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Understanding Interactions in Local Governance of Community Based Natural Resources: Implications for Policy Intervention

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ABSTRACT

Collective action and institutions govern the management of Community Based Water Storage structures (CBWS) and thereby, policy intervention in resolving the issues of management. Institutional factors not only have a direct bearing on the functioning of CBWS but also often interact with physical and technical factors to influence their sustainability. The present study has examined these issues with a framework where CBWS sustainability is taken as a function of two components, financial condition and functionality of resource to draw policy implications in Indian context. The study brought out factors such as Panchayati Raj Institution (PRI) functionality, perception about change in water collection time and number of households served by the water resource significantly affecting financial viability of CBWS. The resource functionality was found to be significantly affected by factors like accessibility and use restriction with respect to the CBWS. PRI functionality was observed to be poor for want of proper representation of weaker section of rural poor in general and women in particular. These primarily are most affected by water resource management. PRI functionality in respect of community resource management, therefore, needs to be genuinely addressed. Technical factors such as catchment land use and storage to catchment ratio, which affected operational status of the source, are critical while designing location and size of the water resource such as pond.

Key words: Common property resources, Community based water storage structures, Local governance

INTRODUCTION

The institutional arrangements for water management are diverse, varying in their structure, scope and style. Common Property Resources (CPRs) entails a set of rules to govern access to, allocation of, and control over water (Edwards and Steins, 1998). In CPR regimes, some form of organized collective action between the individuals constituting the user community is contemplated; since a collective effort is required to manage access to the CPR and allocation of the benefits it produces (Taylor, 1998). Failures under public and private management, however, have lead to community participation as an alternative mode to govern the resource (Agrawal, 2003). In fact, participatory approaches to natural resource management are increasingly being advocated, world over, to promote local stakeholders' involvement in effective management of resources (Kiss, 1990). The literature on Common Property Resource management has also taken cognizance of this fact (Wade, 1988; Ostrom, 1990).

Interaction of various factors and, hence, design of policy instruments in respect of community based water storage structures (CBWS), however, is quite complex. This is more so because of poor understanding of the interaction and lack of sufficient empirical insight into identifying factors affecting the interplay of local governance forces (Heltberg, 2001). In fact, ineffective institutions and their overlapping mandates are seen as bottlenecks for sustainable natural resources use, with institutional reforms and increased institutional coordination being promoted as a solution (Mitchell, 1990; Bandaragoda, 2006; Rydin and Falleth, 2006).

Policy intervention in the management of community based water storage structures depends on the factors governing collective action and institutions. Studies have shown that institutional factors not only have a direct bearing on the functioning of tank irrigation but also often interact with physical and technical factors to influence tank

sustainability (Janakaranjan, 1993). In the present study, sustainability of CBWS is hypothesized to be a function of two components, financial viability and CBWS functionality. Examination of these factors within the frame work of collective action will develop an understanding of the interplay of various physical, technical and social factors, which in turn, will help strengthen, preserve and enhance the collective action through policy intervention on financial and functional parameters of CBWS. Since local institutions are shaped by collective action, these policy interventions will strengthen the institutions for management of community based water storage structures.

METHODOLOGY

The study was conducted in Dhanduka taluka of Ahmedabad district in Gujarat. The selection of study area was based on high number of CBWS structures. Total geographical area of the district is about 7.7 lakhs hectares, out of which 65.3 per cent of the geographical is under cultivation. About 32 per cent of the cultivated land is irrigated, half of which is irrigated by tube wells.

