

Article

Gender Perspective in Water Management: The Involvement of Women in Participatory Water Institutions of Eastern India

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Abstract: The paper examines the extent, nature, and factors affecting women's involvement in participatory irrigation institutions of eastern India. Effective participatory water institutions are urgently needed to improve water management in eastern India, and a significant aspect of this is the involvement of women. There is inadequate representation, participation, and involvement of women in most water institutions. From the participatory and social point of view, this is a significant concern. The relevant data are obtained from the states of Assam and Bihar through a focused survey administered to 109 women in 30 water institutions, and a larger farmer-institutional survey covering 510 households and 51 water institutions. The research examines the extent and nature of the involvement of women in these institutions, as well as in farm decision-making, and the factors that prevent or foster their participation. Additionally, it examines the gender congruence in views regarding water institution activities and their performance, and the perceived benefits of formal involvement of women. The results show that their inclusion is very low (except required inclusion in Bihar), and the concerns of women are usually not being taken into account. Women are involved in farming and water management decisions jointly with men but not independently. Findings indicate that the views of women and men differ on many aspects, and so their inclusion is important. Responses indicate that if women participate formally in water user associations, it would enhance their social and economic standing, achieve greater gender balance, expand their awareness of water management, and contribute to better decision-making in the water institutions.

Keywords: water; women; gender; participatory irrigation institutions; India

1. Introduction

Women play a significant role worldwide in the production of food. It is reported that more than half of the food produced in the developing world can be accounted for by women [1] and that they constitute a majority of the workforce in agriculture [2]. Women in most South Asian economies are actively involved in managing farm households, farm decision-making, and working as labourers in agriculture. They also participate substantially in the construction and maintenance of irrigation systems [3]. According to an estimate by the United Nations Development Programme (UNDP), US\$ 11 trillion worth of women contribution remains invisible [4]. The study, based on 31 countries, suggests that women work longer than men, and half of their work is on economic activities. However, most of the work is unpaid, and their contribution continues to be largely overlooked in agricultural policies and programs. Women should play a greater role in managing water since they have substantial involvement and stake in both domestic and agricultural water use. However, women perspectives and roles in water management are rarely taken into consideration in framing policies and programs [5].

Given their major role in agriculture, the absence of their participation limits the best realization of the benefits from water management. This paper examines the involvement of women in participatory water institutions in eastern India, sampling from two states—Assam and Bihar. The regions are characterized by relatively abundant water resources compared to other parts of the country. However, the region lags behind in development as indicated by low per capita incomes and high incidence of poverty. Efficient management of resources such as water is urgently required and can contribute significantly to overall development in the region. This calls for more effective participatory water institutions and better social rationality where greater involvement of women can play a significant role in achieving better performance [6]. The study seeks to examine the current status and nature of the involvement of women in participatory water institutions of eastern India and the associated factors and patterns from the gender perspective.

1.1. Women in Participatory Water Management

Many countries across the world are implementing the transfer of irrigation management from the government to the farmers with an expectation that it will improve the impact and sustainability of the irrigation systems [7]. However, self-governance through management by farmers needs good institutional design, in which participation and empowerment requires significant emphasis [8]. Enhancing farmer participation through participatory processes, inclusive management choices, and regular meetings are crucial for deepening the reform process in natural resource management [9].

When natural resources such as water get managed by communities, membership and participation in the local institutions become essential in determining the rights over the resources. Women are often found lagging in participation in these institutions. The participation of women in water user associations (WUAs) in South Asian countries such as India, Pakistan, Sri Lanka, and Nepal is often minimal despite the substantial involvement of women in agricultural production and decision-making. If the traditional rather than democratic institutions control natural resources, they tend to carry-on the power structure existing in the society where women are often ignored [10].

Decisions related to land-use and crops are often taken jointly by men and women, but irrigation water-related decisions seem to be mainly taken by men. At the community level, irrigation-related decisions are made in forums where women often have little representation. Even if women are members of such groups, they are typically from higher castes or wealthier households, and hence, the poorer and lower caste women are not represented [11]. Agricultural policies in most developing countries continue to be dominated by the impression that “farmers are men”, and the role of women is restricted to being housewives, homemakers, and helpers [12]. Irrigation is perceived to be the domain of men, and they are considered to be the primary participants of programs and policies by government and development agencies [11]. Even when women play a major role on the farm, they are kept away from the development programs. Water Acts in several countries such as Egypt [13], Zimbabwe [14], and China [3] do not address the strategic gender needs, and they largely ignore women.

1.2. Women and National Water Policies

The National Water Policies of India—1987, 2002, and 2012—do not give significant importance to the concerns related to gender [15]. The National Water Policy of 1987 [16] mentions the need for equity and social justice in water distribution and allocation. However, it does not mention women as a special group and covers only the economically disadvantaged sections (smaller farmers) and socially disadvantaged classes such as Scheduled Castes and Scheduled Tribes. The National Water Policy of 2002 [17] mentions women only once while emphasizing appropriate roles for them in designing participatory water institutions. The National Water Policy of 2012 [18] goes a step further to consider the unique needs and aspirations of women along with Scheduled Castes (SCs), Scheduled Tribes (STs), and other weaker sections. Though the two most recent water policies mention women in their documents, all the three water policies do not look at the design from a gender perspective, and none of them gives concrete guidelines or recommendations to make the policies more gender neutral.

However, the National Policy for Women 2016 [19] acknowledges the role played by women in agriculture and emphasizes legal provisions to ensure women's rights to immovable property such as land. This recognition is expected to address the issues arising out of inadequate legal rights of land to women. The policy also recognizes that non-availability of water puts additional burden on women; hence, it recommends that the design of programs and projects must be done keeping in view women as significant water users. It also suggests the need for involvement and training of women in initiatives on conservation and utilization of water. Unlike the Water Policy, the National Policy for Women pitches for a gender perspective in water resource management strategies. This policy is expected to ensure better participation of women in various stages of water management such as planning, delivery, and maintenance of projects.

