Public private partnerships in watershed management: evidence from the Himalayan foothills

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Public-Private Partnerships in Watershed Management- Evidence from the Himalayan Foothills

Abstract

This paper presents a post-project evaluation of an award winning Joint Forest Management (JFM) program in the Shiwalik Hills, Haryana, India. The focus is on the development and management of a series of small dams which commanded the major proportion of funds in the project. Our findings are based on a rapid survey of 28 Hill Resource Management Societies (HRMS) and a detailed case study of two (HRMS) in the Morni-Pinjore Forest Division of Haryana. Over the period 1990-98 the Ford Foundation, Tata Energy Research Institute and Haryana Forest Department worked together to scale-up the highly successful Sukhomajiri watershed management model. The project can hardly be termed a success. Due to rapid siltation less than 20 percent of dams were functioning in 2000. A number of factors contributed to the failure. These include, lack of an effective catchment stabilization plan, lack of effective leadership in management of dams and lack of interest on the part of farmers who had either tubewells or substantial income from non-farm sources. In summary, government and private agencies attempting to support community management of natural resources must be aware of the pre-conditions needed for success.

Key Words

Public-Private Partnerships/Irrigation Management Transfer/ Water Rights/Collective Action/Watershed Management/Rural Livelihoods

1. Introduction

In recent years decentralized development approaches have gained wide acceptance in policy circles. In the water resources sector in particular, Irrigation Management Transfer (IMT) policies have been promoted with support of multilateral development agencies like the World Bank and Asian Development Bank (ADB). IMT policies typically refer to contraction of government managerial responsibility to encompass only the largest facilities in the irrigation system or vesting management of tertiary distribution facilities with farmer's groups or other private-sector groups (International Water Management Institute (IWMI) 1995:4).

IMT as a strategy has gained wide acceptance in policy circles for a variety of reasons. For one, it is has been demonstrated that IMT has the potential to reduce the budgetary burden on the State of operating and maintaining irrigation systems. Second it is claimed that IMT policies have the potential to improve irrigation system performance and productivity. Third IMT has the potential to enhance sustainability and reduce detrimental environmental impacts of irrigation management. Among the driving forces that have influenced spread of IMT policies world wide is the perception that public irrigation agencies lack the incentives to optimize management performance and that farmer's have a direct interest in ensuring cost-effective irrigation management. It is assumed that a management system that is more accountable to farmers will be more equitable and that equity considerations would be better addressed where beneficiaries bear the costs of service provision (IWMI 1994:2-3).

In recent years Farmer Managed Irrigation (FMI) projects have experimented with transfer of management responsibility for groups of separate systems (intake, distribution and drainage) to management entities under farmer control. Saleth (1999:A87-88) in discussing options for public-private partnerships in irrigation management in India highlights four configurations: build-own operate system (B-O-O), build-own sell system (B-O-S), build-own transfer system (B-O-T) and lease-own operate system (L-O-P). He concludes that the lease-own operate system has the greatest potential in promoting "multi-player centred private participation" whereby the tasks of water distribution, fee collection and system maintenance are undertaken by private entities leasing an irrigation system. In Saleth's view the key policy issues involved in the lease-own operate system are determination of lease payment, period of lease and acceptable minimum maintenance requirement.

Notwithstanding the interest in Farmer management of water resources, it has been pointed out that merely devolving responsibility to farmer groups does not necessarily guarantee efficient management (Kurian 2001). This may be the case especially when farmer's groups lack financial resources to effectively participate in irrigation management through payment of Irrigation Service Fees (ISF's) or by way of committing monetary resources towards routine maintenance of irrigation infrastructure. For example, a study on participatory natural resource management in Zimbabwe revealed that even when a community appears well motivated, dynamic and organized, inadequacy of material resources may present severe limitations (Cleaver 1999:604). Resource constraints may also limit remote communities' ability to effectively lobby with district authorities or donor agencies on issues related to management of natural resources.

The lack of financial resources within farmer's groups should not be mistaken for a complete absence of resources, though. A number of recent studies emphasize that rural groups are internally differentiated on the basis of wealth and agricultural income (see Leach et. al 1999, Beck and Nesmith 2001). Therefore, heterogeneous groups have the potential to produce local leaders that are capable of organizing farmers, resolving conflicts and mediating with State parastatals on issues related to management of natural resources (Vedeld 2000, Mosse 1997). Such perspectives tend to lend support to the growing interest in public-private partnerships in management of water resources (ADB, 2000). The debate on public-private partnerships in water resources management highlights the potential role that well endowed farmers can play in providing irrigation services (Dietz 2000, Grover 2002).

This paper attempts to enrich the debate on public-private partnerships through an analysis of participatory watershed management in the Himalayan foothills. The focus of the paper is on the evolution of State policies, NRM strategies of State parastatals and collective action within farmers's groups vested with the responsibility of managing water resources in the Shiwalik hills, Haryana. The central research question posed by this paper is: How do changes in State policies over-time and spatial differences in implementation of NRM strategies by State parastatals influence the evolution of farmer participation in management of earthen dams constructed under a Joint Forest Management (JFM) program? The Haryana JFM program is a particularly good choice for institutional analysis as it was one of the three programs worldwide awarded the United Nations Environment Program's *Saving the Drylands* prize in 1997 for successfully establishing public-private partnerships in natural resources management (http://www.unep.org/unep/envpolimp.techcoop/1.htm).

2. Methodology

The issue of community participation in watershed management is of extreme importance given the current trend of devolving management to local water user groups and to forest protection groups as part of a strategy of irrigation management transfer or joint forest management, respectively (see ADB 2001). Although only a handful of studies have documented the transition of irrigation management institutions from the project to post-project phase, within these some limitations can be highlighted. For instance, studies have usually relied on secondary data and interviews with former project staff. Also, few studies actually made before-after comparisons on the basis of data for more than four years. These factors limit the generalizability of study findings and prevent definitive conclusions from being drawn on the prerequisite conditions for robust irrigation institutions.

An IWMI report recommends measures to improve the rigor of research methods (IWMI 1997):

- Where possible, studies should include a balanced set of performance indicators including financial performance, quality of organization and management, agricultural productivity and impacts on the environment.

- Studies should avoid excessive reliance on secondary data.

- To enable generalization, farmers should be selected based on stratified random sampling according to location of fields relative to headworks.

- Before-after comparisons of farmer-managed irrigation institutions should be based on data for at least six years.

