- Difficulty to implement projects where the people are divided or where law & order is poor.

All of the above mentioned costs are seen from the perspective of an outsider. The people themselves too make a cost/benefit analysis about whether or not they will participate. Wittfogel highlights the holistic and straightforward weighing of pros and cons that individuals and households went through millennia ago, when confronted with the question of whether or not to join others to manage water:

- Special effort is required to attain the new objective; and this effort may involve not only increased work and a shift from pleasant to unpleasant operations, but also social and cultural adjustments, including a more or less serious loss of personal and political independence. When the sum-total of the accruing benefits clearly and convincingly exceed the required sacrifices, man is willing to make the change; but problematic advantages usually leaves him cool. Here, as elsewhere, the human budget is compounded of material and non-material items; any attempts to formulate it exclusively in terms of smaller or larger quantities of things (goods) will prove unsatisfactory. To be sure, the material factor weighs heavily, but its relative importance can be reasonably defined only when full recognition is given to such other values as personal safety, absence of oppression and time-honored patterns of through and action. [Wittfägel, 1957 no. 125:15-16]

This then is simple institutional bottom-line: people will only be interested in investing time, effort and money in participating in water management if they perceive the benefits to outstrip the cost by a considerable margin (Brett, 1996).
While all the above mentioned reservations about participation are often very real, the benefits of participation too may be very clear. Uphoff, quoted in Oakley, summarizes these benefits as follows:

- More accurate and representative information about the needs, priorities and capabilities of local people; more reliable feedback on the impact of government initiatives and programs;
- Adaptation of programs to meet local conditions so that scarce resources can be employed more efficiently;
- Lower cost of access to the public for agricultural extension programs, nutrition education, immunization, supervised credit, etc., through local organizations and institutions;
- Tapping local technical information that can otherwise be costly to obtain;
- Mobilization of local resources to argument or even substitute for central government resources;
- Improved utilization and maintenance of government facilities & services;
- Cooperation in new programs, which is more likely to occur when local organizations having the confidence of rural people share responsibility for innovation (Uphoff, 1986, 425-226) (as quoted in Oakley, 1991:15)

Since this list was written in the mid 80s at least two other ways of describing the benefits of participation have emerged. The first is a sense of ‘ownership’ by the local people of interventions. This ownership is particularly relevant as time moves on and changing circumstances and needs have to be accommodate. Without that sense of direct involvement and responsibility, projects quickly turn into monuments and not too long after that into ruins. The second additional benefit of more local participation is increased transparency. Such transparency is a need voiced worldwide, but again particularly in countries where government services and private contractor activities have not traditionally been open to scrutiny. Bangladesh is a point in case (Transparency International - Bangladesh, 2001).

GUIDELINES FOR PARTICIPATORY WATER MANAGEMENT

After clarifying ‘community participation and issues in wetland management’ above, this section will look in detail at the Guidelines for Participatory Water Management (GPWM). In the next subsection we briefly look at the predecessors of these guidelines as well as at the process
of producing the guidelines. The second and third subsections cover the strengths and weaknesses of the guidelines. In the final subsection the author briefly suggests why the guidelines have not been able to move away from an agency-driven approach and highlights the consequences of this in the field.

The Birth of the GPWM

In the 80s various Bangladesh Water Development Board (BWDB) projects, such as EIP, developed guidelines on how to deal with social issues at the feasibility stage. In 1986 the Local Government Engineering Department (LGED) developed a guideline for Operation and Maintenance (O&M) of its Small Scale Flood Control and Drainage Schemes. These documents can be seen as the precursors to the 1993 Guidelines for People’s Participation, issued by the Flood Plan Coordination Organization (FPCO). A year later, in 1994, the Ministry of Water Resources (MoWR) issued an edited and updated version of that paper, called the Guidelines for People’s Participation in Water Development Projects (GPP). The 1993 and 1994 guidelines were the first full fledged guidelines covering people’s participation in all stages of project development, from feasibility to O&M.

After applying the GPP it soon became clear that it was rather difficult to put into practice. As a result, between mid 1998 and mid 1999, at least five separate attempts were made to produce more appropriate guidelines. The main differences were in the proponents (BWDB, LGED, individual consultants), the donors (ADB, WB, EU, GON, etc.), the concept of ‘participation’, the number of institutional tiers (2 – 4), the power distribution (agency staff, local government and direct stakeholders), whether or not the water user organizations are registered and if so, where, and who pays for the cost of O&M. For a comparison of the GPP, the 5 interim proposals and the GPWM, see the Table 1.

In January 1999 the government promulgated its first National Water Policy (NWPo). The NWPo called for the GPP to be implemented and adhered to in all public sector water resource interventions (Ministry of Water Resources, 1999: section 4.5.b). The policy also requires the periodic revision of the water related guidelines (ibid: section 4.2.h). The problems with the GPP and the fact that different agencies used rather different guidelines for participation in water management spurred the Ministry of Water Resources into action. In May 1999 the MWR established an Inter-Agency Task Force of officials from the BWDB and
officials and experts from LGED. Its brief was to formulate a “uniform Guideline for Participatory Water management by all agencies working in the water sector” (Ministry of Water Resources, 2001. The author of this paper was facilitator to the Task-Force.

The Task-Force met more than once a month for over a year. It started by co-opting a number of professionals such as the Project Director of LGED’s Small Scale Water Resources Development Sector Project (SSWRDSP), the Aquaculture Specialist and Sociologist of the SSWRDSP Technical Assistance team and a Senior Scientific Officer of WARPO. This made the Task-Force more multi-disciplinary. The Task-Force started by making an inventory of the previous guidelines and proposals, their strengths and weaknesses (for a summary see Table 1). The Task-Force also discussed at length whether or not Water User Organizations (WUOs) had to be registered. There was also considerable discussion about the desirable level of detail in the guideline. Some favored a short, enabling guideline with different agencies then making their own manuals. Others proposed a more detailed, prescriptive guideline including model agreements, bye-laws etc. Given the nature of Bangladesh’s bureaucracy it is probably not surprising that the latter approach found favor.

As facilitator, the author proposed to reverse the traditional approach in which government agencies are in charge of water management interventions and the local people participate in projects of the agencies. Such a local stakeholder-centered approach, with government agencies playing only a supporting role, turned out to be a non-started. Again this is not really surprising. A recent evaluation of the Indian experience with participatory watershed development called for a paradigm switch, observing and recommending the following:

- Even today the mindset of government functionaries and NGO volunteers is conditioned by the compassion to help the peasantry as saviors. Work culture and ethos are inspired more by charity and welfare by outsiders rather than development of the people, for the people and by the people. Villagers are considered beneficiaries, and not the prime movers and not even partners in development…Thus watershed development should become peoples’ program and GOs/NGOs should participate in it in a manner that would enable rural households to enhance their livelihood. (Government of India Planning Commission, 2001:26)
After many drafts the Task Force circulated its proposal for feedback to key actors in April 2000 and held a National Workshop on 10 June 2000. Participants gave much useful feedback that was included in the next draft which was then sent to the executive committee of the National Water Resources Council (NWRC). One of the main comments of that committee was that a number of government departments, indirectly related to water resource development, had to be actively involved in producing the guideline. Therefore officers from the Bangladesh Agricultural Development Corporation (BADC), Department of Agricultural Extension (DAE), Department of Environment (DoE), Department of Fisheries (DoF) and the Department of Livestock (DoL) were co-opted as member of the Task Force. After their input was included the final draft was sent to the NWRC and approved on 28 November 2000. The guideline was translated into Bangla and distributed to the relevant agencies.

**Strengths of the GPWM**

Compared with the GPP the GPWM has a number of obvious strengths. At least seven points can be identified:

1. **This guideline has the backing of the NWPo**

   Previous guidelines did not have that formal/legal backing and it was therefore difficult for local stakeholders to challenge government agencies when they did not comply with them.

2. **The GPWM applies to all public supported water resource development interventions**

   This is an advantage because the previously different guidelines caused a lot of confusion on the ground where different government agencies implemented water schemes side by side, following very different guidelines. The GPWM apply to all government projects and make participation in water resource management more straightforward for direct stakeholders.

3. **The GPWM includes a number of sample Agreements, bye-laws etc.**

   This makes it relatively easy to implement by staff with little experience.
(4) The GPWM calls for at least one level of WMOs in each water scheme to be formally registered under the Cooperative Societies Ordinance (1984) and the Cooperative Societies Rules (1987).

While it is questionable whether the Cooperative framework is appropriate (see below as well as the next subsection), the legal framework and its operation structure give local stakeholders and government officials a comprehensive set of ‘rules and regulations’ to interact and deal with eventualities. This has already proven to be an advantage when things go wrong and legal action has to be taken.

(5) The guidelines acknowledge the limitations of the cooperative framework

In the preface Mr. Azad Ruhul Amin, Secretary, Ministry of Water Resources writes: “To ensure effective WMOs, the Government is considering formation of a separate and appropriate Act or Rule for registration of the WMOs for Participatory Water Management.” (Ministry of Water Resources, 2001:i).

(6) The GPWM has been drafted by an inter-agency group comprised mainly of officials from BWDB and LGED

For various reasons the relationship between these two government agencies had been strained. By working together to produce the GPWM officials from these agencies realized that they had much more in common than they thought. It also became clear that each agency has its own strengths and that by sharing their experience they could complement each other, creating a win-win situation.

(7) Last but not least the GPWM is full of statements that increase the scope for active and decisive local stakeholder participation (Ministry of Water Resources, 2001).