Typically, the requirements and preferences of women concerning economic activities are not given much attention during the formulation of the policies. Even though the needs of men and women for water are largely the same, their opinions and preferences in decisions such as the timing of irrigation might differ [10]. It is argued that the differences in opinions and preferences might lead to different decisions, and these differences would be more pronounced in a female-headed household. The exclusion from decision-making related to water and irrigation can affect the women in terms of their health, livelihood, and well-being in general [20,21]. As a result, to ensure greater equity in water access for work and incomes, it is essential to have a focus on gender while framing policies [3].

1.3. Determinants of Women Participation

The current low level of women participation in water management and Water User Associations (WUAs) in most developing countries has been attributed to several factors. The gender gap in property rights is one of the most important reasons for this [22]. Water rights are typically allocated based on formal land rights, and the women are excluded because of the lack of rights over the land [3]. In most of the irrigation management systems or WUAs, rights are given to "households"—which are headed by men. Therefore, men represent the households while women play mainly a supporting role. It is assumed and accepted that the public and economic spheres of life are managed by men, and only personal and domestic matters may be managed by women [23]. As a result, most of the village groups and committees are dominated by men. Even if women are elected to the committees, they are usually controlled by men of their families or restricted to issues related directly to women such as birth control and women's rights. As a result, women of the households usually remain invisible in water management [3]. It has been a general understanding that only farmers, generally assumed to be men, are interested in irrigation [24–26]. The non-inclusion of gender as an aspect in the principles and focus of managing water continues to keep women away from water management [14].

Community and organizational rules, formal as well as informal, often exclude women from institutions involved in natural resource management [27]. Institutional barriers such as gender division in the hierarchy in water institutions with women doing administrative, non-decision making, non-extension jobs also seem to deter women's participation. It is also indicated that women participation could lead to more claims for property rights over the limited resources, especially when no new resources are being created. It is seen that women's participation is usually more successful in initiatives in which coming together creates enhanced resource rights or availability [13].

Women involvement in water management is also often considered time-consuming for women, which time could otherwise be used in household activity. A few studies report that the time and location of the meetings are unsuitable for women to participate [10,25]. Women are also perceived to be not capable of making a meaningful contribution because they are either illiterate, not aware, busy [24], or lack communication/negotiating skills [26].

The social norms confining women to their traditional roles, and immediate locations, are also responsible for constraining women from participating actively [28]. Lower participation of women is also attributed to conventional power relations [29], politics, gender dynamics, and limited roles within the family, society [30], and geography [31]. Older women, widows, and single women

may be more active compared to young and married women as they have relatively less household responsibilities [32,33]. Women also feel that it is inappropriate to talk in public [3,34]. Low involvement of women in water management is often driven by less familiarity in speaking at public spaces, low level of education, lack of recognized authority, less scope for participation, and disregard of their opinions. [27]. It is also difficult to reach out to women, and the communication gap between male and female members of the household makes their inclusion even harder [13].

1.4. Need to Understand Women Participation and Its Impact

The lack of wider participation in management of common property resources leads to free riding, rent-seeking, and corruption, which affect women [35]. Such behaviour has been reported in Nepal [26], where it was found difficult to enforce rules regarding women's participation or penalize for non-compliance. The lack of participation of women further hampers social equity and initiatives for empowering them [27]. Increasing women involvement through policies and reforms in water management would bring benefits to individuals, society, and the conservation of resources. Since women are primary users of water, improving women's participation in water management can result in better natural resource management [10,14]. If women participate more formally, it can strengthen the WUA through better compliance and maintenance and improve their rights and bargaining power as water users [10,36].

Unequal gender participation has been observed even in urban WUAs because of issues of representation, power relations, and culture [37,38]. It was suggested that equal participation cannot be ensured just by community-based governance, and systematic efforts are required to include the interests and needs of women. Important gender concerns can be addressed only by having a clear mandate from a social and gender equity perspective, especially for small-scale farmers [39]. As more men migrate to cities, women would have an increasingly important role to play in agriculture. Thus, understanding and action on the gender aspect is necessary to enhance the general welfare of communities as well as the sustainable and efficient use of natural resources such as water [22,40,41].

Most of the existing studies on the gender aspect in natural resource management or water institutions are qualitative in nature [1,3,10,11,22,39]. Very few studies, for example, one in Malawi [37] and another in China [42], have quantified the level of participation of women in WUAs. Besides, most studies have not looked at the assessment of WUA performance from the viewpoint of women and the possible benefits of women participation in WUAs. The study contributes findings on these aspects using data from water institutions in two states of eastern India. It seeks to better understand women's role in farm decision-making, WUA committees, and water management. It also looks at institutional facilitation, the impact of WUA as perceived by women, and the potential benefits of enhanced women participation in water institutions.

2. Background

The overall research focuses on eastern India, which lags behind in development as indicated by low per capita incomes and high incidence of poverty. However, the region is rich in natural resources including relatively abundant water from Himalayan rivers, which if effectively managed could support a strong agriculture sector and good economic growth. However, it suffers from substantial institutional deficiencies in water management, and in light of this, a research project with several components was undertaken to understand the performance of participatory water institutions and how it can be improved. Bihar and Assam have been implementing participatory irrigation management (PIM) since the 1990s. The PIM Acts of Bihar and Assam are similar, and both states mandate an institutional structure for different functions and the levels of devolution. The Assam Irrigation Water Users Act, 2004, was enacted to impart farmers' right over irrigation systems and to increase collective action for the management of these systems. The Bihar Irrigation, Flood Management and Drainage Rules of 2003 were framed under the Bihar Irrigation Act 1997 and included components beyond PIM. The Assam Act focuses on PIM alone, whereas the Bihar Act goes beyond

PIM to irrigation management. Under the Acts the WUA structure includes central level committees (CLCs) and village level committees (VLCs). The study followed a conceptual framework developed from new institutional economics and management governance theory fundamentals [35,43–47]. Six in-depth case studies of water user associations (WUAs-CLCs) in the eastern India states of Assam and Bihar were first conducted.