- Given the difficulty of conducting detailed time-series analysis in a large number of schemes, case studies should be complemented by surveys of 20 to 30 randomly selected schemes where data is collected on core performance measures.

- Given the importance of documenting the physical sustainability of irrigation systems after transfer, impact studies should include direct observations of the physical condition and functionality of irrigation structure.

- Given that irrigation institutions are influenced by over-time changes in other sectors of the economy, effort should be made to examine issues like changes in prices, rainfall patterns and cultivation practices.

Our research methodology acknowledges the importance of the concerns outlined above. We therefore adopt a political ecology approach to study participatory watershed management institutions in Haryana. A central tenet of the political ecology school is that land degradation is a result of forces that operate at different scales, both temporal and spatial (see Blaikie 1985, Bebbington 1999). The approach focuses on local decision making and recognizes the context-specific nature of human agency and the constraints placed upon it. The approach recognizes that natural resources are only one of the many elements that make up rural livelihoods, which are shaped by a complex set of political,

social and environmental factors. Access to resources and the ways in which local people evaluate threats to these resources are functions of production and accumulation of wealth and of social status and power over time (Berry 1993, Saul 1988, Warren et al. 2001).

The design of this study relies on two frameworks that adopt a political ecology approach. First is that which attempts to link empirical measures of land degradation to a set of socio-economic variables and behaviour by individuals, households and groups (Gibson et al. 2000, Warren et al. 2001). Second is that in which research is multi-authored, participatory and linked to defined, user-managed outcomes such as compliance with water allocation rules or catchment protection (Uphoff 1993, Chambers 1995).

2.1. *Rapid Survey of HRMS*

Sixty two Hill Resource Management Societies (HRMS) were established in the Morni-Pinjore and Yamunanagar Forest Divisions during the JFM project in Haryana. These 62 HRMS were responsible for managing 96 earthen dams[i] Our study focuses on the HRMS in the Morni-Pinjore division for two reasons: (i) the joint forest management project was initially started in the area and (ii) external intervention in the form of NGO visits was minimal between 1996 and 2000. Excluding the Yamunanagar Forest Division from the sample we were left with a universe of 35 HRMS in the Morni-Pinjore Forest Division. These 35 HRMS were responsible for managing 54 earthen dams. However, due to logistical constraints (roads being washed away in the monsoon rains) we could visit only 28 HRMS. This reduced our sample to 28 HRMS responsible for managing 45 earthen dams (*Table 1*).

[i.] It is important to note that a one to one correspondence between HRMS and dams does not exist. This is because some HRMS like Sukhomajiri had more than one dam under their management. Further, some dams were constructed in areas where no HRMS existed or HRMS were constituted were no dams were constructed.

Our survey of the 28 HRMS in the Morni-Pinjore Forest Division was undertaken over a period of one month in which information was collected on variables like group composition, access to alternative irrigation sources and participation in management of earthen dams. The survey highlighted the diversity of institutional arrangements and over-time changes in Non-Governmental Organization (NGO) and Haryana Forest Department (HFD) intervention and policies. We followed up the survey with intensive case studies of two of the 28 HRMS. Carrying out both a rapid survey and intensive case studies enabled us to explore the generalizability of some of the key findings of the research.

2.2. *Case Study*

Two of the 28 HRMS surveyed- Bharuali and Thadion were selected for a comparative case study. The value of the comparative case study approach is that it highlights local-level institutional processes (Yin 1989). Two rounds of household surveys were undertaken to cover all households in the study sites of the Bharauli and Thadion HRMS. The household surveys collected information on household demography, cropping patterns, asset ownership and participation in management of water harvesting dams. In addition to structured interviews, focused interviews and group discussions were undertaken. Data for the case study was collected over a 10-month period between March and December 2000.

Based on data collected during structured interviews households were stratified on the basis of ownership of endowments[ii] . Analysis of irrigation management at both study sites also benefited from an examination of changes in household endowments over a four-year period between 1996 and 2000. Household-level information on asset ownership was available from a survey undertaken in May 1996.

[ii] The presentation of calculation of household endowment scores is shown in *Appendix 1.*

Satellite imagery of land-use changes at the study sites was visually interpreted based on National Remote Sensing Agency (NRSA) photographs of April 1999 (NRSA 1999). Land-use changes that took place in the Bharauli watershed between 1966 and 1999 were examined by overlaying 1999 satellite imagery onto Survey of India topography sheets of 1966. Map Info computer software was used to arrive at quantitative estimates of changes in land use.

3. Public-Private Partnerships in Watershed Management, Shiwalik Hills, Haryana

Haryana is situated in north-western India. Most of Haryana's natural forests are concentrated along the Shiwalik hills that run along the State's eastern periphery. For instance, approximately 46% of land in the Panchkula district, located in the north-eastern part of the State, is under Shiwalik hills forests (GoH 2000). Management of Shiwalik forests in the Panchkula district is vested with the Morni-Pinjore Forest Division. For administrative purposes the Morni-Pinjore Forest Division is further subdivided into four forest ranges: Pinjore, Morni, Panchkula and Raipur Rani.

Shiwalik hill forests in Panchkula district perform the important function of mitigating the effects of soil erosion. But in the early seventies there was a realization that open grazing of cattle and fuelwood collection by local communities endangered the soil conservation function of the Shiwalik forests. The most visible manifestation of forest degradation was the increasing rate of siltation of the Sukhna reservoir in the State capital, Chandigarh. Sukhna reservoir was an important source of tourism revenues. Urgent steps were required to save the reservoir from complete siltation. Preliminary studies indicated that soil erosion caused by deforestation in the watershed areas surrounding Sukhomajiri, Dhamala and Lohgarh villages was responsible for the high rates of siltation of the Sukhna reservoir

(*Appendix 1)*. For example, in 1982 51.2% of total rainfall in the Sukhomajiri watershed was lost as run-off (Dhar 1994:20). Higher rates of run-off from the watershed area was attributed to reduced tree stocking and poor grass cover. The Haryana Forest Department (HFD), with whom ownership of forests in the watershed areas was vested, was mandated to find a solution to the problem of soil erosion.