The main examples are (italics added):

• Participatory water management is a process by which the local stakeholders are directly and actively involved in identification, planning, design, implementation, operation & maintenance and evaluation of a water resource project/sub-project/scheme (ibid:viii)
• The immediate objectives of the Guidelines are to give the local stakeholders a decisive voice at all stages of water management” (ibid:2).
• It will be ensured that the Project Affected Persons (PAPs) are appropriately compensated for any loss of negative effect, that the PAPs will not be worse off due to project intervention and that the issue will be monitored (ibid:4)
• The WMG/WMA/WMF representing the stakeholders will be the driving force in water resource management. They would have decision-making power at all stages (ibid:6)
• A thoroughly participatory feasibility study is needed for identification of constraints, solutions proposed and alternatives thereof to ensure that public funds are spent on widely beneficial and sustainable interventions (ibid:11)
• Social assessment involving both beneficiaries and project affected persons and those living inside and adjacent to the proposed scheme area (ibid:12)
• At (the stage, before construction, of signing the Implementation Agreement) it will be essential to ensure that the decisions on scheme designs and subsequent O&M would reflect the interest of the beneficiary population at large, instead of a small number of interest groups (ibid:15)

Weaknesses of the GPWM

The GPWM then has quite a few strengths and is an obvious improvement over the GPP of 1994. However, at the same time it has at least the following weaknesses:

(1) In the guidelines the concept of participation is applied inconsistently

When the objectives of the guidelines are worked out in detail in later parts of the document, the role for the local stakeholders seems to be much less active than earlier envisaged. In fact it seems that the implementing agency remains firmly in the driver seat. A few examples (italics added) are:

• The NGOs/Community level Self-help Groups will carry out participatory process and social mobilization activities on behalf of the implementing agency to ensure appropriate involvement (ibid:7)
• The implementing agency of a new or existing project/sub-project/scheme will undertake all necessary steps for the formation of local stakeholder groups (ibid:8)
• Participatory water management should be demand driven by the requirements of the institutional process and not exclusively supply driven by the needs of the project (ibid:9)

These quotations are an indication of how the implementing agencies try to accommodate local stakeholders having a ‘decisive voice’ in water management. At the same time these quotes indicate that they try to do so without losing control, as can also be seen in the following paragraph:

• The purpose of the (Implementation) Agreement is to ensure smooth construction of project in time and with desired quality with active involvement of the local stakeholders (ibid:15)

It is fully understandable, from their own perspective, that the implementing agency describing the purpose of the agreement in this way. However, in the eyes of the local stakeholders the purpose of the agreement may be different. If anything they will want to make sure they get what they have been promised, that the infrastructural works will be of agreed quality and that the system will be able to control the water as intended. In the guidelines these points are not highlighted. In the sample implementation agreement in Annex 4 (41, 43) there are hints about what the local stakeholders may want, but these are not as clear as the purpose of the implementing agency (40, 42).

(2) The guideline is unclear about how “the local stakeholders will examine, suggest and agree to the best possible alternative design prepared by the experts of the implementing agency” (ibid:13).

The fact that the WMO, and particularly its managing committee, has been formed with the direct and prolonged help of that agency results in the process lacking transparency. A proposal was made to ensure that local stakeholders indeed have a ‘decisive voice’. It stipulating that the draft design should be explained at a general meeting of all WMO members and that all the members could then vote for or against the proposal. This proposal did not make it in the GPWM.

(3) Overall it is difficult to avoid the impression that these guidelines allow local stakeholders to assist the implementing agency with
the development, implementation and particularly operation and maintenance of agency schemes (ibid:14-19).

In spite of the positive statements in the guidelines (quoted above) there are too many words, phrases (“local stakeholders will give feedback” (ibid:13); “assist the team” (ibid:14); “assist the implementing agency” (ibid:16)), and paragraphs that reflect the traditional top-down, agency-driven approach. For instance section 4.5, covering the implementation and trail operation, deals in more than two full pages with construction, but not a word is said about the actual trail operation. It is during that part of the process that the implementing agency has to prove to the local stakeholders that the scheme is operation and can deliver the promised benefits.

(4) A weakness of the GPWM, as already hinted at above, is that the cooperative framework is not really appropriate for water management organizations.

There are a number of reasons for this. First of all cooperatives provide an institutional framework for business enterprises of a group of homogeneous producers. Examples are milk or rickshaw driver cooperatives, where the members have the same interests in ensuring low cost of their inputs (rickshaw hire rates or cattle vaccination) and a high price of their outputs (rickshaw trip fares and milk). Cooperatives work well if the members are more or less of the same status and when all members know each other. The cooperative rules and regulations are made to enable that kind of small scale, single focus, business type of cooperation. However, water management is quite different. It is not a business type of activity and there are usually a number of stakeholder groups with different, if not conflicting, interests. One only has to think of farmers and fishermen. Another difference is that the stakeholders are usually not of the same status, with the elite and various minorities involved. Furthermore water management units are often of such a size or shape (long drainage channels), that stakeholders are unlikely to be close enough to know each other. Finally, the century old cooperative department in Bangladesh is bogged down in ‘rules and regulations’ and is not know for the kind of dynamism and enthusiasm that stimulates true cooperation. These limitations were known during the design of the SSWRDSP (ADB, 1994), which nevertheless stipulated the cooperative framework. The reason is that after reviewing all the available options
there was no better alternative. The GPWM and the government (see previous section) both acknowledge the need for a new purpose-made institutional framework.

(5) **One final weakness has to be mentioned: that of implementation.**

Technically speaking it is not a weakness of the GPWM itself, but of the implementing agencies. At a national workshop on 11 March 1998, LGED presented its own draft guideline. Dr. Hossain Zillur Rahman of the Bangladesh Institute of Development Studies (BIDS) pointed out that while the approach was very promising, earlier models failed in implementation. The same will apply to the GPWM, unless the following complementary provisions are made:

- Planning that allows time and flexibility for stakeholder participation in the project design;
- Engaging experienced and capable agencies, including the funds, for the formation of WUOs;
- Effective arrangements for two-way interaction between direct stakeholders and engineers;
- A long term capacity development plan for agency staff and direct stakeholders;
- Close supervision, monitoring and evaluation to ensure implementation and lessons learned.

**DISCUSSION**

Why are the GPWM not consistent in ensuring real and effective stakeholder participation? Based on experience in the field and literature from other countries, three reasons spring to mind:

- The NWPo is not always clear and consistent about the level and purpose of participation;
- Few of those who drafted the GPWM have training in sociological and institutional fields;

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3 One way in which the SSWRDSP has tried to make the best of the cooperative framework is to develop the Water Management Cooperative Associations into multi-purpose bodies involved in various business-like activities. This has clearly facilitated their continuation. It is too early to determine whether or not such multi-purpose cooperatives will facilitate operation and maintenance of the water management infrastructure.
• Giving stakeholders a decisive voice in decision making in water management by implication means taking away control from vested interests, which are unlikely to give that up easily.

It is unlikely that much progress can be made towards real stakeholder participation and successful and sustainable water resource management until all three obstacles are addressed. In the mean time a comprehensive, but step-by-step approach along all fronts will continue to move to process forward.

CONCLUSIONS

In concluding, where do the GPWM leave the local stakeholders and the government of Bangladesh in their desire for more useful, effective and sustainable water management? The government states:

• Decisions regarding water resources management can affect nearly every sector of the economy and the public as a whole, and stakeholder participation should be established in a form that elicits direct input from people at all levels of engagement. Stakeholder involvement should be an integral part of water resources management, at all stages of the project cycle. Towards that objective there should be a complete reorientation of the institutions for increasing the role of stakeholders and the civil society in decision making and implementation of water projects (Ministry of Water Resources, 1999:18)

At this point in time, one-and-a-half year after the guidelines were approved, the conclusion must be that they are a step ahead, but also that rather much remains to be done. As the quote from the NWPo indicates, the government is aware that “a complete reorientation of the institutions for increasing the role of stakeholders and the civil society in decision making” is needed. Such massive change involves radically different attitudes on the part of the personnel of government agencies. New guidelines, even if they were radical and consistent, would not suffice. Much more is needed, such as simultaneous, mutually supportive changes in a number of areas, and time (Korten and Robert, 1989).

How then can the GPWM play a role in enhancing local participation in water and wetland management? Six suggestions come to mind:
1. Implementing agencies apply the GPWM as a guide, not a straightjacket or blueprint;
2. The government name a permanent body or committee that will collect suggestions for improvement to the GPWM and ensure that the experience gained is shared;
3. Implementing agencies make a complaint procedure so local stakeholders who think elements of the GPWM are not implemented or perceive misconduct in construction, can complain;
4. The government develop a long term strategy to change attitudes, skills and capacity of university graduates and agency staff, so as to facilitate participatory water management;
5. The government speed up the process of developing a more appropriate legal framework for institutionalizing stakeholder participation in water management;
6. The critics of the GPMW seen it as but a stepping stone and remain engaged in the process.
Table 1: Matrix Summarizing and Comprising seven Guidelines for People's Participation in Water Management