3. Data and Methodology

Based on the above-mentioned case studies and the conceptual framework, detailed survey instruments were designed to collect responses from a sample of respondents. The types of survey instruments included a farmer-institutional survey instrument and a special gender/women's survey instrument. The water user associations (WUAs-CLCs) were selected to cover a diversity of existing irrigation systems and geographic locations in each state. In Assam, the WUAs selected were Maloibari for river lift irrigation, Jamuna for canal irrigation, and Khairani for river diversion. In geographic diversity, Maloibari and Jamuna are south of the Brahmaputra River (which divides the state) and Khairani, north of the Brahmaputra. In the case of Bihar, almost all are canal systems; therefore, the choice was made in terms of upstream and downstream in a canal system, and north (more flood prone) and south of the Ganges river, which divides the state. The water user associations selected included R P Channel 3, which is upstream in the Sone canal system, and Paliganj, which is downstream in the same system—both are south of Ganges, and Jetwalia, which is north of the Ganges and downstream on the Gandak canal system. The households for the farmer-institutional survey were selected randomly from among the sample frame of the beneficiaries of selected WUAs, with an effort to cover various farm household sizes, and the response rate was about 95%. The farmer-institutional survey covered 510 households through face-to-face interviews: 252 in Assam and 258 in Bihar across 51 WUA VLCs. Accompanying this, the Gender Survey covered a subset: a total of 109 women in face-to-face interviews with a response rate of about 90%, 52 women in Assam, and 57 women in Bihar, from the same set of households, and across 30 WUA VLCs. Figure 1 shows the study areas in which the surveys were conducted in eastern India.

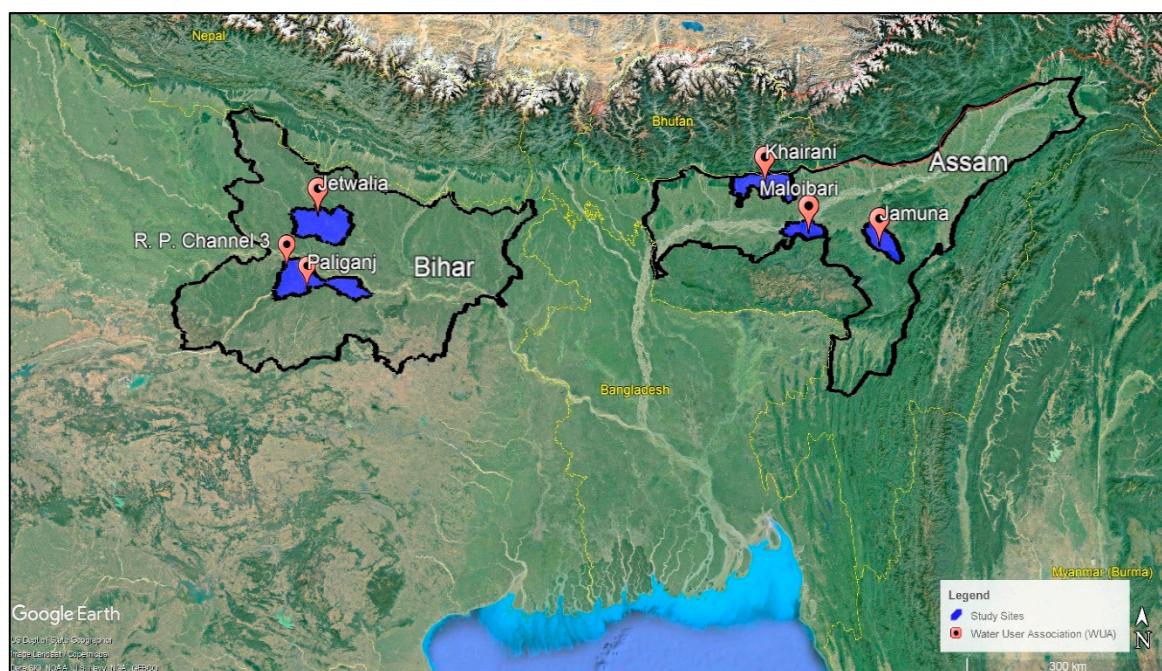


Figure 1. Location of study areas in eastern India. Source: Google Earth, 2019.

The gender survey was conducted by women assistants in independent face-to-face interviews with women respondents. In most cases (73%) only the respondent or only women were present. The interviews sought various responses including on the roles and involvement of women in water management and water institution decisions, and their perceptions regarding the features and performance of water user associations (WUAs). They were also asked about their role in farm household decision-making, the level and nature of involvement in WUA activities, the factors affecting this, the impact of WUAs on different groups of people, and the perceived benefits if women participate more actively in the WUAs. Many of the responses were recorded on standard five-point Likert scale as follows: strongly agree (5), agree (4), partially agree/disagree (3), disagree (2), and strongly disagree (1). (Note that in the Likert scale, for the intermediate response, "Neither agree nor disagree" has been widely used [48]. "Partially agree/disagree" has also been used effectively in the context of water management [45,46].) With respect to recording performance, the five-point Likert scale used included excellent (5), good (4), satisfactory (3), poor (2), and very poor (1). Correlations, where used, were examined through Pearson correlation coefficients. The results are all based only on the women/gender survey, except where explicitly stated.

4. Results and Discussion

4.1. Sample Profile

Some features of the sample of respondents in the women survey are shown in Table 1. The average age was 41.2 years, education was 6.0 years, and the family landholding was 1.4 hectares (ha). The average landholding of the Assam sample (1.1 ha) was lower than that in Bihar (1.6 ha). The sample included women of both upper and lower social groups: in Assam 86.5% belonged to the lower social groups, whereas in Bihar this was 29.8%. In terms of land ownership, only 11.9% of women owned land: 1.9% in Assam and 23.1% in Bihar. Thus, some women owned land but the percentage was small, and the percentage was higher in Bihar.

Table 1. Sample profile.