3.1 *The Sukhomajiri Watershed Model*

From the mid-seventies onwards the Central Government, the HFD and the Central Soil and Water Conservation Research and Training Institute (CSWCRTI) with support from the Ford Foundation were involved in undertaking soil and water conservation activities in the vicinity of Sukhomajiri village. Initially check dams were constructed to arrest the movement of silt from catchment areas. However, when villagers destroyed the check dams and continued to open graze cattle in forest areas, a more comprehensive dialogue was initiated with local communities. Discussions revealed that inadequate irrigation facilities caused fodder scarcity, resulting in villagers open grazing their cattle in state forests. One of the significant decisions taken as an outcome of those discussions was to construct two earthen dams in 1978. The dams provided supplemental irrigation to wheat crop and thus helped to increase agricultural productivity in the *rabi* season. Further, production of wheat straw increased farmer's disposable income by enabling them to reduce their fodder grass purchases from external sources. The improved supply of wheat straw fodder also led to an increase in cattle dung, which was used as a cooking fuel, and thus lessened pressure on state forests for fuelwood *(Appendix 2)*.

In subsequent years two more earthen dams were constructed in Sukhomajiri village. The increased fodder production resulting from the reliable provision of water from the dams led to changes in livestock composition. For instance, people gradually began substituting buffaloes for goats (Sarin, 1996). The reduction in goat numbers was spurred as well by a simultaneous expansion in markets for buffalo milk (Varalakshmi, 1993). Increased availability of fodder grass from private fields as a result of access to irrigation also led to an increase in stall feeding of cattle (Tata Energy Research Institute (TERI) 1998). Post-project evaluation studies carried out in subsequent years revealed that due to reduced open grazing of goats in forest areas, browsing of tender saplings decreased thereby permitting their faster regeneration. Improved forest condition, as reflected in increased tree and grass regeneration, ameliorated sediment run-off from the catchment, dramatically reducing siltation of the Sukhna reservoir (See Grewal et. al 1995). This initial success with eliciting people's participation in watershed management in Sukhomajiri led the forest department to contemplate scaling up (*replicatin*g) the program to cover a much larger number of villages in the Shiwalik hills.

Success with participatory watershed management lead the forest department to expand the mandate of the JFM program in the Shiwalik hills. For instance, evidence of increased yield of fodder grass in the forest areas as a result of regulated use led villagers to petition the forest department for a share in profits from the sale of forest products. Until 1983 the HFD annually auctioned fodder grass leases for forest compartments to private contractors. The contractors in turn charged Rs 450 per person as grass-cutting fee for villagers to cut grass in the forest areas. But in 1983 the HFD agreed to sell the fodder grass lease for the adjoining forest area to Sukhomajiri. To ease the management of the fodder grass lease for local communities the water users associations were reconstituted as Hill Resource Management Societies (HRMS). Fodder grass leases were given to Sukhomajiri HRMS upon the

payment of a lease amount equivalent to the average of the previous three years' prices fetched in open auction. At the village level, granting the fodder grass leases directly to the HRMS reduced the average grass cutting fee from Rs 450 to Rs 150 (Sarin 1996: 29).

In 1986 the HFD agreed to lease even fibre grass (*Eulaliopsis binata*) to the HRMS on the basis of the same principle of the average of the three years' auction prices. An important precondition for sharing forest benefits was that the HRMS must actively cooperate with the forest department to protect the forest. The reasoning behind the HFD strategy of teaming up with the HRMS in soil and water conservation is captured well in the working plan of the HFD. The plan notes:

> For the state Government, there will be no loss in existing revenues from the concerned areas. The present levels of revenue will be maintained and in certain cases, this will increase over time. Simultaneously, through the Government's adoption of the policy of sharing, the bulk of the increased production resulting from villager's participation. The latter's economic status will improve substantially without any additional cost. The government will get the benefit of increasing incomes and employment without making any additional investments. Further, with villagers accepting responsibility for protection and management of forest areas near villages, the Department's future costs for their protection and rehabilitation will be substantially reduced. In fact the [forest department's] traditional role of policemen will change to one of enabling villagers to participate in improved management of forest areas (HFD 1995: 92).

3.2. *Scaling Up- Replicating the Sukhomajiri Watershed Model*

Between 1990 and 1998 the HFD with support from the Ford Foundation and Tata Energy Research Institute (TERI), an NGO scaled up (replicated) the Sukhomajiri watershed management model. In the process a well defined set of institutional rules were laid down regarding management of water from earthen dams. An important principle followed in the case of distribution of water from earthen dams was that every family was to get an equal share of water upon payment of an hourly Irrigation Service Fee (ISF). The equal share principle was to be based on either a time or area criteria (ie. Acre or hourly basis). Annual water auctions are held at which rights to water allocation are leased out to the HRMS which acts as the authority responsible for allocation of water and collection of ISF's. An alternative scenario is that an individual farmer bids for water allocation rights at the auction. The highest bidder is awarded an annual contract to allocate water, collect ISF's and undertake routine maintenance of the dam. At the end of the year a proportion of the proceeds from ISF's collected are deposited by the farmer with the HRMS.

Between 1990 and 1998 TERI launched a major effort to build an institutional structure for dam management. The effort included consultation with communities on potential sites for construction of dams, catchment protection, fixing of irrigation service fees, leasing out of water allocation rights to individuals and modalities for community participation in dam repair and maintenance. Six features of the institutional contracts that characterized formation of community organizations are notable:

- Water user associations were constituted as Hill Resource Management Societies (HRMS) under the Registration of Societies Act. 1900.

- Landless households were given a share of water from dams provided they were members of the HRMS. Attempts were made to institute a system of tradable water shares so that landless households could sell their share of water to other households.

- An important principle followed regarding use of HRMS funds was that profits from the sale of water from dams (and fibre and fodder grasses) could be used for community development activities. Such activities could take the form of construction of village roads, repair of school buildings or construction of rest areas for labourers.

- The HFD was to facilitate annual elections of the HRMS managing committee.

- Membership issues were tackled, especially in cases where not all members in a village could benefit from water supply from dams. Further, where the HRMS comprised two or more villages, attention was paid to issues like how revenue raised from sale of water (and fibre and fodder grasses) could be spent. At least a third of positions in the managing committee of the HRMS are to be reserved for women. Every woman in a household was entitled to membership distinct from membership of the male head of household in the general body of HRMS.

- Profits from the sale water from earthen dams (and fibre and fodder grasses) constructed in areas under joint management were to be shared between the HFD and the HRMS.