The study draws from extensive, primary surveys and focus group discussions held at the household levels. Structured questionnaires were prepared and pre-tested for socio-economic data elicitation. Apart from the socio-economic surveys, engineering surveys were also envisaged as an integral component of the study. The hydro geological data gathered through field trips (and supplemented by secondary information) were useful in establishing the potential sustainability of the community water storage structure. The entire survey exercise involved finalizing the sample sites and the systems, collecting basic village level information including sources of water, household survey focusing on socio-economic characteristics and pattern of water use, focus group discussions to obtain villagers views and perceptions about specific system related issues as well as surveys for geo hydrological and structural features of the structures. Following discussions with different stakeholders, including concerned government and NGO officials, community talavs (pond) were identified for study. Twenty two ponds were randomly selected for extensive study. The major emphasis in the selection of households was placed on the fact of their using the selected CBWS. Depending on the number of households using the CBWS in a given village, the proportion of sample households selected from each village varied. Factors such as topography, distance between the CBWS and the houses also influenced the sample size. An attempt was made to select beneficiaries staying at varying distances from structures. Ninety beneficiaries and two members of Panchayati Raj Institutions managing each ponds were identified for data collection. Elaborate survey instruments were used for the purpose of collection of both quantitative and qualitative data from the field as well as PRI records. Village Level Questionnaire was used to collect information on area, broad socio-economic characteristics of village population, access to ponds. In addition, information was elicited on existence of traditional and modern sources of water supply, crops grown, irrigation sources, and other relevant water related issues. Household Level Questionnaire was used to elicit information on household level information on demographic profile of the family, social status, occupation, sources of income, housing details, land holding and also variety of information on domestic water collection and use. Hydrological and Engineering survey Questionnaire was used to collect information on location, design, hydro-climatic data and catchment characteristics of the structures. The triangulation approach was followed to cross-examine responses to ensure similar result to a question with different methods (Denzin, 1978). This approach helped ascertain reliability of data collected even with low data base used in this study.

Theoretical framework used for study

Sustainability of a community based water storage structure depends on its ability to reliably deliver services to the target community, through financial and physical maintenance support from the community, and with as little intervention from external sources as possible. This was hypothesized

to be a factor of two components, viz., financial viability of the structures and functionality of the structure. The former would sustain the structure through regular maintenance, thereby, improving efficiency of the water delivery system, while the latter would ensure reliable service in perpetuity. Financial viability was examined through a financial viability index (FVI). This was computed in terms of charges collected for domestic water use, charges collected for livestock water use, frequency of collection, utilization of collected saving (pond maintenance), mode of water charge collection. Factors that predict revenue generation for use of CBWS included household characteristics such as perception about change in water collection time, Panchayati Raj Institutions (PRI) functionality and number of household drawing water from resource and population below poverty line. CBWS functionality was measured in terms of reliability (number of days the structure has water in a year). Factors affecting the functionality included the physical and technical factor associated with the structure, the quality of pond management, and the number of residents using the pond. Panchayati Raj Institutions functionality in water resource management was measured in terms of meeting and participation in decision making, amenability / capability to resolve water management issues, social representation in the PRI executive body (resolving social conflict) and benefits perceived from community water source. The data collected pertained to the years 2009-10 and 2010-11. Logit and regression models were fitted for establishing various relationships.

Pond operational functionality model used dependent variable as operational sustainability of pond (water stored during the year, a Dichotomous variable, more than six month = 1, otherwise 0) and the independent variables catchment Land use (Non-arable land = 1, Arable land = 0), surplus arrangement (Separate inlet & outlet = 1, otherwise=0), storage to catchment ratio (More than 0.1 = 1, otherwise = 0) and pond seepage behavior (No seepage = 1, otherwise = 0). It was hypothesized that non-arable land, which in case of these structures was mostly open land with little scrubs here and there, would produce more run off into the ponds and would positively sustain the operationality of the pond. Pond with proper inlet and outlet systems were observed to retain water for longer time. Similarly, if rainfall runoff is to be used, and stored in a reservoir to supply the ponds, a ratio of 10 ha of catchment area to 1 ha of pond is required if the catchment area is pasture; a slightly higher ratio is needed for woodland, and less for land under cultivation (Kovari, 1984). It was, therefore, hypothesized that storage to catchment ratio of more than one would suitably keep the pond operational. Similarly, a pond with no seepage would retain water for longer time.