	All (109)	Assam (52)	Bihar (57)
Average Age (years)	41.2	37.3	44.8
Average Education (years)	6.0	5.8	6.1
Average Landholding (ha)	1.4	1.1	1.6
Social Group-Percent			
Upper	43.1	13.5	70.2
Lower	56.9	86.5	29.8
Women Landholders-Percent	11.9	1.9	23.1

4.2. Involvement of Women in Farm Household Decision-Making

Regarding the involvement in farm household decision-making including water management, and whether the decisions were taken by men, women, or jointly, the findings are given in Table 2. They indicate that most decisions were made by men only, but the decisions regarding bringing more land under irrigation, crops to grow under irrigation, when to irrigate, payment of irrigation fees, and the spending of additional income were frequently taken jointly. Decision-making by women alone was rare. How actively women were involved was captured on a Likert scale ranging from 5 to 1, as described in the methodology. Findings indicated that women were not actively involved in most of the decisions, but a little more active involvement was reported on crops to grow under irrigation, payment of irrigation fees, and spending the additional income generated. A comparison across states shows that joint decision-making was more frequent in Assam, perhaps indicating more gender equality. The decisions taken independently by men were more frequent in Bihar. The mean scores indicated that active involvement of women was more common in Assam and can be seen

in the case of bringing more land under irrigation, crops to grow under irrigation, when to irrigate, payment of irrigation fees, and spending the additional income. These are all largely joint decisions. The findings indicate that independent decision-making by women in water-related matters was quite rare, but joint decision-making was present and was more common in Assam.

Table 2. Involvement in farm household decision-making by gender—overall and state wise.

Decision(s)		Men (Yes)	Women (Yes)	Joint (Yes)	Women are Actively Involved ¹
		(%)	(%)	(%)	(Mean Score)
1. Whether to use irrigation water?	Overall	80.7	0.9	18.3	1.6
	Assam	65.4	0.0	34.6	2.0
	Bihar	94.7	1.8	3.5	1.1
2. Source of irrigation water to use (canal/well/others)	Overall	91.7	0.9	7.3	1.2
	Assam	94.2	0.0	5.8	1.2
	Bihar	89.5	1.8	8.8	1.2
3. Bringing more land under irrigation	Overall	70.6	0.9	28.4	2.0
	Assam	40.4	0.0	59.6	2.9
	Bihar	98.2	1.8	0.0	1.1
4. What crops to grow under irrigation?	Overall	53.2	1.8	45.0	2.5
	Assam	30.8	0.0	69.2	3.3
	Bihar	73.7	3.5	22.8	1.7
5. When to irrigate the crops?	Overall	68.8	0.9	30.3	2.0
	Assam	42.3	0.0	57.7	2.8
	Bihar	93.0	1.8	5.3	1.2
6. Approaching WUA/Government for more water	Overall	98.2	0.9	0.9	1.1
	Assam	98.1	0.0	1.9	1.1
	Bihar	98.2	1.8	0.0	1.1
7. Investment in new irrigation structures/equipment	Overall	97.2	0.9	1.8	1.1
	Assam	96.2	0.0	3.8	1.1
	Bihar	98.2	1.8	0.0	1.1
8. Undertaking repairs and maintenance	Overall	96.3	0.0	3.7	1.1
	Assam	96.2	0.0	3.8	1.1
	Bihar	96.5	0.0	3.5	1.0
9. Payment of fees/charges for irrigation	Overall	67.0	0.9	32.1	2.1
	Assam	32.7	0.0	67.3	3.3
	Bihar	98.2	1.8	0.0	1.1
10. Spending of additional income generated	Overall	32.1	1.8	66.1	3.0
	Assam	25.0	1.9	73.1	3.3
	Bihar	38.6	1.8	59.6	2.6

¹ Likert scale: strongly agree (5), agree (4), partially agree/disagree (3), disagree (2), strongly disagree (1).

4.3. Inclusion of Women in the Water User Associations (WUAs)

Regarding the inclusion of women in the WUA General Body as members, and as members of the Executive Committees of the WUAs, the results are given in Figure 2. They indicate that the inclusion of women was very low. In Assam, only 1.9% of the respondents reported the inclusion of women in the VLC general bodies, and there was no inclusion of women in the CLC general bodies. No inclusion of women was reported in the VLC and CLC executive committees. However, 7.0% and 5.3% of Bihar respondents reported women inclusion in the VLC general bodies and executive committees, respectively. This was even higher at the CLC level, where 10.5% and 7.0% of Bihar respondents reported inclusion of women in the general body and executive committee. The data show a significant difference between the states, and the major reason is the fact that the inclusion of a woman member is

mandatory in Bihar and not so in Assam. This shows that rules such as mandatory inclusion make a substantial difference in inclusion. Further to inclusion, the actual involvement of women is examined in the next section.

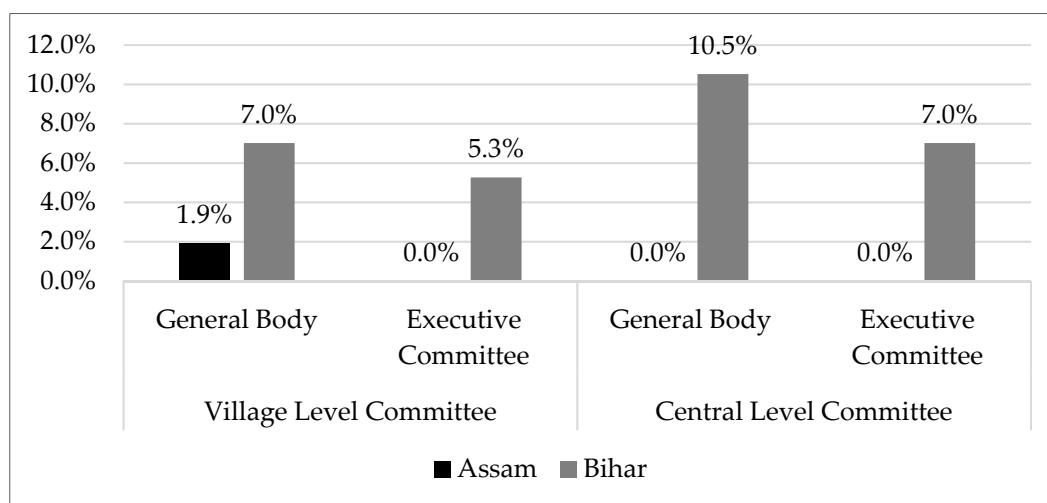


Figure 2. Inclusion of women in WUA committees—state-wise.