3.3.1 *Declining Market in Fibre Grass and Changes in Fiscal Regime- Implications for Farmer Participation*

Public-private partnerships in natural resources management are influenced by State policies and fiscal regimes. Changes in import policies and taxation regimes of government's can impact on potential for farmer co-operation in watershed management. The importance of inter-sectoral policy co-ordination is highlighted by the experience in Haryana. For example a review of forest department records for the period 1996–97 and 1999–2000 reveals that HRMS' gross profits from the sale of fibre grass declined steadily (*Table 2*). This decline in prices received by HRMS from the sale of fibre grass is explained in large measure by changes in the demand for the product by paper mills in the region.

Fibre grass from the Morni-Pinjore Forest Division was traditionally supplied to the Ballarpur paper mills in Yamunanagar and the Pawmi paper mills in Barotiwala in Himachal Pradesh. The central government's liberalization of raw material imports in 1993 made it cheaper for paper mills to use imported softwood pulp rather than rely on traditional sources like forest departments. In the case of the Pawmi mill, for instance, prior to 1993 the mill relied on 1,200 metric tonnes of imported softwood pulp from Sweden, the U.K. and Canada to meet half of its raw material requirements. The balance was met by procuring some 1,500 metric tonnes of fibre grass annually from HRMS and purchasing some 500 metric tonnes of wheat stalk per month. But with cheaper imported raw materials becoming readily available, reliance on fibre grass and wheat stalk declined.[iii] Transition to cheaper raw material imports also explains the decision of Ballarpur paper mill in 1998 to stop sourcing fibre grass from

[iii.] For a general discussion of trends in international prices of paper and supply of raw materials by forest departments see Kurian 1998.

forests under management of HRMS. Another factor influencing paper mills' decision to look for alternative raw materials was the 10% higher labour costs of using fibre grass.

HRMS gross profits as we observed above were adversely affected by the decline in markets for fibre grass. As a result within a couple of years the HRMS showed little interest in leasing out fibre grass rights from the HFD. These trends were bound to severely affect forest department revenues. So in 1998 the forest department came out with a set of rules that stipulated that the HRMS were to share a proportion of their profits from the sale of fibre grass with the HFD. Some argue that the forest department's taxation regime impeded the HRMS' ploughing back profits into community development or resource conservation tasks (CSE 1999)[iv].

3.4. *Declining Markets for Fibre Grass: Implications for Repair of Earthen Dams*

The link between forests in catchment areas and agricultural fields is critical in conceptualising resource degradation in the Shiwalik hills. Two basic features characterize the link between forests and agriculture. First, soil erosion in forest areas leads to siltation of earthen dams, which would consequently compromise agricultural productivity. Second, most HRMS funds derived from the sale of fibre grass are known to have been channelled towards the repair of the earthen dams. A study of HRMS investment patterns found the main share of HRMS funds had been invested in construction/repair of village hall, followed by construction/repair of temples and earthen dams (Datta

[iv]. A sales tax (23.8%) and a HFD tax (25%) were imposed on gross profits from fibre grass sales. Subsequently, 30% of what remained after imposition of the HFD tax was deposited in a joint account operated by the Divisional Forest Officer and the president of the HRMS. Ten percent of what remained after imposition of the HFD tax was deposited in a common fund or *kalyan kosh*. Sixty percent of what was left after imposition of the HFD tax was deposited in the HRMS account. Our survey of HRMS in the Morni-Pinjore Forest Division shows that such taxation of proceeds dramatically reduced the net profits accrued by community organizations. For instance, in the case of Sukhomajiri HRMS barely 42% of gross profits from fibre grass sales remained with the local community.

and Varalakshmi 1999: 117). However, the ability of the HRMS to channel funds from the sale of fibre grass towards repair of earthen dams was severely curtailed by declining markets, owing to limited demand for fibre grass from paper mills.

3.5. *Natural Resource Management Strategies of State Parastatals- Importance of Transparent and Accountable Procedures*

An important principle highlighted by scientists at the Central Soil and Water Conservation Research and Training Institute during the Sukhomajiri experiment related to catchment stabilization. The catchment stabilization principle basically emphasizes the need to form village forest management organizations prior to dam construction. Village-based organizations were to institute rules regulating access to state forests for fuelwood, fodder and fibre grass. In response to regulated use of forest areas, earthen dams could be built. The assumption was that the regulated forest use would have stabilized rates of soil erosion and, as a result, increased the lifespan of the dams. Our analysis of earthen dams in the post-project phase reinforces the importance of institutions for catchment protection (*Table 3*).

We note that approximately 31% of all dams in the Morni-Pinjore Forest Division silted up within five years of construction and 33% within ten years of construction. Interestingly 20% of dams constructed functioned for less than a year! A range-wide analysis highlights the importance attached to watershed institutions during the different phases of the scaling up. We notice there are two clear periods of dam construction in which it is possible to discern a relationship between watershed institutions and the lifespan of dams. The first period extends between 1984 and 1989. This was a period in which scant attention was paid to institutional issues related to setting up water user groups. Instead emphasis was

purely on constructing earthen dams. As a result half of the dams silted up within five years of construction.

During the second phase of dam construction, which extended from 1990 to 1998, we note a gradual movement towards Raipur Rani forest range. During this phase new dams were constructed and community-based organizations were also established. The Ford Foundation, TERI and the HFD closely monitored the process. As a result of closer monitoring and greater transparency, dams surviving beyond five years increased by half. Further, the proportion of dams silting up within five years of construction fell from 50% in the previous phase to 21.4%. Nevertheless, we must emphasize that when compared to the Sukhomajiri pilot phase, dam performance had undergone a marked decline in Raipur Rani. This is evident from figures on numbers of dams surviving beyond 10 years from construction. This we argue is because of the failure to ensure catchment stabilization before dam construction.

4. Contractor Based Water-Provisioning- Unpacking the Role of Organizational Entrepreneurs

4.1. *Contractors as Foot Soldiers of Public-Private Partnerships*

Joint Forest Management (JFM) in Haryana was originally conceptualized as a means of doing away with private contractors. Instead HRMS were to serve as intermediate organizations to share the benefits of forest management with the HFD. In the case of fibre grass, the HRMS was expected to make an initial payment to the HFD to lease the right to harvest the product. However, discussions

with forest guards revealed that forest communities were seldom able to raise the lease amount for fibre grass. So in most cases an individual from within the village paid the lease amount. In the case of some HRMS, especially those in the Pinjore forest range, HRMS' held open auctions to award fibre grass harvesting rights. At these auctions sometimes the same individual who paid the initial lease amount of behalf of the HRMS again purchased the harvesting rights. Similarly in the case of earthen dam management too we found that individual farmers were responsible for purchasing rights to allocate water. We found that water contractors undertook considerable risk considering that in the event of failure of rainfall they stood to lose their initial deposit with the HRMS.