<table>
<thead>
<tr>
<th>Produced by</th>
<th>MWR GPP ‘94</th>
<th>SRP</th>
<th>Maloney</th>
<th>Choudhry</th>
<th>BWDB/MWR</th>
<th>SSWRDSP/LGED</th>
<th>GPWM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pages (main/app.)</td>
<td>21/2</td>
<td>103/-</td>
<td>13/10</td>
<td>11/23/30/29</td>
<td>19</td>
<td>9/17</td>
<td>30/46</td>
</tr>
<tr>
<td>Production process</td>
<td>Initial draft by FAP projects, final version made by SRP</td>
<td>Outcome of studies, surveys, workshops, seminars and National Workshop</td>
<td>Single handed effort by Dr. C. Maloney</td>
<td>Single handed effort by Dr. Yusuf A. Choudhry</td>
<td>By a limited number of BWDB staff</td>
<td>Produced by the BPPM, TA team of the SSWRDSP</td>
<td>Produced by an Inter-Agency Task Force of BWDB and LGED officials and experts</td>
</tr>
<tr>
<td>Concept of “participation”</td>
<td>Beneficiaries</td>
<td>Stakeholders</td>
<td>Stakeholders who are managers</td>
<td>Stakeholders</td>
<td>Stakeholders</td>
<td>Local stakeholders driving development</td>
<td>Local stakeholders</td>
</tr>
<tr>
<td>Institutionalization</td>
<td>5 tiers; related to BWDB; WUGs, WUCs, WUAs, WUFs, Project Council</td>
<td>2 tiers; WUGs and Local Government Committee</td>
<td>3 tiers; flexible and linked to Local Government System</td>
<td>4 tiers; WMG, WMA, JWM Committees and a JWM Council</td>
<td>4 tiers; WMG, WMA, FWMA and a WM Council</td>
<td>1 tier; Water Management Cooperatives Associations</td>
<td>3 tiers; WUG, WUA, WUF</td>
</tr>
</tbody>
</table>

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4 Based on a five page comprehensive chart developed by the Task Force that produced the GPWM, which itself was based on the “Comparison of Concepts in Guidelines for Water Management” (1998) by Dr. Clarence Maloney and “Comments on the January 1999 GPMWRDP” by BWDB.
Table 1: Matrix Summarizing^4 and Comprising seven Guidelines for People's Participation in Water Management

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<th>GPWM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus of committee membership</td>
<td>Farmers, but others could be involved</td>
<td>All stakeholders incl. fishermen, boatmen, etc.</td>
<td>All stakeholders</td>
<td>All stakeholders</td>
<td>Mainly farmers</td>
<td>All stakeholders</td>
<td>All stakeholders, i.e., beneficiaries and project affected people</td>
</tr>
<tr>
<td>Power distribution</td>
<td>Dominated by GOB employees</td>
<td>Dominated by Local Government representatives</td>
<td>Local stakeholders, no GOB employees</td>
<td>Dominated by Local Government representatives</td>
<td>Local stakeholders + GOB employees</td>
<td>Local stakeholders, no GOB employees</td>
<td>Local stakeholders, no GOB employees</td>
</tr>
<tr>
<td>Registration</td>
<td>None, but WMA “recognized” by BWDB</td>
<td>None</td>
<td>Flexible, Society, Cooperatives, non-profit Company</td>
<td>Undecided</td>
<td>Undecided</td>
<td>Cooperative Department</td>
<td>Cooperative Department</td>
</tr>
<tr>
<td>Mobilization by</td>
<td>Not covered</td>
<td>Briefly touched upon</td>
<td>Initially by TA, with NGOs at field level and BWDB or BRDB nationally</td>
<td>Unclear</td>
<td>BWDB and in time BRDB</td>
<td>NGO Facilitators and the Cooperative Department</td>
<td>Implementing Agency will make arrangements</td>
</tr>
<tr>
<td>Role of Local Government</td>
<td>Union Parishad and TDCC involved</td>
<td>Union Parishad members heavily involved</td>
<td>Depending on system size any of the 4 LG Parishads involved</td>
<td>Union Parishad members heavily involved</td>
<td>From WMA upwards involved</td>
<td>Union Parishad identifies sub-projects, thereafter role unclear</td>
<td>LGIs have an advisory role towards WUOs</td>
</tr>
<tr>
<td>Contribution to Operation and Maintenance cost</td>
<td>Mentioned but not detailed</td>
<td>Contribution in cash and kind mentioned but not detailed</td>
<td>Starting with partial contribution leading to 100%</td>
<td>Contribution in cash and kind mentioned but not detailed</td>
<td>Resource mobilization mentioned but few details</td>
<td>100% except in the case of a calamity</td>
<td>Depends on the size of the scheme</td>
</tr>
<tr>
<td>Main strengths</td>
<td>• Formalized people’s participation on the water sector agenda • Formed the basis for further field-</td>
<td>• All potential stakeholders had a chance to give their input • Very systematic</td>
<td>• Conceptually consistent • Short/concise • Schemes size fully taken into account • Covers ultimate</td>
<td>• Makes the SRP raw material more easily accessible</td>
<td>• Conceptually strong and based on NWP • Short and to the point</td>
<td>• Conceptually strong and based on NWP • Short/concise • Clear on the decision-making power of the local</td>
<td>• Acceptable to BWDB and LGED • Applicable to all WR schemes • Does not require registration of village level WUOs</td>
</tr>
</tbody>
</table>
Table 1: Matrix Summarizing and Comprising seven Guidelines for People's Participation in Water Management

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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>level experimentation and implementation</td>
<td>on roles, tasks, responsibilities, and duties</td>
<td>aim and action now • Non-BWDB agencies do institutional work</td>
<td>stakeholders • Clear on the complementary roles of the departments</td>
<td>Flexible as to the need for a WUF in schemes up to 5000 ha</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Main weaknesses**

- Institutions dominated by GOB people
- Project Council too large in large projects
- WM institute without legal status
- Project size not fully considered
- Capacity and mandate of BWDB to mobilize people not considered
- So detailed and repetitive that it is difficult to understand/implement
- WM institutions without legal status
- Project size not fully taken into account
- Capacity and mandate of BWDB to mobilize people not taken into account
- Depends heavily on 4-tier Local Government structure, much of which itself is still in its childhood stage
- WM institutions without legal status
- Project size not fully taken into account
- Capacity and mandate of BWDB to mobilize people not taken into account
- Focused on agricultural development
- Too much BWDB focused, overlooking role of LGED and other GOB agencies, etc.
- only applicable to small schemes
- Institutionalization only under Cooperative Framework which may not be sustainable
- only applicable to small schemes
- Institutionalization only under Cooperative Framework which may not be sustainable
REFERENCES


INTRODUCTION

Bangladesh’s agriculture was basically characterized by twin problems of drought during the dry season (December to May) and floods during the monsoon (July to October) that often adversely affected the successful crop production. As a consequence, food deficit was a chronic problem for this country. The situation has now improved and the country has become almost self-sufficient in food-grain production. One of the most success stories of this improved rice production is the availability of ensured irrigation water supply to the crop field, more especially for the cultivation of Modern Variety (MV) of Boro rice. There are three types of minor mechanical irrigation devices such as: Low Lift Pump (LLP), Deep Tubewell (DTW) and Shallow Tubewell (STW), which have been using in the dry season for MV Boro rice farming in Bangladesh.

Given the dense population and high level of rural poverty, efforts to develop a mechanized irrigation system for the country by various agencies from mid fifties could not come out with suitable results. Meanwhile, with privatization of irrigation equipment some changes in the irrigation service delivery system and management have taken place. In this paper, an attempt has been made to present background information on privatization of minor irrigation equipment in Bangladesh and also to assess the importance of STWs in producing MV Boro rice taking into account the smallholder rice farming.

EVOLUTION OF MECHANICAL IRRIGATION TECHNOLOGY IN BANGLADESH
Mechanical irrigation technology, as stated before, was introduced in Bangladesh in the early 1960s. Before introduction of this mechanical technology, farmers usually used to cultivate local Boro rice by lifting surface water through traditional manually operated irrigation technology like Doon (conical shaped 10-15 feet long wooden container) and sewing baskets. Its coverage, unlike the present situation, was limited to the low and very low topographical areas of the country. The evolution of mechanical irrigation technology in Bangladesh agriculture passed through a series of phases, which started from heavily dominated public sector at the beginning until it became absolutely a private sector enterprise (Table 1). However, this privatization transition has briefly been discussed below:

**The period between 1950 to 1973/74**

In this period, Bangladesh Water Development Board (BWDB) was created and involved in developing canal irrigation. Similarly, Bangladesh Agricultural Development Corporation (BADC) and Department of Agricultural Extension (DAE) started mechanized cultivation and power pump irrigation program. BADC introduced LLP in 1961 and DTW in the following years. At the beginning, LLPs were operated by BADC’s own field staff with diesel fuel supplied by them and the client farmers had to pay water fees on the basis of per unit area of cropland. In 1969, of course, BADC started renting LLPs on yearly basis and the farmers had to pay for fuel themselves with 70 to 75 percent subsidized rate. In 1971, just after the War of Liberation, BADC expanded its LLP and DTW rental program and started renting STW in 1972. However, this rental program of BADC was converted to a sale program after 1974/75.

**The Period between 1974/75 to 1978/79**

In this period, BADC maintained its control over DTW and LLP procurement, installation and rental system. In 1975, BADC stopped operating LLPs and began to continue renting them out. At the same time, it also started selling STWs through the Bangladesh Krishi (i.e., agriculture) Bank (BKB) with little subsidy.

**The Period between 1979/80 to 1983/84**

In this period, the irrigation equipment rental programs were recognized as being too expensive from the viewpoint of the public budget, there were simultaneous moves to discontinue LLP and DTW rental programs and shifts selling both new and old LLPs and DTWs to the private sector.
Liberalization of credit distribution, reduction of import duties and involvement of the private sector in equipment importation led to a rapid increase in the number of wells.

**The Period between 1984/85 to 1986/87**

In the dry season of 1983, a serious drawdown of groundwater was experienced in some northern districts of the country. As a result, the government took some discouraging actions against STWs such as: (a) a ban on STW sales in 22 northern sub-districts; (b) an embargo on the importation of STW engines; (c) standardization of engine brand; (d) formulation of Groundwater Management Ordinance imposing a mechanism of spacing requirements on all tubewells. As a consequence, STW expansion slowed down in 1984 (Amin, 2001) and practically stopped during 1985 to 1987 (Ministry of Agriculture, 1995).