4.4. Involvement of Women in WUA Decisions/Activities

Regarding women involvement in the WUA decisions/activities, the results are given in Table 3. Reported involvement of women was very low in most decisions, typically less than 10%. It was somewhat higher with respect to voicing the needs and concerns of women, fee collection, assessment of water supply/demand, monitoring the water use, and decisions related to investment in structure/equipment. On other aspects such as water distribution, pricing, maintenance, and action on misusers, very low involvement was reported. Between the two states, women in Bihar were more involved in decisions related to structural investment, fee collection, and voicing their needs. The women of Assam reported no involvement in decisions related to investment in structure/equipment, distribution, and pricing of water and maintenance. Overall, women involvement in WUA decisions/activities was very low. The reasons preventing the participation of women are examined in the next section.

Table 3. Women's involvement in WUA ¹.

	Overall	Assam	Bihar
Investment in Structure/Equipment	6.4	0.0	12.3
Assessment of Water Supply/Demand	6.5	7.7	5.4
Release of Water	5.6	5.8	5.4
Distribution of Water	2.8	0.0	5.4
Pricing of Water	2.8	0.0	5.4
Collection of Fees from Farmers	6.5	1.9	10.7
Maintenance/Repair	3.7	0.0	7.1
Monitoring Use	6.5	3.9	8.9
Action on Misusers	3.7	3.9	3.6
Voicing Needs and Concerns of Women	11.1	5.8	16.1
Encouraging Women to Participate	4.6	1.9	7.1

¹ Responses captured as Yes and No. The figures reported are the % of respondents saying yes.

4.5. Reasons Preventing Women Participation in WUAs and Their Activities

Regarding what prevents women participation, responses to a set of possible reasons were obtained on a Likert scale of 5 to 1 as described in the methodology, and the mean scores are presented in Table 4. The findings indicate that the foremost reasons preventing women from participation in WUA were: only men participate/address meetings, and men make all the decisions related to farm and water management. Other reasons for Assam were: women lack personal confidence to attend and participate, and women can accomplish more useful tasks with their time. For Bihar, the other major reasons were: wives need permission of husbands to attend meetings, family tradition and culture prevent women from attending and participating, and women lack knowledge about water management issues. Overall, only men participating and addressing the meetings, and men making all the decisions, were seen as major deterrents to participation of women.

Table 4. Reasons preventing women participation—mean score ¹.

		Overall	Assam	Bihar
1	Only men can participate/address meetings	4.2	4.5	4.0
2	Men make all the decisions in farm management	4.1	4.2	4.0
3	Men make all the decisions in water management	4.0	4.2	3.8
4	Wives need permission of husbands to attend meetings	3.6	2.8	4.4
5	Women lack knowledge about water management issues	3.2	2.8	3.5
6	Women lack time to attend meetings—are too busy	3.0	2.5	3.4
7	Women can accomplish more useful tasks with their time	2.9	3.1	2.8
8	By participating women would challenge existing roles in the household	2.9	2.5	3.3
9	Family tradition & culture prevent women from attending and participating	2.7	1.8	3.5
10	Women lack personal confidence to attend and participate	2.7	3.1	2.3
11	Women lack interest in water management issues	2.6	2.8	2.4
12	Women do not see it their role to attend such meetings & participate	2.6	2.7	2.5
13	By participating women would challenge existing roles in the community	2.6	2.4	2.8
14	Lack of land ownership prevents women membership/participation	2.5	2.9	2.2
15	Women lack money or transport to attend meetings	2.5	1.9	3.1
16	Meetings are conducted far away from home	2.4	1.9	2.9
17	WUA rules prevent membership/participation of women	2.1	2.2	2.0
18	Women do not feel safe in attending/participating	2.0	1.8	2.2
19	The time when meetings are held (e.g., night time) doesn't suit women	1.9	1.6	2.2

¹ Likert scale: strongly agree (5), agree (4), partially agree/disagree (3), disagree (2), strongly disagree (1).

To further understand the barriers, correlations were calculated between the deterrents preventing participation of women in WUAs and some demographic variables. Pearson correlation coefficients were used as described in the methodology. Only the significant correlations are reported in Table 5. It was found that age was positively and significantly correlated with reason of family tradition and culture, indicating that this is a greater barrier for older women than for younger women. Age was negatively and significantly correlated with reason of lack of interest in water management, indicating that younger women may not participate due to lack of interest. Education had a negative and significant correlation with the reasons of lack of land ownership, only men participation in the meeting, men making all decisions related to farm management, and need for husband's permission. Thus, educated women would be less affected by many barriers. However, the positive correlation of education with lack of interest in water management indicates that better-educated women may lack interest in the issue. Correlations with landholding indicate that women of households with larger landholding would be less affected by the reason of family tradition and culture preventing

participation. The significant, positive correlation of landholding with lack of interest in water management as a reason indicates that this would be a bigger issue for women of households with large landholdings.

Table 5. Correlation between demographics and reasons preventing women participation in WUA.

	Age	Education	Landholding
Family tradition and culture prevent women from attending and participating	0.222 * (0.020)		-0.327 ** (0.001)
Lack of land ownership prevents women membership/participation		-0.195 * (0.042)	
Only men can participate/address meetings		-0.271 ** (0.004)	
Men make all the decisions in farm management		-0.299 ** (0.002)	
Meetings are conducted far away from home			-0.230 * (0.016)
Women lack money or transport to attend meetings			-0.338 ** (0.000)
Wives need permission of husbands to attend meetings		-0.198 * (0.039)	
Women lack interest in water management issues	-0.259 ** (0.007)	0.189 * (0.049)	0.207 * (0.030)

* and **—correlation significant at the 0.05 level and 0.01 level, respectively.