From the point of view of the discussion on public-private partnerships five points may be made with reference to management of earthen dams[v]. First, collective action[vi] among farmers was evident in five out of eight HRMS. Four HRMS where collective action was prevalent were characterized by relative heterogeneity in distribution of endowments (arable, rainfall land, livestock and family labour). All three HRMS that failed to show evidence of collective action were characterized by relative homogeneity in distribution of household endowments. Second, water allocation from earthen dams tended to be relatively more equitable and efficient under a system of contractor based management that tended to emerge in heterogeneous groups. By contrast water allocation under HRMS management that emerged in homogeneous groups was characterized by poor compliance with ISF collection rules.

[v]. Our analysis of contractor based water provisioning focuses on 8 HRMS that were responsible for management of 8 out of a total of 45 earthen dams (17.7%) that were constructed in Morni-Pinjore Forest Division.

[vi]. Collective action was evident in relatively higher levels of compliance with water allocation rules. The criteria we used to evaluate compliance with water use rules were as follows: number of water users as a percentage of total complying with ISF's. We examined degree of compliance by reviewing HRMS records and through focussed group discussions for HRMS wise details on collective action in management of earthen dams.

Thirdly, we also notice that contractors tended to engage in water provisioning when less than fifty percent of water users had access to private alternatives like tubewells. This fact was highlighted by the single HRMS group that despite being heterogeneous, failed to show evidence of collective action. Fourth, contractors tended to engage in water provisioning when more than fifty percent of water users relied on agriculture as a primary source of income with non-farm income making a negligible contribution. Finally, contractors tended to emerge in water provisioning when they felt assured that they could ensure farmer compliance with rules regulating water use, ISF collection and dam repairs due to presence of a repository of social norms. In the following sections we will examine each of the above issues in greater detail. However, prior to that it may be useful to situate the discussion within the wider context of trends in the regional economy.

4.2. *Trends in the Regional Economy*

Haryana is one the Green revolution states in India that has charted impressive gains in agricultural per-capita income. In this connection five factors merit attention in our analysis of regional economy trends. First, there appears to be a de-linking of agricultural performance from poverty reduction. This is apparent from the fact that between 1989-90 and 1993-94 the poverty level more than doubled despite impressive gains in per-capita agricultural income (Bhalla 1999). Second, due to the increasing non-viability of farm operations marginal landholding households have tended to take up non-farm jobs that were traditionally the preserve of landless households. Third, there has been a gradual shrinkage of seasonal employment offered by the HFD together with a simultaneous increase in jobs like stone quarrying that are unpredictable and low paying. Fourth, except for wheat and maize, the increases of harvest prices of crops have not kept pace with increases in consumer prices of food (see

Table 4). Finally, our case study data on changes in distribution of household endowments suggests that access to irrigation was leading to a process of peasant differentiation (*Table 5*)[vii].

4.3. *Peasant Differentiation- Influence of Historically Defined Power and Social Exchange Relations*

White characterizes the process of peasant differentiation as follows:

> Peasant differentiation is a dynamic process involving the emergence or sharpening of differences within the rural population, but it does not in itself consist of (and in some cases, at least in the short term, may not involve) increasing income inequalities. It is not about whether some peasants become richer than others but about the changing kinds of relations between them (or between peasants and non-peasants, including extra-rural groups) in the context of the development of commodity relations in the rural economy. The changes involved in differentiation processes are thus essentially qualitative rather than quantitative, although of course they may be quantitatively measurable; they involve changes in the form or at least in the function of production relations, they can occur in stagnating, expanding or declining rural economy (White 1989:39).

[vii] Household endowment scores calculated based on data collected from two rounds of data in 1996 and 2000 reveal some interesting patterns. The findings were applied to our case study of two HRMS- Bharauli and Thadion. Two points are evident from the table:Group First, heterogeneity in Bharauli is greater than that in Thadion at both points in time (1996 and 2000). Second, Bharauli appears to be becoming more heterogeneous over time while Thadion is becoming more homogeneous. A useful way to understand the reasons behind such trends in group heterogeneity is to examine each of the four variables that went into calculations of the household endowment scores (*Table 6*). We examine the coefficient of variation for each of the following variables: average land irrigated, average size of land owned, average number of livestock and average family size. We also examine patterns of variance for each of these variables in Bharauli and Thadion. Patterns of variance are comparable for all the variables except average irrigated land. We therefore argue that the land area irrigated by the earthen dam in Bharauli had the greatest explanatory power for understanding the trends captured in the movement of endowment scores for both water user groups.

Land ownership may be the starting point of a process of peasant differentiation but it by no means is the only source (Lenin 1982). Our stratification of water using households in Bharuali and Thadion revealed that Thadion was a relatively more homogeneous group in terms of distribution of household endowments. We find that in Thadion all households with the exception of one are concentrated in the medium category, reflecting a great degree of homogeneity in distribution of endowments. In Bharauli by contrast most households are in the low and medium categories, with three households in the high category; there is thus a relatively greater degree of heterogeneity[viii].

Considering that contractor based water provisioning emerged in Bharauli we focus on an analysis of production relations there. We find that households in the high endowment category achieved the highest per acre crop productivity. Further, high endowment category households also achieved the highest cropping intensity rates and per acre rates of fertilizer application. When compared to households in the medium and low categories households in the high category benefited from higher levels of labour hiring and larger area with access to water from earthen dams (*Table 7*). In addition it must be pointed out that households in the high endowment category achieved the highest mean farm based incomes. Primarily due to their greater access to irrigation such households tended to be rely less on livestock rearing as a source of farm based income. However, it is important to point out that such households were not averse to taking risks. This is evident from the fact that households from high endowment category tended to devote the largest acreage towards radish cultivation that has been characterized by downwards price fluctuation between 1996-97 and 2000-01.