<table>
<thead>
<tr>
<th>Table 1: Liberalization Policies of Irrigation Water Markets in Bangladesh</th>
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</thead>
<tbody>
<tr>
<td><strong>Irrigation Markets</strong></td>
</tr>
<tr>
<td>1. BADC sold LLPs to farmers</td>
</tr>
<tr>
<td>2. BADC sold all tubewells to farmers and cooperatives supported by credit</td>
</tr>
<tr>
<td>3. Restriction of import of engines and pumps withdrawn</td>
</tr>
<tr>
<td>4. Standardization restrictions withdrawn</td>
</tr>
<tr>
<td>5. Import duties removed</td>
</tr>
</tbody>
</table>


**Period from 1987 to onward**

The slow growth of the minor irrigation sector of the previous years prompted the government to remove the restriction imposed earlier. Removal of ban on the importation of small-engine in 1987 and removal of import duties on small diesel engines in 1988/89, private sales of STWs picked up and increased quickly.

As a consequence of liberal importation of irrigation equipment, shifting of irrigation management to the private sector, withdrawal of sitting restrictions and standardization of irrigation equipment, total area irrigated and number of irrigation equipment have significantly increased. It has, in fact, appeared to be the driving force for increasing food-grain production in Bangladesh, especially rice.
LARGE-SCALE VERSUS FARMER MANAGED MINOR IRRIGATION PROJECTS

Although the superiority of farmer managed minor irrigation over large-scale irrigation projects might be debatable, but many researchers (Miah and Hardaker, 1988) still agree that the minor irrigation is less capital intensive, generates extra production more quickly, and easily replicable to small holdings than large-scale irrigation projects. Large-scale projects, on the other hand, not only take a considerable time to construct but also suffers from a lot of constraints, for example, lack of skilled man-power, high foreign currency costs for purchasing plant and machinery from abroad. Thus, minor irrigation devices have become very popular and one of the leading agricultural inputs among the farmers.

ROLE OF STWS IN SMALLHOLDER RICE FARMING

The major source of irrigation expansion in Bangladesh has been the groundwater technologies, predominantly STWs. Both DTWs and LLPs have virtually not increased in the recent years (Appendix Table 1) due to serious capacity under-utilization of the equipment and hence, increased the cost of irrigation, which in turn increased production cost of individual farmers.

A recent study (Islam et. al., 2001) shows that the landholding per farm family in Bangladesh has gradually been decreasing from 1.2 ha in 1990 to 0.33 ha in 2000, due to high pressure of population on land together with the country’s Muslim Laws of inheritance. Another study (Miah, 2001) indicates that the average size of a plot of cultivable land in three villages of Tangail district was only 18.7 decimal (0.08 ha) and each farm family possessed on an average 5.3 plots. This implies that each farm family, at present, has only 99.1 decimals (0.40 ha) of cultivable land. These studies hint that the average cultivable land is very small and is gradually becoming smaller with passage of time in this country. Under such smallholders’ agriculture, STWs have been found as the most appropriate technology for rice farming in this country.
PROFITABILITY OF STWS FROM THE VIEWPOINT OF INVESTORS

Investors are required only Taka\(^2\) 9,500.00 as investment cost for purchasing a new STW having 4 Horse Power (HP). In practice the command area (i.e., Boro rice-field) under this STW on an average is 2.5 ha and its Operation and Maintenance (O & M) cost is around Taka 15,700.0 per season (Appendix Tables 2 and 3). Three discounted methods (see Gittinger, 1994) such as: Benefit-cost Ratio (BCR), Net Present Value (NPV) and Internal Rate of Return (IRR) were employed to assess the profitability of this farmer managed STW minor irrigation project. It is evident from the results presented in Table 2 that this STW project is highly profitable investment from the viewpoint of individual investor, since its BCR is greater than the unity, NPV is greater than zero and IRR is much higher than the opportunity costs of capital.

Table 2: Summary Results of Financial Analyses of Diesel Operated STW from the Viewpoint of Individual Investors

<table>
<thead>
<tr>
<th>Discounted Measures</th>
<th>Profitability of a Minor STW Project</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Considering 25 Percent Crop-share for Water</td>
</tr>
<tr>
<td>BCR at 14%</td>
<td>1.23</td>
</tr>
<tr>
<td>NPV at 14% (Taka'000)</td>
<td>18.50</td>
</tr>
<tr>
<td>IRR (per cent)</td>
<td>206.9</td>
</tr>
</tbody>
</table>

Source: Appendix Table 2 and 3

Note: Investors of STW received 25.0% physical product of MV Boro rice from client farmers as water charge under crop-share payment system, while this was Taka 30.0 per decimal under cash payment system.

In other words, the results of financial analyses indicate that these STW projects are highly attractive investment to the individual investors whether they are following crop-share payment system or cash-payment system for water. The investors, however, are making more profits from minor STW projects having crop-share arrangement than the projects following cash-payment system for water. This is one of the clear indications of expanding STW projects in rural Bangladesh.

\(^2\) US$ 1 = 58.40 Taka
PROFITABILITY OF IRRIGATED RICE FROM THE VIEWPOINT OF FARMERS

It can be seen from Table 3 that individual farmers are making profits from MV Boro rice production under STW projects, whether they are producing under 25.0 percent crop-share or cash-payment system of irrigation water. However, it is evident from the results that farmers are making higher profit (Taka 10,640/ha) under the cash payment system than the 25.0 percent crop-share payment system (Taka 9576/ha) (Appendix Tables 3 and 4).

Table 3: Per Hectare Profitability of MV Boro Rice Production under STW Projects Considering Crop-share and Cash-payment for Irrigation Water

<table>
<thead>
<tr>
<th>Items</th>
<th>Under 25% Crop-share</th>
<th>Under Cash-payment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield (kg/ha)</td>
<td>4500</td>
<td>4500</td>
</tr>
<tr>
<td>Gross return (Taka/ha)</td>
<td>34,875</td>
<td>34,875</td>
</tr>
<tr>
<td>Gross cost (Taka/ha)</td>
<td>25,299</td>
<td>24,235</td>
</tr>
<tr>
<td>Net return (Taka/ha)</td>
<td>9576</td>
<td>10,640</td>
</tr>
<tr>
<td>BCR (Undiscounted)</td>
<td>1.38</td>
<td>1.44</td>
</tr>
</tbody>
</table>

Source: Appendix Table 4.

The above-mentioned discussions clearly indicate that both investors of STWs and individual farmers, who have been growing MV Boro rice, are making profits. It can, therefore, cautiously be concluded that STW irrigation technology is the most appropriate and sustainable mechanical irrigation technology for Bangladesh.

POLICY IMPLICATIONS AND CONCLUSIONS

On the basis of the ultimate findings of the present study, some policy considerations arise which are highlighted below:

This study reveals that STWs are highly profitable investment. Policy makers and extension personnel should pay an immediate attention to expand this STW technology where topographies are similar to this study area is found. The study also clearly indicates that in crop-share payment system, investors of STW are making more profits than the cash payment system for water. This study, therefore, suggests that crop-share should be reduced from 25.0 to 20.0 percent, if per hectare yield of MV Boro rice and inputs as well as output prices remain the same. Efforts could also be taken to reduce O & M costs of these minor STW projects by improving
tubewell management efficiency and increasing command area under each of the STWs.

Private sector initiatives for repair and maintenance equipment at the doorsteps of the farmers should be encouraged. A soft-term financial support through the institutional credit could be provided for setting improved workshops at each of the Upazilas (sub-districts) in Bangladesh.

In the existing Integrated Paste Management (IPM) school, necessary training could be imparted to the farmers either for reducing water loss or efficient use of water through increased their on-farm water management system. At present, tubewells are mainly used for irrigating MV Boro rice production, extension personnel should encourage farmers to use supplementary irrigation for their Aman rice as well. Thus, per hectare sustainable yield of MV Aman rice could be increased in this country.

Although no investment analysis was shown for electrically operated STWs in this study, but many studies (for example, Miah and Hardaker, 1988) clearly indicate that electrically operated STWs are more profitable investment than the diesel operated STWs from the viewpoint of individual investors. Policy makers should, therefore, pay an immediate attention to the findings of the present study and topmost priority should be given to electricity connection and ensured supply of electricity for all STWs.

Since the majority Bangladeshi farmers were still illiterate and did not keep any written records for their day to day farm business transactions, the reliability of the data used for this study fully depend upon their memory, sincerity as well as honesty. Despite much care taken for collecting the most accurate information, the possibility of errors in data cannot fully be ruled out. Moreover, the data used in this study were collected from the low-lying areas of Bangladesh. The findings of the present study should, therefore, be interpreted with certain degrees of caution whenever any greater generalizations are sought for different topographies of Bangladesh.