Pond functionality perception model used dependent variable as CBWS status (Perception of beneficiaries about present status, good = 1, otherwise 0) and the independent variables viz., distance from village (Less than one kilometer = 1, otherwise = 0), accessibility to resource (Unrestricted to all = 1, otherwise=0), use restriction (All uses (domestic, animal, irrigation) = 1, otherwise = 0) location (With village premises = 1, otherwise = 0). Pond functionality perception affects beneficiaries' involvement with the management issues of the community owned water storage structures. A positive perception induces to participate in resource management. It was hypothesized that resource with less distance, un-restricted use and within village premises would receive better involvement of the beneficiaries.

Financial viability model used dependent variable, financial viability Index with the independent variables such as PRI functionality index (Panchayati Raj Institutions functionality in water resource management), perception about change in water collection time since constructing the CBWS (Positive change = 1, no change = 0), number of household dependent on resource (Nos.)

X_4 = Number of BPL household (Nos.), total benefits accrued from the pond (Rs.), private water source owned by the members of PRI body (Yes =1, No=0) and perception about change in water quality (Yes = 1, No = 0). An index of CBWS's financial viability was computed from factors viz., fee

collected for domestic, animal and irrigation uses, frequency of collection and mode of utilization. A community structure was hypothesized to be financially viable if more fee is collected on regular basis and is utilized with unanimous decisions of the members of the PRI. It was hypothesized that a functional PRI would positively contribute to the finances for the maintenance and up keep of the CBWS. PRI functionality was computed from factors, viz., meeting and participation in decision making, amenability to resolve water management issues, social and gender representation in PRI decision making body and benefits perceived by members and non-members of the body assigning equal weightage to each of them. A positive perception about change brought about by the CBWS would induce the beneficiaries to contribute to the finances. In the same manner, while higher number of beneficiary is positively related to financial viability of the community structure, the effect of a higher number of beneficiary household below poverty line would be contrary to that. Further, it was hypothesized with higher benefits accruing a community structure fee charged for water use would be higher as compared to those structures with lower benefits. A PRI with members owing their private water resources would not be much concerned about its maintenance and thereby, affecting the finances collected for the community structure. The perception about change in water quality available from the community structure would, similarly, play a role in beneficiaries' decision about contribution to finances for that structure.

RESULT AND DISCUSSION

Characteristics of community based water storage structures

The community based water storage structures selected for study were distributed over different villages the geographical size varying from 50 ha to 7500 ha (Table 1). The share of agricultural land in total geographical area was quite high (varying between 70 to 90%) but irrigated land was very small. The water storage structures largely met the domestic and animal water requirements as most of the cultivation was rainfed, though in some villages these also served the supplementary irrigation requirements.

Table 1

Village profile of selected community based water storage structures

Village name	Geographical area (ha)	Agricultural land(ha)	Irrigated land (ha)
Rayka	1569	1382	-
Khadol	1204	1200	-
Khasta	1600	1584	16
Haripura	880	880	40
Fatepur	1120	1104	-
Jaska	2400	1600	33
Vagad	799	763	480
Pachcham	4238	3325	-
Gunjar	1000	800	280
Pipli	7500	6667	167
Bahadi	50	50	-
Tagadi	583	583	-
Zinkhar	1000	917	167

Though each villager was eligible to take water from village pond for any domestic use as per the requirement, the supply was limited by the pond's storage capacity and the quantity of water available to fill the tank depending upon catchment characteristics (Figures 1& 2).