Historical differences in ownership of arable land in Bharauli have influenced the process of peasant differentiation. For example, households with sufficient stock of endowments (irrigated land and

[viii] It may be noted here that sharecropping does not exist among any of the water users in Bharuali and Thadion.

livestock) proportionate to family size tended to rely less on non-farm employment. Households in the medium endowment category with individuals in government jobs in nearby towns tended to resort to purchases of fodder and fuelwood from local markets. By contrast households in the high endowment category, that made fewer trips to towns tended to rely on State forests for supply of fuelwood and fodder. Low endowment category households who relied on low paying jobs in nearby towns and stone quarrying employment relied on State forests the least. Interestingly, due to the fact that men in such households were always away from the settlement, it was women who performed tasks of fuelwood and fodder collection from State forests. The low paying nature of jobs engaged in by low endowment category households prevented them from adopting Liquified Petroleum Gas (LPG) technology for cooking and water heating. Peasant differentiation is also evident in social exchange relations in Bharuali. For example, we find that households in the high endowment category have traditionally been sources of credit and agricultural implements for poorer households especially during periods of natural calamity like droughts or floods. Further, poorer households have also relied on wealthier households for on-farm wage labour. Caste based professional specialization and social exclusion based on notions of ethnic purity has effectively limited access of *harijan* households to arable land and representation in political bodies like *panchayats.*

4.4. *Irrigation Service Provision- Strategy of Peasant Accumulation*

Our analysis indicates that an individual farmer drawn from the high endowment category has been responsible for leasing out water harvesting rights for the last three years in Bharuali (see *Table 8*). This we argue is a strategy aimed at accumulation. The farmer who has purchased water harvesting rights has the largest land area in the command area of the earthen dam. Moreover, his farm plots are located at the end of each of the three distribution lines. Alternative irrigation from private tubewells in

particular is unavailable due the prohibitive costs involved in striking a tubewell. This makes it imperative for him to closely monitor the use of water by head end water users to ensure that he received his designated share of water with minimal conflict. By contrast in Thadion three of the wealthiest households using water from the dam had access to water from private tubewells. Therefore, their motivation to undertake risks of water provisioning was less.

The success of the water contractor in ensuring reliable supply of water from the dam in Bharuali has enabled him to derive surplus agricultural income that he has in recent years devoted in part towards purchase of fibre grass harvesting rights. Interestingly, the water contractor does not rely on non-farm employment as a source of household income. However, it must be noted here that the potential for the individual farmer to accumulate profits from purchase of water and fibre grass harvesting rights is influenced by factors like availability of markets for forest products and favourable agricultural terms of trade. For example, we find that the contractor in Bharauli has in recent years been less enthusiastic about purchasing fibre grass harvesting rights due to decline in markets for the product. On the other hand favourable terms of trade for wheat (that is grown in *rabi* season using water harvested in earthen dams) has meant that the contractor is assured of sufficient demand for water from other farmers using the dam.

4.5. *Ensuring Compliance with Irrigation Service Rules- Influence of Social Norms*

We noted in the preceding discussion that three factors; namely surplus agricultural income derived under irrigated conditions, absence of private tubewells and sufficient demand for water by other peasants had motivated the contractor in Bharuali to engage in water provisioning. However, water provisioning is only the first step towards sustaining a process of peasant accumulation. For the

individual peasant to ensure that accumulation actually takes place compliance of water using households with rules regulating use of earthen dams is of utmost significance. Here we find that a repository of social norms in Bhaurali has facilitated compliance with water allocation rules and resulted in relatively less conflicts over water use.

Water users in Bharauli had evolved a wealth of expertise from managing a *kuhl* (traditional water course). Some 60% of water users in Bharauli have evolved a common set of norms from participating in management of a *kuhl* (water distribution channel) that is over 100 years old[ix]. In addition, norms operating at the level of extended families (*gotras*) influence bidding at water auctions. For instance, Singh Ram a nephew of the water contractor said that he abstained from bidding at water auctions since it went against ethics that specified he should not participate when a member of his family was involved already. Such norms may be predicated on the expectation of a family member receiving a favour in the future.

Another interesting facet of water user charges in Bharauli is the role of local-level processes in ensuring compliance with payment of irrigation service fees. Contrary to what most NGOs and donor agencies expect, compliance with water user charges is mediated by a complex web of exchange relations. Such inter-linked exchange relations also influence modes of payment of charges for use of water from earthen dams. For instance, Singh Ram, a marginal peasant in Bharauli pays for use of

[ix.] Each family or gotra is allocated water from the kuhl by rotation for a twelve-hour period. One water user has been given the responsibility of monitoring the rotation. For his services he is allocated six hours of water from the kuhl in excess of his designated share of twenty minutes of water. The number of hours a household receives water is determined by the size of their landholding. For example, among the Poswal gotra there are seven households with a total water availability of twelve hours per rotation. One among the seven households with land size of 20 acres is allocated six hours of water while the remaining six households with land size of three acres each are allocated water for one hour only. In case of sub-divided land within a household the number of hours of water allocated is likewise reduced. The water users of Bharauli meet twice annually to decide on minor repairs to be undertaken to the kuhl.

water from the dam over a period of six months. Sometimes he even borrows money from the water contractor. The contractor keeps an account of his dues. Sometimes he can make no cash payment to clear his debt with the contractor. At such times Singh Ram can be asked to work as hired labour on the contractor's land and his wages are adjusted in accordance with the debt he owes the contractor for a variety of services.

Fieldworkers' reports also testify to the fact that Bharauli residents are honest and meticulous in their dealings with government agencies. "In the meeting, the secretary and cashier had come with all the records, very meticulously maintained" (Kanetkar and Vijh 1993). Contrast this account with one on Thadion:

> Even before the formal meeting began, Puran Chand, who is the *lambardar* of Thadion and is also the member of the *Panchayat*, came and complained that there has been no meeting of the HRMS after the one we had organized a year ago. He said villagers had no idea about the HRMS accounts, what income it had got from fibre grass, what had been done with it, etc. Similarly, water from the dam was being used in a chaotic manner without water charges being collected systematically.

What the above descriptions indicate is that Bharauli HRMS was able to effectively delegate tasks to ensure organizational performance. For example, at water auctions in Bharauli educated men were called upon to ensure that minutes were recorded and accounts audited. Once the auction award was made public the water contractor ensured monitoring of water use from the earthen dam and mobilized labour (usually from landless households) to undertake periodic maintenance work on the dam.

An inability on the part of Thadion HRMS to get its act together has left little opportunity for water allocation rules to take root. As a result of poor cooperation in Thadion, external agencies like the HFD and NGO representatives have had a greater say in HRMS affairs. For example, a field report from Thadion stated, "Balwan, the beat guard was asked to go to Thadion the next day and assist the President and Secretary enter the accounts systematically in a cash book." At the water auction held in 2000 in Thadion, the president of the HRMS went on record as saying, "The HRMS is resolved to keep dam management under the HRMS and not to contract out its management to a contractor. I promise to operate the dam without prejudice. But in case of a problem I need the full support of the forest guard of the HFD."