Finally, it could be concluded that STWs under the existing privatization policy of the government have been playing very significant role to provide food security for the rural people and to achieve self-sufficiency in food-grain, and hence, to the growth and stability of the economy of Bangladesh.
Appendix Table 1: Number of Mechanical Irrigation Equipment and Irrigated Area by Minor Technology from 1982/83 to 1997/98

<table>
<thead>
<tr>
<th>Irrigation Season</th>
<th>Equipment number ('000 unit)</th>
<th>Cropped Area irrigated ('000 ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>STW</td>
<td>DTW</td>
</tr>
<tr>
<td>1982/83</td>
<td>93.1</td>
<td>13.8</td>
</tr>
<tr>
<td>1983/84</td>
<td>120.3</td>
<td>15.5</td>
</tr>
<tr>
<td>1984/85</td>
<td>147.0</td>
<td>16.9</td>
</tr>
<tr>
<td>1985/86</td>
<td>146.9</td>
<td>17.9</td>
</tr>
<tr>
<td>1986/87</td>
<td>160.3</td>
<td>18.7</td>
</tr>
<tr>
<td>1987/88</td>
<td>188.7</td>
<td>20.3</td>
</tr>
<tr>
<td>1988/89</td>
<td>235.9</td>
<td>22.4</td>
</tr>
<tr>
<td>1989/90</td>
<td>260.0</td>
<td>22.6</td>
</tr>
<tr>
<td>1990/91</td>
<td>270.3</td>
<td>21.5</td>
</tr>
<tr>
<td>1991/92</td>
<td>309.3</td>
<td>25.5</td>
</tr>
<tr>
<td>1992/93</td>
<td>348.9</td>
<td>25.7</td>
</tr>
<tr>
<td>1993/94</td>
<td>359.2</td>
<td>24.5</td>
</tr>
<tr>
<td>1994/95</td>
<td>488.9</td>
<td>26.7</td>
</tr>
<tr>
<td>1995/96</td>
<td>576.2</td>
<td>27.3</td>
</tr>
<tr>
<td>1996/97</td>
<td>629.8</td>
<td>25.2</td>
</tr>
<tr>
<td>1997/98</td>
<td>664.7</td>
<td>25.3</td>
</tr>
</tbody>
</table>

Source: Adapted from Mandal (2000, Pp. 120-21).

Appendix Table 2: Financial Analysis of a STW from the Viewpoint of Individual Investors Considering 25 percent Crop-share Payment System

<table>
<thead>
<tr>
<th>Item</th>
<th>Year</th>
<th>1</th>
<th>2 - 7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Gross Benefit</td>
<td></td>
<td>Taka</td>
<td>Taka</td>
<td>Taka</td>
</tr>
<tr>
<td>Water charge</td>
<td></td>
<td>21,094</td>
<td>21,094</td>
<td>21,094</td>
</tr>
<tr>
<td>Salvage value</td>
<td></td>
<td>-</td>
<td>-</td>
<td>1400</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>21,094</td>
<td>21,094</td>
<td>22,494</td>
</tr>
</tbody>
</table>

| B. Gross Cost             |      |     |       |     |
| Invest cost               |      | 9,500| 0     | 0   |
| O & M costs               |      | 14,200| 15700| 15700|
| Total                     |      | 23,700| 15700| 15700|

| C. Incremental Benefits   | -2606| 5394 | 6794 |

Results: BCR at 14% = 1.23, NPV at 14% = Taka 18,495, IRR (per cent) = 206.95%

Note: Engine having 4 HP and 2.5 ha command areas. Data were collected from randomly selected 10 STWs of Tangail and Netrakona districts.
### Appendix Table 3: Financial Analysis of a STW from the Viewpoint of Individual Investors Considering Cash Payment System for Water

<table>
<thead>
<tr>
<th>Item</th>
<th>Year</th>
<th>1</th>
<th>2 – 7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Gross Benefit</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water charge</td>
<td>Taka</td>
<td>18,525</td>
<td>18,525</td>
<td>18,525</td>
</tr>
<tr>
<td>Salvage value</td>
<td></td>
<td>-</td>
<td>-</td>
<td>1400</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>18,525</td>
<td>18,525</td>
<td>19,925</td>
</tr>
<tr>
<td><strong>B. Gross Cost</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Invest cost</td>
<td></td>
<td>9,500</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>O &amp; M costs</td>
<td></td>
<td>14,200</td>
<td>15700</td>
<td>15700</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>23,700</td>
<td>15700</td>
<td>15700</td>
</tr>
<tr>
<td><strong>C. Incremental Benefits</strong></td>
<td>-5175</td>
<td>2825</td>
<td>4225</td>
<td></td>
</tr>
</tbody>
</table>

**Results**: BCR at 14% = 1.08, NPV at 14% = Taka 6578, IRR (per cent) = 52.48%

**Note**: Engine having 4 HP and 2.5 ha command areas. Data were collected from randomly selected 10 STWs of Tangail and Netrakona districts.

### Appendix Table 4: Per hectare Costs and Returns of MV Boro Rice Production in Greater Mymensingh Considering Crop-share and Cash-payment for Irrigation Water

<table>
<thead>
<tr>
<th>Items</th>
<th>Under 25% Crop-share for Water</th>
<th>Under Cash-payment for Water</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Quantity</td>
<td>Return/Cost (Taka/ha)</td>
</tr>
<tr>
<td><strong>A. Gross Return</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main-product (kg/ha)</td>
<td>4500</td>
<td>33,750.0 (96.77)</td>
</tr>
<tr>
<td>By product (Straw)</td>
<td>-</td>
<td>1125.0 (3.23)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>-</td>
<td>34,875.0 (100.0)</td>
</tr>
<tr>
<td><strong>B. Gross Costs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Human labor (Manday)</td>
<td>159</td>
<td>11,130.0 (43.99)</td>
</tr>
<tr>
<td>Power tiller use (Taka)</td>
<td>-</td>
<td>1440.0 (5.69)</td>
</tr>
<tr>
<td>Seedlings of 44 kg seed</td>
<td>-</td>
<td>1320.0 (5.22)</td>
</tr>
<tr>
<td>Urea (Kg/ha)</td>
<td>194</td>
<td>1164.0 (4.60)</td>
</tr>
<tr>
<td>TSP (Kg/ha)</td>
<td>34</td>
<td>476.0 (1.88)</td>
</tr>
<tr>
<td>MOP (Kg/ha)</td>
<td>18</td>
<td>180.0 (0.71)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------</td>
<td>-----</td>
<td>--------</td>
</tr>
<tr>
<td>Irrigation water (Taka)</td>
<td>-</td>
<td>8438.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(33.35)</td>
</tr>
<tr>
<td>Pesticide (Taka)</td>
<td>-</td>
<td>295.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1.17)</td>
</tr>
<tr>
<td>Interest on operating capital</td>
<td>14%</td>
<td>856.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(3.39)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>-</td>
<td><strong>25,299.0</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(100.0)</td>
</tr>
</tbody>
</table>

**C. Net Return (A – B)**

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>BCR (Undiscounted)</td>
<td>-</td>
<td>1.38</td>
<td>-</td>
<td>1.44</td>
</tr>
</tbody>
</table>


*Note:* Figures within parentheses indicate percentages of total. Data were collected from randomly selected 20 farmers of Tangail and Netrakona districts.
REFERENCES


Islam M.S. and others, 2001. *Socioeconomic Impact of Mechanized Cultivation on Livelihoods of Rural Laborers in Bangladesh*. A PRA report of four selected villages in Bangladesh, Bangladesh Agricultural University, Mymensingh.


PART VI: FINAL SESSION
PANEL DISCUSSION ON FUTURE DIRECTIONS
FOR FMIS

CHARLES L ABERNETHY

The title of this seminar is very good. It refers to the changed, and changing, context in which Farmer Managed Irrigation Systems (FMIS) have to function. It seems to me that response to change is an aspect where developing countries have often suffered by being too slow to react: slow in grasping new opportunities, and slow in adjusting to new external circumstances. So the organizers of the seminar have done well to identify the need to consider the changed context in which a traditional institution has to operate.

The papers and discussions in the seminar, as well as the enormous amount of literature that has been produced concerning Nepal’s FMIS, have shown that there is high interest nationally and internationally in this Nepali tradition. Nepal can indeed be proud of this heritage, and the FMIS Promotion Trust should be congratulated on its efforts to promote studies and to disseminate information about these systems.

However our perspective in this final session of the seminar is to try to identify future directions for the evolution of these systems. That involves trying to predict what kind of new challenges, and new opportunities, may face them in the coming years; and then trying to see whether the present arrangements are going to be adequate to survive difficulties and to take advantage of potential opportunities.

The first point I want to make is that we should not allow a sort of nostalgia or pride in these traditional systems to become an obstacle to change. All institutions, however good, need to move and change, adapting to new contexts. Sometimes, respect or admiration for some tradition can lead people to try to perpetuate it without change, even after the conditions have changed. We should take care that this does not occur in relation to the Nepali FMIS.

1 Consultant on Irrigation and Management.
One of the best indicators of whether a traditional system like this is remaining viable is the behavior of young people. Young people are not always so much satisfied by traditions as the older people are. But we can be sure that, if young people do not want to remain actively within the irrigation systems, then these systems will ultimately fail. So I would like to recommend to the FMIS Promotion Trust that they may promote some demographic research or monitoring, aiming to find out the proportions of young people who are active in these FMIS, and to see over several years whether this portion is rising, falling or stable.

In the world in general, not only in Nepal, we can now see three major types of organization. There are FMIS (meaning systems where the facilities are owned, and the water is legally controlled, by an organization of its users); there are government managed systems, usually built and operated by some agency of government; and there is a relatively new category, systems operated by government-sponsored users’ organizations. This last category has been produced by the management transfer programs which have been adopted by an increasing number of countries over the last 25 years. It includes two sub-sets: fully transferred systems (sometimes called “turned-over” systems) and systems where the government agency has retained a role in control (called “jointly-managed” systems).

Fully transferred systems become very similar to FMIS, and Nepal has many lessons for this category. But jointly managed systems are different. In general, globally, the level of success with new organizations for jointly managed irrigation has not been very high: these organizations are often ineffective. Nepal’s success in this category does not seem to be much better or worse than that of other countries. This is surprising, in view of the strong tradition of organization that is represented by the Nepali FMIS. Maybe this is another direction in which the Trust may make beneficial studies. What is the reason why this strong tradition has not led to strong institutions in the cases of joint management?