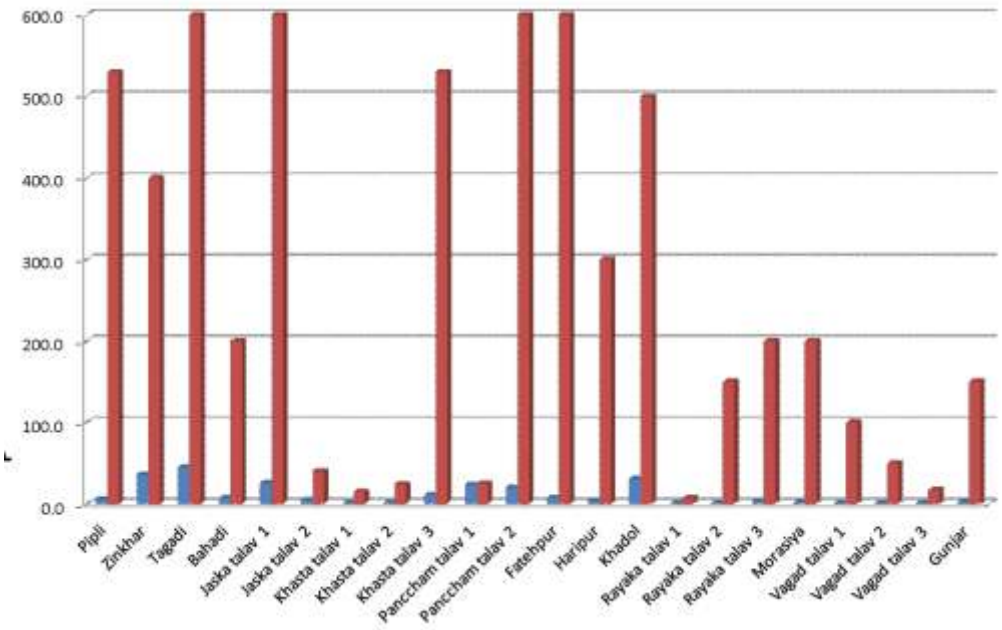

Figure 1: Pond surface area and catchment area

Some ponds retained water for the major part of the year during normal rainfall, while others became dry in five to six months. Similarly some ponds (60% of the sample surveyed) were filled more than once in a year while others were filled only once in a year. Some ponds 22 per cent also overflew during the season. Siltation and seepage problems 41 per cent had reduced the storage capacity of many ponds. The surplus arrangement (inlet and outlets) in the pond also affected the amount of water stored and thus, its availability to the beneficiaries. Though majority of the ponds 86 per cent had proper inlet and outlets, the remaining either had breached or were in defective condition. Absence of maintenance had reduced the water storage capacity of the ponds.