In Bharauli it is evident that three years of sustained cooperation in dam management has led to the evolution of a set of rules and a habit of complying with them. Such organizational success is bound to influence perceptions of external agents – field staff of the forest department, NGO workers and middle-level bureaucrats. External validation of organizational success may go a long way to improve community self-esteem and create a determination to 'keep up the good work'. On the contrary, in Thadion where irrigators have failed to cooperate, external agencies have appropriated a greater role for themselves in managing local-level organizations. External project interventions in Thadion, one may argue, have failed to achieve community mobilization and empowerment.

4.6. *Rule Compliance- Implications for Rural Livelihoods*

Rule compliance need not be viewed as an end in itself. Instead we argue that rule compliance is only a means to an end- achieving sustainable rural livelihoods. Ensuring sustainable rural livelihoods is predicated upon presence of robust institutions that ensure efficient resource use, equity, empowerment

as defined by a local community and regeneration of natural resources that would facilitate productivity improvements in the future (see Bebbington, 1999).

4.6.1. *Collective action rules: Some efficiency and equity considerations*

We examine collective action rules in relation to management of earthen dams by focusing on two issues: water allocation and participation in repair and maintenance. In so doing, we examine *efficiency* and *equity*[x] implications of collective action rules in Bharauli and Thadion that have implications for rural livelihoods.

Water allocation rules

We adapted Ostrom's use of "water availability difference" to examine predictability in availability of water among peasants at the head-end and tail-end of the dam distribution network (Ostrom 1994: 552).[xi] The difference in predictability of water supply between head-end and tail-end peasants was lower in Bharauli than in Thadion (*Table 9*). This we argue reflects the higher level of efficiency associated with lower level of conflict among peasants and greater clarity about water usage rules.

[x]. In defining efficiency we adopt a multi-layered approach. We argue that efficiency would be enhanced due to presence of robust operational rules that minimize conflicts, elicit payment of irrigation service fees that facilitate routine maintenance of watershed resources. Presence of such robust operational rules we argue would greatly facilitate organizational sustainability of community-based natural resource management. In discussing equity we highlight three issues: 1. Those who use water pay for its use, 2. Those who use more water pay more and 3. Those who bear a cost in facilitating provision of the collective good are compensated for the risks they bear (see Sen 1999).

[xi]. We allotted weights to qualitative assessments of how predictable farmers access to water from earthen dams was in Bharauli and Thadion. The weights were allotted based on whether farmer's access to water was high (2), medium (1) or low (0).

Another indication of the efficiency of the water distribution system is the difference between average water requirement and water availability. Based on rule of thumb calculations of water requirements during the *rabi* season and mean land sizes we arrived at the difference between water requirements and water availability.[xii] In Bharauli relatively efficient water management rules guaranteed a relatively large number of households access to water from the dam. In Thadion, by contrast, because a few households have a monopoly on use of water, the difference between water availability and requirement is double. Greater efficiency in use of the water-harvesting dam is also reflected in the expansion of the Bharauli distribution network.

In response to growing profits from water sales, the contractor expanded the distribution network in 1999/2000 to provide irrigation to 15 additional households. As a result, a total of 19.5 acres was brought under irrigation. We must emphasize here that within the constraints imposed by command area topography and availability of water in the dam, the dam contractor does attempt to balance the needs of a wide constituency of water users. For instance, 40% of the new beneficiaries were either his brothers or belonged to his extended family. Further, the contractor attempts to supply peasants from other caste groups and those with smaller land sizes as well. Finally, the interests of large landholders who can wield enormous political clout are accommodated in the expansion plan.

Water management in Thadion provides a contrasting picture. We find that that due to relatively greater access to private tubewells water users had developed conflicting interests in water use. For

[xii.] During a period of normal rainfall three waterings are required for a wheat crop. Four hours are required to water 1 acre of wheat crop from the dam. Mean land size among water users in Bharauli is 4.7 Acres. Therefore, mean per-capita water requirement for water users in Bharauli is 18.8 hours (4.7 x 4). But in 1999-2000 a total of 555 hours of water was supplied in Bharauli at a mean per-capita rate of 16.1 hours. In Thadion mean land size is 5.8 acres. Therefore, mean per- capita water requirement for water users is 23.2 hours (5.8 x 4). But in 1999-2000 a total of 479 hours of water was supplied in Thadion at a mean per capita rate of 32 hours.

instance, we find that approximately 46.6 percent of water users in Thadion compared to barely 9 percent in Bharauli were growing paddy in the dry season. Interestingly all households growing paddy in Thadion had their farm plots located in the head end of the distribution channel of the earthen dam. The relatively greater water intensity of paddy cultivation (when compared to wheat) has compromised access of tail end water users to water from earthen dams. Such differences in cropping preferences among head and tail end water users in Thadion has resulted in conflicts and poor enforcement of water allocation rules.

Participation in repair and maintenance of earthen dams

We found that farmers in Bharauli were more keen on participating in routine maintenance of the earthen dam when compared to their counterparts in Thadion. For instance, between 1995 and 2000 the mean number of labour days contributed towards maintenance of the distribution network was 3.7 compared to 2.3 in Thadion. Further, the mean monetary contribution towards maintaining the distribution network was Rs 377 compared to Rs 156 in Thadion. We also observe through regression analysis that large landholding households made the largest monetary contributions towards maintenance of the distribution network; peasants with smaller areas irrigated by the dam made more labour contributions towards maintenance activities (*Table 10*).

4.6.2 *Land Use Changes*

We pointed out earlier that the Sukhomajiri watershed model posited a linear relationship between irrigation management institutions and regeneration of forests in catchment areas. However, our analysis of watershed management institutions suggests that it is difficult to posit such a direct

relationship. We identify three factors that make positing of a linear relationship difficult. First, the HFD has continued to invest in raising forestry plantations in catchment areas under JFM. How then is it possible to distinguish between improvements in forest condition that are an outcome of external investment and those resulting from regulation of forest use by local communities? Second, our analysis indicates that earthen dams provide irrigation to only a small percentage of a watershed population. In Bharauli HRMS, for example, approximately 73 percent of households remains excluded from water harvesting benefits. Such households we argue would continue to rely on forests for fuelwood and fodder grass. Third, our qualitative analysis of catchment condition in Bharauli and Thadion suggests that there is no direct link between livestock use and rates of soil erosion. On the other hand we argue that differences in slope may better explain differences in rates of soil erosion (see also Stocking 1996).