4.6. Institutional Sanction/Facilitation for Women Participation in WUA

Regarding institutional facilitation/sanction on participation of women in WUAs, women respondents were asked questions, and responses were collected on a Likert scale of 5 to 1 as described in the methodology. The results are shown in Figure 3. Overall, 39.5% of respondents agreed (strongly agree plus agree), whereas 58.7% disagreed (strongly disagree plus disagree) that the rules and systems to ensure women participation were being set by the government, indicating considerable differences. The percentage of women agreeing was much higher in Bihar (73.7%) compared to Assam (1.9%). As mentioned, women inclusion is mandatory in Bihar. Overall, only 1.8% women indicated that these rules and systems worked well, and there was hardly any difference in this between the states. The responses indicate that efforts have been made at the institutional level to enhance representation of women in Bihar, but not so in Assam. However, the effect of this was not substantial in both the states. Thus, some institutional sanction/facilitation to enhance women participation in WUA exists, but the impact is weak.

4.7. Leadership and Community Influence

To examine the comfort of women in taking up leadership or leading roles in the community, the women respondents were asked a few questions with responses recorded on a Likert scale of 5 to 1 as given in the methodology. Overall, 62.4% of the women agreed (strongly agree plus agree) that they would be comfortable raising development and infrastructure issues such as water, roads, and sanitation in the public, whereas 37.6% said that they were not comfortable. State-wise responses indicate that only 48.0% of women respondents in Assam, as compared to 75.5% of respondents in Bihar, would be comfortable raising such issues. Further, 46.8% women respondents overall, agreed that they would be comfortable raising issues related to irregularities and misbehavior of authorities, and 52.3% disagreed (strongly disagree plus disagree) in raising their voices on such issues. More women in Bihar reported feeling comfortable in speaking on this as compared to Assam. In general,

the comfort of women respondents in voicing the needs of development and infrastructure in the community (mean 3.4) was more compared to speaking up against irregularities and misbehavior of authorities (mean 2.9). The findings indicate that a large percentage of women were comfortable playing leading or leadership roles if given a chance, though some are not.

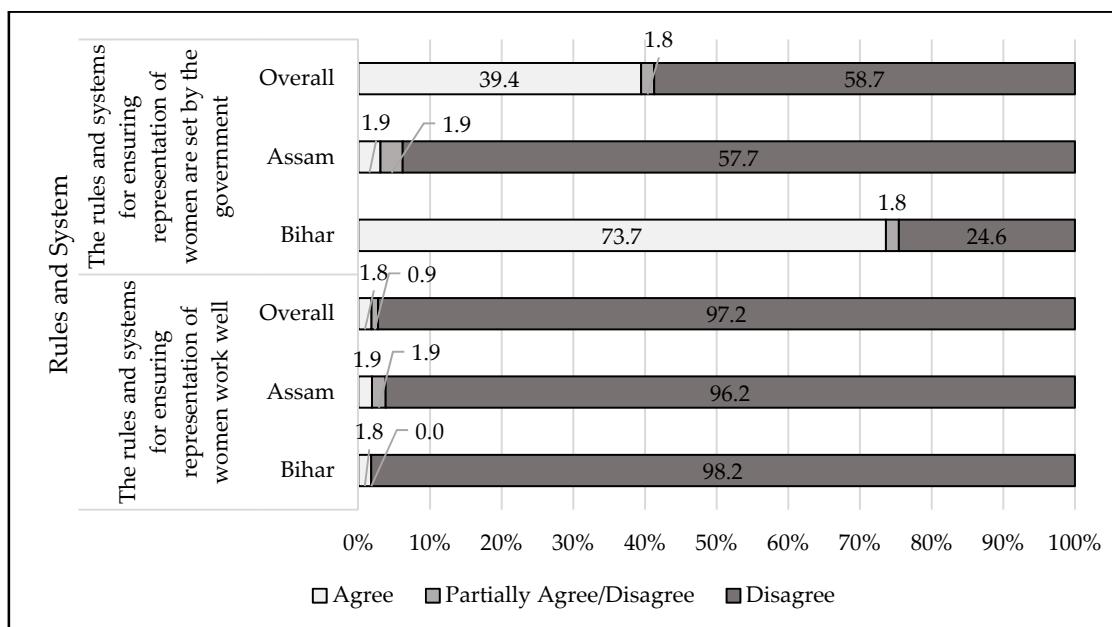


Figure 3. Institutional facilitation of women participation in WUA.

4.8. Women's Assessment of the Impact of WUAs

The women respondents were asked to assess the overall performance/impact of WUAs on four aspects—production/income benefits, equity benefits, environmental benefits, and financial benefits—on a Likert scale of 5 to 1, excellent to very poor, as described in the methodology. The results in terms of averages are shown in Table 6. The women found the overall impact of the WUAs to be good. The highest positive impact was perceived to be on the environment goals, followed by production/incomes, and financial viability goals. Equity benefits of WUA were rated slightly lower. While respondents in Assam reported higher production benefits, those in Bihar reported better impact on the environment and financial viability. The two states showed almost the same average response in equity benefits. Thus, women had a favorable overall opinion regarding most of the benefits of WUAs, but there was scope for improvement.

Table 6. Overall impact/benefit mean scores ¹.

	All	Assam	Bihar
Overall Production/Income Benefits	3.2	3.4	3.0
Overall Equity Benefits	2.9	2.9	2.9
Overall Environmental Benefits	3.4	3.3	3.5
Overall Financial Benefits	3.1	3.1	3.2

¹ Likert scale: excellent (5), good (4) satisfactory (3), somewhat poor (2), very poor (1).

Further, examining the performance on specific aspects under the four benefits, more detailed questions were asked using a five-point Likert scale (strongly agree to strongly disagree), and Table 7 summarizes the results. The findings indicate substantial variation across different aspects. The majority agree that there was positive impact on higher incomes, greater water availability, and more timely availability of water. On equity, the majority agreed regarding greater fairness and

empowerment of farmers. However, very few agreed that the impact on women involvement and empowerment was positive.