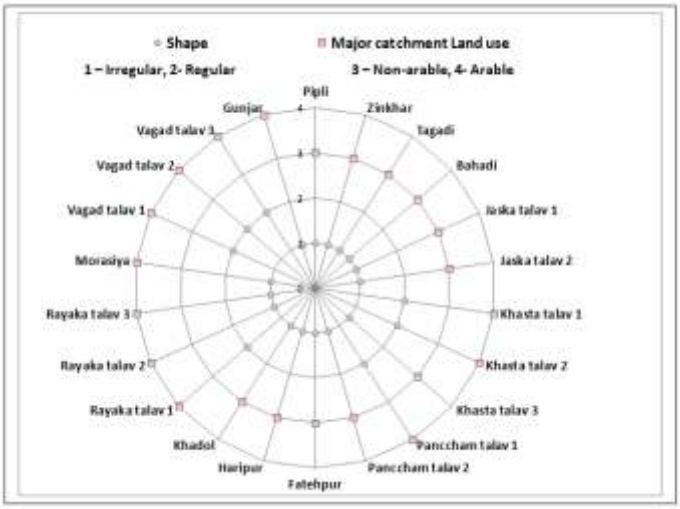

Figure 2: Pond characteristics

Sociology of community resource management

Only few ponds (less than 10% of the ponds) were managed by state department. The remaining ponds were managed by Panchayati Raj Institution (PRI), an elected body for local management. In majority of the cases (55% PRIs surveyed), however, the executive body did not hold meetings to discuss about water related issues. Women, who mostly bear the burden of arranging water for domestic and animal use, were not well represented in the panchayat executive body. Among the members of executive body, women were members in only few cases (45% PRIs). In these bodies, women as sarpanch, head of the executive body, was observed in only a few cases (15% PRIs). The other members did not bother to take up the issues related to water from pond. Similarly, in majority of the cases executive body members largely had own private sources. For drinking water, government source like Narmada canal pipe lines were laid in most of the villages. In a few villages, poorer farmers still depended on the village pond even for domestic uses.

Logit and regression analysis results

The general description of the variables used in the study is given in Table 2. Based on the technical and social attributes the variables for which consistent data could be procured from beneficiaries were used for analysis and the results of logit analysis are given in Table 3. Catchment land use was same in case of all the community structures and the model fitted with this variable turned out to be poor. The relationship of factors like surplus arrangement in the pond, storage to catchment ratio and pond seepage behaviour with operational status was examined and the model slightly improved. Hence, these variables were retained for final analysis. Storage to catchment ratio turned out to be significantly affecting operation of ponds (significance level 11%). The other two factors turned out to be insignificant. The perception about current status of community based natural resource (pond) was found to be affected by factors like accessibility to the resource, distance of community water resource from household and use restriction with respect to the resource. These factors significantly affected the current status of the resource (7%, 10% and 2% level of significance, respectively). Examination of relationship of financial viability index with explanatory variables revealed that PRI functionality, gross benefit from pond and perception about water quality change were significantly related with dependent variable at 8%, 20% and 20% significance level, respectively. Perception about change in water collection time was closely related with location of the source from village. Resources closer to village periphery changed in water collection time and affected financial resource of the PRI positively.

Table 2
Model variables used in the study

Variable	Description	Mean	Standard deviation	Observations
Pond operational functionality model variables				
Dependent variable				
Operational sustainability Index	Water stored for more than six month	0.77	0.43	22
Explanatory variable				
Catchment Land use	Arable and non-arable land use	0.50	0.51	22
Surplus arrangement	Inlet and outlet system of the pond	0.14	0.35	22
Storage to catchment ratio	Ratio of storage area to catchment area	0.45	0.50	22
Pond seepage behavior	Presence or absence of seepage from pond	0.72	0.45	22

Pond functionality status model variable				
Dependent variable				
CBWS status	Per caption about present status of pond	0.67	0.47	22
Explanatory variable				
Distance from village	Distance of pond from village	0.44	0.50	22
Accessibility	Resource accessibility to users	0.23	0.49	22
Use restriction	Restriction in the use of water from pond	0.52	0.50	22
Location	Existence within village or outside the village	0.27	0.45	22
Financial viability model variables				
Dependent variable				
Financial viability Index	Revenue generation through collection of water charges	1.11	0.17	22
Explanatory variable				
PRI functionality index	Panchayati Raj Institutions functionality in water resource management	1.09	0.32	22
Collection time change perception	Perception about change in water collection time from water source	0.70	0.47	22
Household dependent on resource	No. of household dependent on water resource	463	575	22
BPL household	No. of household below poverty line dependent on resource	133	146	22
Gross benefits	Total benefits accrued from the pond	500498	6.57	22
Private water source	Private water source owned by the members of PRI body	0.70	0.47	22
Water quality change	Perception about change in water quality	0.30	0.47	22

The accessibility to the resource and use restriction with respect to the resource affected perception about present status of community based natural resources. Similarly, distance of resource also affected its current status in terms of maintenance. The ponds being located in the outskirt of village, only a few were observed to have easy access. Storage to catchment ratio affected operationality of the community based water storage structures. Similarly, catchment with arable land use was observed to have water storage for less than 6 months. In those structures with non-arable catchment use, storage was much higher than that. These catchment were devoid of vegetation except for some scrubs. PRI functionality, perception about change in water collection time and number of households served by the water resource affected financial viability of the ponds. Perception about change in water collection time was closely related with location of the source from village. Resources closer to village periphery did perceive change in water collection time, quality and regularly paid for water charges. PRI were observed to have