People build an organization because they want to achieve something which they could not achieve as individuals. (In the richer countries we increasingly see that they also organize to prevent something that they do not want; but that is another matter that is not yet so prominent in the developing countries). They may organize for a positive objective, for example when they see an opportunity of economic or social benefit through co-operative actions. Or they may organize to remove some constraint that is keeping their lives at lower economic or social levels.
So, to form a view of how we should expect the traditional FMIS to evolve over the next ten or twenty years, we need to try to predict what new constraints and opportunities they will be likely to face. I would like to suggest three changes that seem to be imminent, or are already in progress to some extent. One of these is economic, one physical, and one is in the socio-economic domain.

The economic change refers to crop patterns. Irrigation in most south and south-east Asian countries has traditionally been dominated by cereal crops: rice principally, but wheat and maize are also significant. The price of rice has been in decline for nearly 20 years, and seems likely to continue to decline, as the potential for supply exceeds the demand. Land that formerly grew irrigated rice has been falling out of use in many countries of the region that are higher up the wealth ladder than Nepal. In future, cereal production will not be so dominant in Asian irrigated agriculture. So the organizations in charge of irrigation systems have to assist their members to cultivate new crops, which will be more competitive, and more able to attract the labor required to keep the irrigation systems going.

The second change that I expect is in the physical technology of irrigation water distribution systems. I think that the days when open-channel distribution systems were the norm will soon be over, and we will see a steady movement towards piped and pressurized water-delivery systems. This refers both to lift irrigation systems where water is pumped up from river or well sources, and to systems that are pressurized in order to make it possible to use water-application devices such as drip, sprinkler and micro-jets. We have seen for the past 20 to 30 years plenty of evidence that the farmers like these modes. There are many irrigation systems, in India and Thailand for example, which were designed and operated by governments as surface canal systems, but where the farmers have paid for installation of shallow wells and pumps. Why have farmers made these investments? There are many reasons, but the most prominent ones are probably that with a private well the farmer obtains personal control of irrigation timing and quantity, which in turn gives him or her freedom of crop choice and reliability of delivery.

Piped irrigation is relevant also to my third, socio-economic item of change. The demands for water for non-agricultural uses are growing, as we have heard several times during this seminar. These demands, especially for domestic and industrial uses, and for protection of the
natural environment, are going to continue to grow. It seems quite certain that the share of total water resources taken by agricultural users will have to decrease, in almost all countries. FMIS leaders will have to accommodate their members’ activities to this trend. Water-saving technologies, including pipe systems, and adjustments of crop patterns towards less demanding crops, will be part of these strategies of change.

These three trends, towards less dominance of rice, more pressurized delivery systems, and reduced overall abstraction of water, will involve various institutional changes, such as new rules about water scheduling, water distribution and other aspects of joint decision-making among the farmers. They will imply a further movement away from subsistence cultivation towards market-oriented production, which in turn may require the FMIS organizations to adopt a more multi-functional stance, helping their members with marketing, and other supports such as crop storage and input procurement.

In the longer term, I wonder whether it may be possible for some of the Nepali FMIS to adapt their role further, and become the basic organization for general water management and water apportionment among different users, taking on responsibility for small-scale watershed management.

NORMAN UPHOFF

In understanding and assisting Farmer Managed Irrigation Systems (FMIS), it is always important to consider the time dimension of irrigation systems and their management, given the continuous evolution and change that they undergo. The ancient Greek philosopher Heraclites should be the patron philosopher of irrigation management if not its patron saint for his profound observation that has come down to us through 2,400 years: You can never step in the same river twice. He said it was always changing, if only because we stepped in it.

Thus it was very appropriate that the theme of this conference was FMIS in the Changed Context. Irrigation systems are not fixed or permanent but rather always in some kind of flux, for better or for worse or – more likely, with some encouraging and some disappointing trends coexisting. Our challenge is to figure out how to identify and reinforce the positive trends, and to comprehend and check the negative ones.

In the opening session, we were told that the changed context includes a "disabled state" that is less capable than previously of playing a supportive
role for irrigation systems and their water users. There are many aspects to this problem: economic, political, administrative, socio-cultural. Friends of FMIS should not put "all of their eggs in one basket." They should be trying to strengthen and reinforce state capabilities to assist water users in constructive ways at the same time they try to improve water users' own capacities for irrigation management.

In this consideration, it is important to think anew about "who are the beneficiaries?" of irrigation improvement. Conventionally, we say that farmers, as irrigation water users, are the beneficiaries. But one needs to do some sophisticated economic analysis to be sure about this. Much of the technological change in irrigation in some countries has had the effect of increasing productivity with accompanying declines in the price for agriculture produce. Sometimes with rising costs of production, farmers are left worse off than before by what looks like a technological or managerial advance.

The real beneficiaries in such a situation are the consumers, who pay less in real term for their food. In such situations, it makes good sense for the government, which gets its revenues from all or most citizens, to pay the costs of irrigation systems construction and improvement, since all citizens are consumers whereas only some of them are producers. It would make for better and fairer policy if we could know with more certainty who really benefits, and how much, from irrigation improvements, so that the costs of system construction and operation could be apportioned accordingly. The FMIS Trust might well address this issue for sake of both equity and efficiency.

The changing context is one where irrigation is increasingly linked to sectors and activities outside itself. There are three major domains with which irrigation is inextricably connected though these connections are thus far not fully understood or documented. FMIS Trust might well look at these linkages:

a) Links to **agriculture** which affect the productivity of irrigation activities. Water should not be acquired and distributed for its own sake but for what it can contribute to greater agricultural production and efficiency. Here the concern is optimization of resource use.

b) Links to the **environment** which affect the natural resource base—obviously water, but also soil and associated vegetation. Irrigation practices can undermine or reinforce the natural resource
foundations on which not just agriculture but also society depend. Here the concern is sustainability of resource use.

c) Links to civil society which are probably the least explored. Participatory irrigation management can enhance the experience, skills and confidence of millions of rural people to participate in processes of governance. Here the concern is democratization of society, to which FMIS can contribute at the same time they enhance livelihoods and food security.

It is very gratifying to see how much and widespread is the interest in FMIS in Nepal. The FMIS Promotion Trust has done a remarkable job in focusing, on and building up knowledge about farmer managed systems, being concerned with the welfare of farmers and their families, with the efficiency of water use, and with the preservation of a fine cultural heritage.

Given the changes that are seen in the irrigation sector, with agency managed irrigation systems being reorganized to give farmers a larger role, and with many such systems being transferred to farmer management, it might make sense for the Trust to redefine its name to address Farmer Management in Irrigation Systems, rather than Farmer Managed Irrigation Systems, which puts a focus on the systems rather than their management.

By now, FMIS has become a well-known concept, so maybe no change is advisable. But those who use this honorable acronym should henceforth give more focus to the processes and potentials of farmer management than to the systems themselves. There have been substantial advances in understanding and practice, but there is still more to be known and done in the years ahead. I wish the FMIS Promotion Trust success in this endeavor.

LINDEN VINCENT\(^1\)

This workshop has brought forth many new lessons about Farmer Managed Irrigation Systems (FMIS). I would like to present the following points on which I think more research is necessary. My points focus on understanding more about the nature of transformations in FMIS in their management activities, output, and the forces driving them.

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\(^1\) Professor, Irrigation and Water Engineering, Wageningen Agriculture University, The Netherlands.
In Nepal today FMIS are affected by several forces of change, but these include increasing miniaturization and the transformation of local political organizations. Increasingly work once done by hand by individuals or collective action is done by monetary exchange. Local politics have also been transformed by recent history. There is a growing maturity of not only of FMIS organizations, but also Village Development Committees (VDC). How do these organizations interact and influence each other? How do both now act, together or independently, to get resources for repairs, or new development? There is evidence that much general funding for repairs may come from local allowances to councils and constituencies.

How do FMIS access services and markets, and how do we now see key production and marketing zones for FMIS. Studies were originally done by ICIMOD, but these are now old. We need to revisit this work and see changes. Irrigation organizations can be single purpose or multi-purpose – we can talk of Multi-purpose Organizations (MPO) that may organize inputs or other services as well as management irrigation. Do we see MPOs in farmer-managed irrigation in Nepal?

As we look into this change, we can also see whether generations of FMIS exist in terms of the breadth and scope of their management. This concept of ‘generations’ was used first by Benjamin Bagadian to look at changing FMIS in the Philippines. He used this to emphasize how there were stages and degrees of change that FMIS organizations went through, for which different kinds of training and support were needed. He also warned that some programs of management transformation had expectations of change to sophisticated monitoring and accounting that were too high without understanding of the time change took. He called more sophisticated organizations ‘fourth generation’ water user organizations, in recognition of the time it could take for change to come and that some organizations might never get beyond a second or third generation level. (A generation was at least one change of management but could also be linked to the local cultural time equivalent.

How do FMIS created or transformed through Irrigation Management Transfer programs and project finance compare with locally-developed FMIS? To what extent are any differences present a result of models of transfer or community organization, and what other factors are involved. Under government policies many systems managed jointly with government have been turned over to local organizations, or local management has been transformed. But does the nature of government involvement and turnover approach have different outcomes? What other
theoretical frameworks can help us understand how FMIS organizations transform themselves?

What difference does size make in how FMIS organizations evolve, survive and get representation? Many of Nepal’s FMIS are small – under 100 ha, and are not yet involved in the wider federation which seems to be influenced more by the larger systems and systems which have been turned over and influenced by external interventions. Investigation of this topic might also show both what local small FMIS want, and also what is possible locally, but also how the federation might have to change to give such systems a voice.