Table 7. Assessment of impact/benefits of WUA by women.

	Positive Impact on	Agree	Mean Score ¹
		%	
Production, Income Benefits	1. Greater water availability	58.7	3.3
	2. Timely water availability	49.6	3.0
	3. Better and timely maintenance and repairs	55.0	3.2
	4. Higher incomes	55.9	3.3
Equity Benefits	1. Wider membership and greater involvement	54.1	3.2
	2. Greater sense of ownership and empowerment of farmers	59.6	3.3
	3. Greater involvement and empowerment of women	9.20	1.8
	4. Greater fairness and justice	57.8	3.3
Environmental Benefits	1. Better care of the environment and biodiversity	65.1	3.5
	2. Better conservation of water	72.5	3.6
	3. Better conservation of soils, reduction in soil erosion	69.7	3.6
	4. Reduction in flood damage	45.9	2.9
Financial Benefits	1. Better collection of fees and charges	79.8	3.8
	2. Better availability of funds and support from the government	24.8	2.3
	3. Better financial discipline and avoiding misuse of funds	47.7	3.1
	4. Greater financial strength	51.4	3.4

¹ Likert scale: strongly agree (5), agree (4), partially agree/disagree (3), disagree (2), strongly disagree (1).

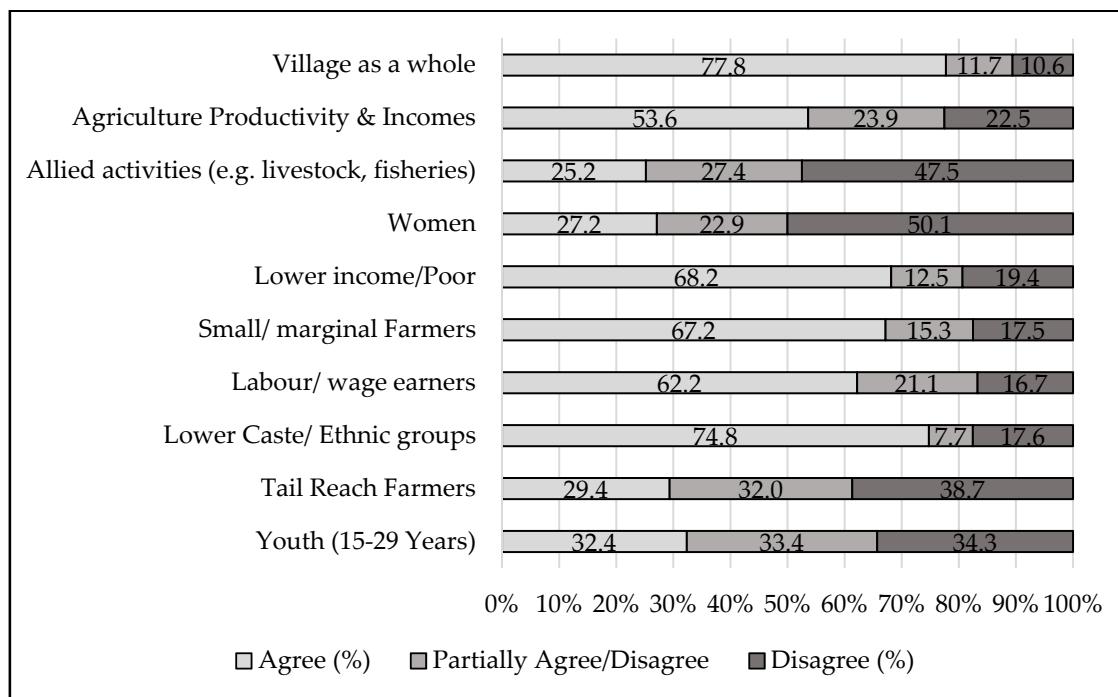
Most respondents agreed regarding a positive impact on better conservation of water, soil, and biodiversity, but not many found a reduction in flood damage. The positive financial benefits of WUA were reported on better collection of fees and greater financial strength. On the other hand, positive impact was not seen by many on better availability of funds from the government. Thus, women saw a number of positive impacts, but low impact was seen on women involvement and availability of government funds.

4.8.1. Impact of WUAs on the Village and Different Groups of People, as Indicated by Women

The results on women responses regarding the impact of WUAs on different groups of people and specific activities on a Likert scale of 5 to 1 are reported in Figure 4. The impact on the whole village was seen to be positive, and the impact on lower castes/ethnic groups, small and marginal farmers, and poor and labour/wage earners was also seen as positive. The least positive impacts were perceived to be on women, allied activities, tail reach farmers, and youth.

4.8.2. Perceived Benefits of Formal Women Participation in Water Management/WUA Decision-Making

Regarding perceived benefits if women were to participate in WUA decision-making, different questions were asked, and responses were obtained on a Likert scale of 5 to 1. Table 8 summarizes the results. The responses indicate that women participation would lead to better communication of their concerns regarding water management, improved knowledge of women about water management, increase the respect and social standing of women, creation of a culture of gender acceptance, changing of rules which unfairly limit women involvement, and better outcomes in water management.

**Figure 4.** Perceived positive impact of WUAs indicated by women.**Table 8.** Perceived benefits of formal participation of women in water management.

	Agree	Mean Score ¹
1. Participating in WUA meeting will provide an opportunity to women to raise their concerns with the leaders	64.3	3.6
2. By participation, the needs and concerns of women on water/irrigation would be better communicated	69.7	3.5
3. Participation of women would lead to better outcomes in water management	63.3	3.6
4. Participation of women will create a culture of gender acceptance for future generations and other activities	69.7	3.7
5. Participation of women will give women increased respect and social standing	79.8	4.0
6. Participation of women will provide an opportunity to women to come out and contribute beyond their traditional roles	60.6	3.5
7. By participation, women will gain knowledge about water management	84.4	4.2
8. Participation would help change rules that unfairly limit the role of women	67.9	3.7
9. With participation, women can enhance their own/family's income/well-being	75.2	3.7

¹ Likert scale: strongly agree (5), agree (4), partially agree/disagree (3), disagree (2), strongly disagree (1).