Table 3
Logit model result for community based water storage structures

Sl. No.	Variable	Coefficient	Significance level
	Dependent variable : Operational sustainability of pond		
1	Surplus arrangement	-0.44	*
2	Storage to catchment ratio	2.08	11%
3	Pond seepage behaviour	-0.97	*
	Number of observations	22	
	-2 Log likelihood	9.85	
	Pseudo R-Sq. (Cox & Snell R –Sq)	0.16	
	Pseudo R-Sq. (nagelkerke R –Sq)	0.24	
	Dependent variable : Pond status perception		
1	Distance from village	-2.20	10%
2	Accessibility	2.29	7%
3	Use restrictions	-3.13	2%
	Number of observations	22	
	-2 Log likelihood	47.60	
	Pseudo R-Sq. (Cox & Snell R –Sq)	0.24	
	Pseudo R-Sq. (nagelkerke R –Sq)	0.34	
	Dependent variable : Financial viability		
1	PRI functionality index	6.63	8%
2	Collection time change perception	23.5	*
3	Household dependent on resource	0.001	*
4	BPL household	0.007	*
5	Gross benefit from pond	0.00002	20%
6	Private water source	-0.70	*
7	Water quality change	-2.58	20%
	Number of observations	20	
	-2 Log likelihood	19.82	
	Pseudo R-Sq. (Cox & Snell R –Sq)	0.51	
	Pseudo R-Sq. (nagelkerke R –Sq)	0.63	

* Insignificant

poor gender sensitivity. The number of members in the executive body of panchayat vary from 7 to 10, women being member of the body in only few cases (45%). Similarly, women as Sarpanch, head of the body, was observed in only a few cases (15%), and these bodies incidentally held executive body meeting at least once in a year. In other cases, the other executive body did not hold meetings (55%). Except for a couple of cases (10%), in other bodies the members were medium and large farmers, and having own private source of water such as tube wells. PRI functionality can, therefore, be strengthened by motivating and sensitizing PRI members to water governance issues by enhancing representation of women, who manage water uses at household level and weaker sections of farmers who did not have private water source and, primarily depended on these community resource. Both these groups were poorly represented in most of the panchayat body. The weak sensitivity of PRI towards these community based natural resources can also be partly explained in terms of network of Narmada Canal and pipeline to villages to meet largely domestic uses. Only animal uses like bathing, maintaining hygiene and in some villages drinking.

CONCLUSION

The active participation and local governance of community resources for more efficient, effective and equi Table development need promotion of equi Table participation of women and weaker section of rural community. The essential assumption here is that women and poor farmer represent a marginalized group in society whose lives are entrapped in an institutional framework characterized by gross inequalities of formal power and authority in the public sphere and denied equal access to and control over resources. The new institutional structures introduced under gender-equity based participatory models of local governance seek to balance out the inequalities by offering a platform or space where women can come together alongside men and be empowered to express their opinions as well as contribute effectively in decision-making processes. With respect to the water sector in general, women's participation seeks to correct imbalances perceived in terms of access to water resources and benefits from water development projects as well as exercise of decision-making powers with respect to the management of these resources (UNDP, 2003 and GWA, 2003). Similarly, technical design and scientific planning in creating water resources would go a long way in not only serving the rural community but also efficiently as people's perception about resource utility was positively higher in case of ponds with right technical parameters. Storage to catchment ratio of more than 0.1 or more has been suggested appropriate (Kovari, 1984) for pond utility such as aquaculture. Such ponds with water for sufficiently longer period of time would also serve other purposes of rural

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