The points raised so far have been about management of irrigation. Now I end with some points about production and water use.

We need to understand more about the farming systems of FMIS, both their productivity and ecological integrity. We have begun to understand a little more about how local designs in FMIS have adapted to their habitat, in terms of physical ecology and human dynamics. But there is still more to do, in the different hill areas and the Terai, for more sustainable design and intervention.

Much of the funding for FMIS assistance and expansion has been justified from the perspectives of food security as well as economic development and poverty alleviation. Many figures are generalized about the impacts FMIS should have had. But do food deficits still exist locally in areas of Nepal? Are yields and areas increasing alongside of demand? We need to refocus again on the significance of FMIS as a local engine of food security and decreased vulnerability, and also to see what future food deficits may still be present locally and at national level that FMIS are expected to meet. Work on this by the FMIS Promotion Trust would link into the international debates on irrigation and food security.

Much of the change in agricultural technology used in irrigation has been tested and driven by regional agricultural research stations, often funded by donors. These research stations have been important, but now their funding and continuity is increasingly under threat. We need to understand much more about how farmers will access technical advice in the future, but also of the social dynamics that underpin local exchange of information and change in production and water use.
Finally, but not least, we need to see FMIS in their wider hydrological context, to understand more about the inter-actions and effects that irrigation systems have on each other and the wider river basin. What dialogue can FMIS have with each other and new organizations for river basin management, and how effectively can FMIS and their water needs and use be portrayed in river basin planning?

Although there is much we do know about FMIS, the rapid nature of changes in society, production and water management still bring many new questions for research in the future.

**SURYA NATH UPADHYAY**

Irrigation is intertwined with culture, history, anthropology, sociology and so on all connected to the softer side human relationship, desire and behavior. This provides Farmer Managed Irrigation Systems (FMIS) a flexible informal set of behavior to manage these systems. It grew and remained sustained because it had in it the attributes like flexibility, responsive to needs and informality but yet sanction of moral values. However, with the changes basically on two fronts-social relationship on the one hand and the growing conflict and competition on the use of water on the other hand, FMIS faced increasing challenges for its sustainability. In this kind of situation, it was natural to turn to written rules than unwritten, somewhat more specific guidelines than unwritten ones. The need to be recognized under the eyes of law was necessary for not only managing the internal behavior but also to get support from outside.

As the social life style changed, the labor which was to be made available by *sramdana* (voluntary labor) took the form of money. It became easier for people to contribute in cash than to contribute labor for the whole day. Similarly, the need to construct intake and some portion of the canal more stable necessitated the purchase of cement and other materials. Hence, it was natural to shift from informal regime to a formal regime. In this transition the shift however, did not become smooth. Varieties of legal models emerged to make this shift. The institutional and legal model that are generally practiced are co-operatives, NGO’s, WUA etc. All these institutional and legal frameworks again have various characteristics in their content, forms and operational rules. In many cases, even the objective could be broader or specific, single or multiple. Countries seem to have tried these models as it situated to their legal regime and the

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1 Honorary Member, FMIS Promotion Trust, Nepal.
historical evolution of FMIS. This transition that FMIS faced is still going on.

With the growing pressure of population and demand on agriculture, FMIS have now, in recent years, are facing further challenge to secure their water right light as also to link their activity with other aspects of agriculture. The issue of efficiency which was not much emphasized in earlier days has become the prime issue. Hence, the conflict is bound to occur. Water is no longer easily available. Even if it is available it needs to be utilized in a more efficient manner. There is no space for wasting it. FMIS have to be vary being cautious about it. Their water rights have been conditioned to limitations. Even the quantum of water that they were utilizing has been sanctioned by efficiency because the same water is needed to others or for various other purposes. For FMIS in this situation there is a specific need to know the rules as to how much water is available to them in what from and time and how they should distribute it among their members and how they solve their internal conflict as also face the external conflict. A simple yet clear, a flexible yet specific set of rules need to be developed not only for FMIS but also for the regulatory authorities who are to manage the conflicts between the FMIS.

The second challenge that FMIS is facing is that of the changing pattern of agriculture. In many countries, more specifically countries where agriculture has been more of a subsistence level, the pressure of population has necessitated to change the crop and cropping pattern. If the farmer is to survive, he is bound to move towards more cash crop, more technology, more inputs like seed, fertilizer etc. Marketing which was not an issue earlier has become an important issue now. This new dimension certainly has changed the institutional and legal regime of many FMIS. Now the question is under which law the FMIS are to be registered if they are to function many agricultural activities. In Nepal, for instance, FMIS can be registered under the Water Resources Act. Now with the new dimension, they seem to be more appropriate to be registered under Co-operative or Society Registration Act. In that kind of situation, relation between the authority responsible for registration and the concerned agency also needs to be further clarified. In the case of Society Registration Act, all the NGO's are registered under that same Act. There is a big difference in the function, manner and ways the NGO's function and the FMIS. Hence, the issue could be whether the same set of rules or regulatory regimes would work for both or whether we need to evolve some special kind of regulation for FMIS. These are some of the pertinent legal issues and those
of us who work in this field must find answers so that the legal regime of a country should help the FMIS in their growth and effectively.

Besides the above challenges, there is yet another challenge that has been very pronounced over the years after the introduction of multiparty democracy in Nepal and I am sure, this probably is true in many countries of South Asia. FMIS, as they become effective in the social/economic sector of the society, provide a vehicle for reaching to the people for political ends. Politicians who have votes of the people for being elected in the parliament and all other kinds of political positions have a compulsion to reach the people and pose themselves as the benefactors of the people. They belong to a particular political party and it is within their normal behavior to downgrade or criticize person having allegiance or faith to other political party and be non-co--operative to them. Unfortunately, all our development activities is plagued with the vice of politicization. The ways, means and the internal management of the development are severely affected by such actions. The unfortunate thing is that those who are in the decision making places and have means and resources to influence and intervene the FMIS do utilize their authority for this. One has to find answer to this problem. Law can provide a mechanism to take away the arbitrary authority of the politician and adopt a more transparent, democratic and less interventionist procedure so that FMIS may act in an autonomous and independent way. If this is done, the intervention made for so called strengthening of FMIS is bound to turn into destroying the very institutional strength of FMIS. In this respect, quite often we hear in Nepal Sarbadaliya Committee (all party committee) to solve the local issue and more particularly keeping the development efforts away from the political interventions. If it has proved temporarily successful in certain specific cases, it is very doubtful whether the political parties would be away from utilizing the alluring opportunity to their political objective. We must devise ways and means to check politicizing the FMIS and keep them away from political interventions.
VOTE OF THANKS

LAVA RAJ BHATTARAI

On behalf of Farmer Managed Irrigation Systems (FMIS) Promotion Trust, I would like to extend a vote of thanks to all the participants for their valuable time and contribution. This seminar has been made successful by the collaborative efforts of several contributors from 15 different countries. The contributors are: Dr. T. N. Upreti, President, Society for the Promotion of CMC Education, former Vice-chancellor of Tribhuvan University and former Royal Nepali Ambassador to France for Chairing the Initiation and Honor Session;

Distinguished guests Dr. Elinor Ostrom, Dr. Norman Uphoff and Dr. Robert Yoder from USA for enlightening the gathering with their keynote speeches and accepting Trust Honor;

Mr. Ganesh Shivakoti, Asian Institute of Technology; Mr. Iswer Raj Onta, Coordinator, Nepal Water Partnership/Jalshrot Vikas Sanstha; Mr. Jitendra Ghimire, DDG, Department of Irrigation; Dr. Prachanda Pradhan, Chairman, FMIS Promotion Trust, Mr. R. L. Kayastha, former Secretary, Ministry of Agriculture; Dr. Ram Prakash Yadav, former Member, National Planning Commission; Franz Heim, Head, Agricultural Production, DSE/ZEL, Germany; Prof. Norman Uphoff, and; Dr. Robert Yoder; for Chairing the Plenary Sessions;

Mr. A.V. Ramana Charyulu, Mr. Devi Dutta Devakota, Dr. Dhurba Panta, Mr. Drik R. Frans, Mr. Duman Thapa, Mr. Min Bikram Malla Thakuri, Tej Prasad Subedi, Ajay C. Lal and Rupa Lamichhane Mr. Emmanuel Reynard, Mr. Ganesh Shivakoti Mr. John Skutsch, Mr. Lakshmi Narayan Choudhari, Mr. Laya Uprety, Mr. Naeem Akhtar, Abdul Hamid and Mian Abdul Wahid Dr. Prachanda Pradhan, Ms. Pranita Udas, Mr. Shambhu Prasad Dulal, Mr. Shiva Kumar Sharma, Mr. Sishir Prasad Aryal, Ms. Synne Movik, Mr. Tofazzal Hossain Miah, Dr. Umesh Nath Parajuli, Dr. Upendra Gautam, Mr. Phalasack Pheddara, Mr. Nguyen Xuan Tiep, Mr. Sona Chy, Mr. Mao Sannay, Mr. Te Ouvkim, Mr. Sin Vuthy and Mr. Pang Peng, for paper contribution and presentation.

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1 Senior Engineer and Founding Member, FMIS Promotion Trust, Nepal.
Mr. Abinash Pant, Mr. Ajay Chandra Lal, Mr. Ajoy Karki, Mr. Ajaya Lall Shrestha, Mr. Binaya Shah, Mr. Ganesh Khaniya, Mr. Hari Krishna Shrestha, Mr. Laya Uprety, Ms. Megh Ranjani Rai, Mr. Min Bikram Malla Thakuri, Mr. Rajan Subedi, Mr. Suman Sijapati, and Mr. Umesh Nath Parajuli for coordinating and reporting the sessions;

Trust Members Mr. Krishna Murari Gautam and Dr. Vijaya Shrestha for their contribution in the efficient organization and conduction of the seminar.