Visual interpretation of satellite imagery acquired on changes that have occurred in command areas of the earthen dam however, indicate some positive trends. For example, in visual interpretation of satellite imagery of April 1999 and its comparison with Survey of India Maps of 1965 reveals some interesting land-use changes in Bharauli (NRSA 1999). Firstly, as a result of the expansion of the dam distribution network the area under perennial agriculture has increased. Approximately 60 acres of agricultural land has been brought under perennial agriculture as a result of supply of water from the dam in Bharauli (*Appendix 3*). Household surveys in Bharauli indicate that crops like radishes, onions and chillies are sown during the *rabi* period, between December and April. Secondly, expansion of the dam distribution network has resulted in reclamation of riverbed areas for cultivation purposes. Satellite imagery indicates that approximately 30 acres of land was reclaimed and brought under cultivation.

4.6.3. *Irrigation access and intra-household gender relations*

Access to irrigation from earthen dams has improved fodder grass production on agricultural fields. However, focused discussions indicate that increased fodder grass production has meant more work for women (see also Arya et al. 1998). For instance, women make more trips transporting fodder grass from fields to their homes. Second, when decisions are made to increase cattle herd sizes to maximize returns from sale of milk, women end up spending more time feeding and bathing cattle. Third, unlike grass from forest areas, fodder grass from agricultural fields has to be threshed in a machine before it is fed to livestock. Women's involvement has increased in this task and will rise with an increase in fodder grass production from agricultural fields.

4.6.4. *Evidence on community empowerment*

Evidence on community empowerment in the context of robust irrigation institutions in Bharauli is mixed. On the positive side, well-functioning institutions have resulted in a steady source of funds for the HRMS due to compliance with irrigation service fees and payments of lease amounts by contractors. Further, water users expressed their desire that an individual from within the village be involved in leasing out water allocation rights. This was because of their perception that a local contractor would be flexible with regard to payment of irrigation service fees.

A contractor from within the village would tolerate a delay of six months, as he would understand the financial condition of the people. A contractor from outside, in contrast, would likely be ruthless about payment schedules. Interestingly, water users in Thadion preferred a contractor from outside the village as they hoped such a provider would indeed be able to ruthlessly enforce compliance with irrigation rules. Thus, putting an individual from within the village in charge of contracting out water

allocation rights may be viewed as empowering, since it prevents Bharauli residents from being at the mercy of a ruthless water contractor. Similar analyses have pointed to the experiential dimension of well-being. Such studies essentially build on local perceptions of empowerment (see Bebbington(1999).

On the downside is the fact that women played no role in HRMS affairs. They are represented on the managing committees of HRMS but do not attend meetings and are not consulted on decisions taken. Further, the level of exclusion from irrigation benefits at the village level is enormous. As said, irrigation from the earthen dam benefits only 35 households in Bharauli. Approximately 73% of households have no access to water from the earthen dam. Although they have access to *kuhls* they are left with a relatively less reliable source of supplemental irrigation for wheat production. Further, considering there are no private tubewells in Bharauli, inability to access water from earthen dams could limit the capability of such households to cultivate crops like radishes and onions.

5. **Conclusions**

In recent years there has been a growing interest in decentralized development approaches. In the water resources sector in particular, IMT policies have been promoted with support from multilateral development banks. In this paper we argue that merely turning over management of water resources to farmer's groups, for instance may not necessarily ensure efficiency. This is particularly because groups may be constrained by the lack of monetary resources at their disposal. In this context we argue that well endowed farmer's within rural communities could potentially play an important role in fostering public-private partnerships in water management.

Our analysis of public-private partnerships in the context of watershed management in Haryana underscores the importance of public sector initiative in natural resources management. We pointed out how the HFD with support of the Ford Foundation and CSWCRTI initiated a dialogue with community groups in the watershed area of Sukhna Lake. The dialogue was to result in the Sukhomajiri model of participatory watershed management that resulted in positive socio-economic and environmental benefits for all stakeholders- the HFD as well as farmers. We also highlighted the important role that the HFD played in institutionalizing a system of water rights and organizational rules for management of water from earthen dams.

Public-private partnerships by their very nature are dynamic. We demonstrated how access to irrigation in the context of skewed land distribution in Bharauli was leading to increasing group heterogeneity when compared to Thadion. Further, we highlighted the fact that changes in State import policies and fiscal regime affected gross profits of HRMS'. Declining profits of HRMS' were to have adverse implications for investment of HRMS in repair of earthen dams. This example highlighted the importance of inter-sectoral policy coordination as an instrument of sustaining public-private partnerships. Further, we also pointed out that lack of transparent and accountable procedures of the HFD resulted in poor success in dam construction. A large number of dams silted up and were destroyed due to poor technical design and faults in construction.

Our analysis of collective action within peasant groups revealed that contractor based water provisioning tended to be relatively more successful in ensuring compliance with water management rules. Interestingly, we observed that contractor based water provisioning tended to emerge in groups that were relatively more heterogeneous in distribution of household endowments. However, we

pointed out for contractors to actually engage in water provisioning there must be sufficient interest among other water using households in use of water. This we pointed out was a function of factors like agricultural terms of trade for particular crops like wheat. Further, we pointed out that water contractors emerged when private alternatives like tubewells did not exist and when agriculture provided a significant source of household income.

This paper has also demonstrated that apart from provisioning, contractors play an important role in ensuring compliance with water management rules. Ensuring compliance with water management rules is facilitated by presence of social norms within community groups. Historically defined power and social exchange relations may go a long way in facilitating compliance with water management rules. However, we pointed out that rule compliance on its own need not be a measure of success. More important in judging success of contractor based provisioning is its impact on rural livelihoods. In this context we pointed out that contractor based water provisioning in Bhaurali was relatively more efficient and ensured equity in resource use. We noted also that favourable land use changes had taken place as a result of operation of robust water management rules in Bharuali. However, the outcomes for women of robust water management institutions were disappointing. We pointed out in this context that women had to shoulder more tasks because of improvement in agricultural productivity arising from improved access to irrigation from earthen dams. But despite their increased workload women remained outside the pale of decision making in HRMS.

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