We are grateful to the panelists Mr. Charles Abernethy, Prof. Norman Uphoff, Prof. Linden Vincent and Mr. Surya Nath Upadhyay for their observation and insightful suggestions for future directions.

Support staff of the Trust deserve sincere thanks for their untiring efforts to smoothly organize the seminar from its very beginning to the end. Hotel Annapurna deserve due thanks for providing the seminar venue, excellent foods and conference services.

Thank you once again.
ANNEXES
## SEMINAR PROGRAM

Second International Seminar Program on
"Farmer Managed Irrigation Systems in the Changed Context"

Venue : Hotel Annapurna, Durbar Marg, Kathmandu, Nepal
Date : April 18-Thursday and April 19-Friday, 2002
Master of Ceremony: Mr. Krishna Murari Gautam

### Day 1

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<td>8:00-8:30</td>
<td>Registration Participants</td>
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<tr>
<td>8:30</td>
<td>Welcome Mr. Rajan Subedi, Member-Secretary FMIS Promotion Trust</td>
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<td>8:40</td>
<td>Introduction to the Seminar theme Dr. Prachanda Pradhan, Chairman FMIS Promotion Trust</td>
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<td>8:55</td>
<td>FMIS Promotion Trust in 2000-2002 Dr. Upendra Gautam, Vice-chairman FMIS Promotion Trust</td>
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<td></td>
<td>Announcement of the FMIS Promotion Trust Icons of Honor</td>
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<td></td>
<td>- Dr. Elinor Ostrom</td>
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<td>- Dr. Norman Uphoff</td>
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<td>- Dr. Robert Yoder</td>
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<td>Brief Introduction of the Icons of Honor Dr. Vijaya Shrestha, Member FMIS Promotion Trust</td>
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<td>9:10</td>
<td>Presentation of Honors Reading out the Commendation Plaque Ms. Rupa Lamichhane, Member FMIS Promotion Trust</td>
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<td>- Dr. Elinor Ostrom</td>
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<td>9.45</td>
<td>Keynote Speech: &quot;Understanding and Utilizing the Softer Aspects of 'Software' for Improving Irrigation Management&quot;</td>
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<tr>
<td>10.05</td>
<td>Keynote Speech: &quot;Farmer Managed Irrigation Systems and Subsistence Agriculture in Nepal&quot;</td>
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<td>10.25</td>
<td>Closing Remark from the chair</td>
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<td>10.35-10.50</td>
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**II. Parallel Sessions of the Seminar in Two Rooms**

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<th>Session</th>
<th>Presentation and Discussion: Trust's Collaborative Research</th>
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<td></td>
<td>Mr. Ajay Lall Shrestha</td>
<td>Banquet Hall</td>
<td>Chairman: Mr. Jitendra Ghimire, Deputy Director General, Department of Irrigation, Mr. Laya Prasad Upreti</td>
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<td></td>
<td>Mr. Rajan Subedi</td>
<td>Arch Room</td>
<td>Chairman: Mr. R.L. Kayastha, Former Secretary Ministry of Agriculture, Mr. Suman Sijapati</td>
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<tr>
<td>10.50 – 11.35</td>
<td>&quot;Action Study on New FMIS and their Dynamism&quot; by Mr. Min Bikram Maalla Thakuri/Interdisciplinary Group</td>
<td>10.50 – 11.35</td>
<td>&quot;Sub-Watershed Study in Khadgabhanjyang VDC, Nuwakot to Identify Water Use Inventory&quot; by Mr. Shiva Kumar Sharma/Interdisciplinary Group</td>
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<td>Floor Discussion</td>
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<td>11.35 – 12.20</td>
<td>&quot;Recrafting the Role of Education For FMIS Knowledge Promotion&quot; by Mr. Lakshmi Narayan Choudhari/ Nepal Engineering College</td>
<td>10.35 – 12.20</td>
<td>&quot;Inventory of Irrigation Systems in Kathmandu District&quot; by Mr. Shambhu Prasad Dulal, Kathmandu District Unit of NFWUAN and Dr. Prachanda Pradhan</td>
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<td>12:20-12:30</td>
<td>Group Photo at the Pool Side</td>
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<td>12.30 – 2.00</td>
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<td><strong>Presentation and Discussion: Case Studies</strong></td>
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<td>Chairman: Mr. Ishwer Raj Onta, Coordinator Nepal Water Partnership/Jalshrot Vikash Sanstha</td>
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<td>Reporter: Mr. Hari Krishna Shrestha</td>
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<td>2.00 – 2.45</td>
<td>&quot;Public Intervention and Changing Irrigation Institutions: A case of FMIS in Nepal&quot;</td>
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<td>Paper presentation by Dr. Dhruba Pant</td>
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<td>2.00 – 2.45</td>
<td>&quot;FMIS in High Land&quot;</td>
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<td>Paper Presentation by Mr. Devi Dutta Devakota and Dr. Prachand Pradhan</td>
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<td>2.45 – 3.30</td>
<td>Accessing the Performance of Farmer Managed Irrigation Systems: An Evidence from &quot;Hakra 4R Distributory, Southern Punjab, Pakistan&quot;</td>
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<td>Paper presentation by Mr. Naeem Akhtar</td>
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<td>Floor Discussion</td>
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<td>2.45 – 3.30</td>
<td>Farmers' Participation in Large Scale Irrigation Project</td>
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<td>Paper presentation by Dr. Duman Thapa</td>
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<td>Floor Discussion</td>
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<td>3.30 – 4.00</td>
<td><strong>Tea Break</strong></td>
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<td>4.00 – 4.45</td>
<td>&quot;Indigenous Knowledge and Practices in Shringighat Simunia Satgaon Irrigation System&quot;</td>
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<td>Paper presentation by Mr. Shishir Prasad Aryal</td>
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<td>Floor Discussion</td>
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<td>4.00 – 4.45</td>
<td>&quot;Diversified Activities of WUA&quot;</td>
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<td>Paper presentation by Dr. Prachanda Pradhan and Dr. Upendra Gautam/Alternative Paper</td>
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<th>Parallel Session II in Arch Room</th>
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<tr>
<td><strong>Chairman</strong></td>
<td>Prof. Norman Uphoff, Cornell University</td>
<td>Dr. Ram Prakash Yadav, Former Member, NPC</td>
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<td><strong>Reporter</strong></td>
<td>Mr. Binaya Shah</td>
<td>Mr. Ajoy Karki</td>
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<tr>
<td>9.00 – 9.45</td>
<td>&quot;Irrigation Technology and Devolution of Water Management&quot;&lt;br&gt;Paper presentation by Dr. Umesh Nath Parajuli</td>
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<td>10.30 – 11.15</td>
<td>&quot;Impact of Increasing Trend of Privatization on FMIS&quot;&lt;br&gt;Paper presentation by Ms. Synne Movik</td>
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<td>Floor Discussion</td>
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<td>11.15 – 12.00</td>
<td>&quot;Gender Issue in Farmer Managed Irrigation&quot;&lt;br&gt;Paper presentation by Ms. Pranita Udas</td>
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<td>Floor Discussion</td>
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<td>12.00 – 1.00</td>
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<td>Lunch</td>
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### Presentation and Discussion: Country Papers

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<tr>
<td>1.00 – 1.45</td>
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<td>Mr. Dirk R. Frans</td>
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<td>1.45 – 2.30</td>
<td>Country Paper from Vietnam</td>
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### III. Plenary Session: Comparative Study

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<td>Dr. Robert Yoder</td>
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<td>Session Coordinator</td>
<td>Mr. Rajan Subedi</td>
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<td>Reporter</td>
<td>Mr. Min Bikram Malla Thakuri</td>
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<td></td>
<td>&quot;Intervention in Montane Farmer Managed Irrigation Systems in Thailand and Vietnam: How Participatory and Dynamic are the Process?&quot;</td>
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<td></td>
<td>Paper Presentation by Dr. Ganesh Shivakoti</td>
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<td>Floor Discussion</td>
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### IV. Final Plenary Session: Final Discussion on Future Direction of FMIS

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<td>Chairman</td>
<td>Dr. Prachanda Pradhan</td>
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<td></td>
<td>Session Coordinator</td>
<td>Mr. Abinash Pant</td>
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<td>Reporter</td>
<td>Dr. Umesh Parajuli</td>
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<td>Panelists</td>
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<td>5. Mr. Lava Raj Bhattarai</td>
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Annex 2
List of Participants
## LIST OF PARTICIPANTS

### a. Foreign

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Annex 3
Photographs
PARTICIPANTS: MOMENT OF TOGETHERNESS
SESSION PRESENTATION AND DIALOGUE

Second International Seminar
On Farmer Managed Irrigation Systems in the Changed Context
18-19 April 2003, Kathmandu
Organised by Farmer Managed Irrigation System Promotion Trust, Nepal

Jitendra Ghimire, Session Chair (left) addressing the seminar while Laya Prasad Uprety, Session Reporter looks on

Ratneshwor Lal Kayastha, Session Chair, flanked by Shiva Kumar Sharma, Paper Presenter (left) and Suman Sijapati, Session Reporter (right), addressing the seminar
Devi Dutta Devkota responding the queries raised during the presentation

Emmanuel Reynard making his presentation
SEMinar ACTIVITIES IN PROGRESS