4.9. Correlation in Responses of Women and Men on Selected Aspects of Water Institutions

This section brings together data from the women's survey, and the farmer-institution survey (where men answered) regarding the same questions asked in both. The questions were derived from a framework based on new institutional economics and management governance theory explaining institutional performance [48]. The responses were on a Likert scale of 5 to 1 (strongly agree to strongly disagree) given in the methodology. Pearson correlation coefficients were calculated between the answers of men and women on selected questions. These included eight rationalities [49], five

institutional features [35,46,50,51], and five performance indicators [48]. Appendix A Table A1 gives the correlations, agree responses (strongly agree plus agree), and the mean responses of men and women on selected rationality questions.

Positive and significant correlations were found on water release/distribution, environment, changes for involvement of women, fairness and justice, regularity of meetings, staff competence, sufficiency of funds, and government controls, and the agree response did not differ much between men and women. However, the correlations were low and agree responses differed regarding repair and maintenance, marketing arrangements and equal opportunity for all to participate. There was substantial disagreement/poor correlation on “people/women of all social groups have the opportunity to be members, participate, and be on executive committees/posts” and on “adequate infrastructure, marketing/processing arrangements are available to get good prices”. Other than on organizational rationality, and some aspects of political, financial, and government rationality, the correlations were not high, indicating lack of agreement in views. Thus, the evaluations/perceptions of men and women differed on many aspects. This indicates a need to include the views of women in water institutions and management for decision-making to be more inclusive and comprehensive.

Appendix A Table A2 similarly provides results comparing the responses of men and women on the institutional features of WUAs. Positive and significant correlation were seen on features of good interaction and adaptiveness and were also seen in the scale/size issue of distribution of power and resources. However, there was a poor correlation on “WUA uses its powers to bring compliance to the rules” and on the clarity of objectives, as well as plans for their achievement. This again indicates the need to include the views of women.

Similarly, correlation analysis was done regarding the evaluation of WUA performance by women and men (on a five-point Likert scale, excellent to poor), and the results are presented in Appendix A Table A3. There appears to be substantial agreement between women and men on this. The correlation of responses was high at about 0.50 (though not very high) on overall performance, water availability/economic performance, and financial management performance. The correlation was low on environmental performance—where more men and less women agreed that the performance was good.

5. Conclusions

Water institutions need substantial improvement in eastern India, and inadequate inclusion of women is a significant weakness. This study focusses on the women/gender inclusion and involvement in the water user associations in eastern India. It is based on a survey of 109 women respondents as well as 510 farm household respondents from the states of Assam and Bihar, covered through special questionnaires in a study of water institutions. The results indicate low inclusion of women in the WUA general body and executive committee both at the village and central committee levels. The results indicate that the farm household decision-making is mostly done by men, but women are part of joint decision-making in issues related to bringing land under irrigation, crops to grow under irrigation, and spending the additional income. Joint decision-making is more prevalent in Assam compared to Bihar. Women’s role in WUA decision-making is mostly restricted to voicing their needs and concerns. Women representation in leadership roles is inadequate, and not enough efforts were being made to include them in decision-making. Women, on the other hand, seemed comfortable with talking in public on development and infrastructure issues, and to a lesser extent also on pointing out the irregularities and misuse by authorities.

The main reasons preventing women from participating in WUAs is reported to be that only men can participate in and address meetings, and men make all the decisions in water management. However, these barriers reduce with education. The reason of family tradition and culture preventing women from attending and participating is more in Bihar than Assam. Lack of time as well as interest in water management is also expressed by some. Women indicate that if they formally participate in water institutions, they would achieve better status and respect in society, and other benefits include greater

knowledge of water management, ability to change rules that limit their participation, and better water management. The women respondents see a generally positive development impact of WUAs on the village, including positive impact on lower castes, small and marginal farmers, lower-income groups, and wage earners, but little positive impact on women. Data analysis indicates that the responses of women and men generally agree on aspects of organizational rationality and good interaction, but disagree on aspects of economic and social rationality and compliance.

In particular, the study finds that women are often involved in joint decision-making with men on a number of farm decisions, but when it comes to farm water management decisions, their involvement is very low, and still lower when it comes to water user association decision-making. Thus, it appears that women are not considered capable in this domain by men and are thus excluded, and this exclusion further increases the knowledge gap. However, many women have confidence in participating and talking in public regarding concerns of development and infrastructure. But, when it comes to water institutions/user associations, only men participate and speak. Even though there are some social barriers for women, they reduce with education and have less effect on younger people. In order to break these barriers and cycles, the inclusion of women in government schemes, training programs and education related to water management would be an important way to bring about gender equality and involvement in this matter. Mandatory inclusion of women in the WUA executive committees would also help substantially in overcoming this handicap. Since it is found that women's views differ from those of men on many matters of rationality and institutional features, the involvement of women will add new ideas and views to the discussions on water management and lead to better outcomes for the society and the economy. This would be particularly important for eastern India where water institutions need substantial strengthening to manage water resources more effectively.

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Appendix A

Table A1. Comparison between responses of women and men on WUA rationalities.

		% Agree		Mean Response ¹		Correlation	Sig. (2-tailed)
		Women	Men	Women	Men		
Technical Rationality	The structures and equipment are regularly repaired and well maintained	58.7	29.4	3.2	2.8	0.138	0.152
	The water release/distribution are technically well scheduled and managed	51.4	45.5	3.2	2.9	0.333 **	0.000
Environmental Rationality	Environmental care & problems are well addressed (including water & soil conservation, soil fertility, natural vegetation & life)	44.0	52.5	2.9	3.1	0.403 **	0.000
	Flooding and flood waters are well controlled and damages promptly repaired	37.6	40.6	2.7	2.7	0.035	0.715
Economic Rationality	Adequate infrastructure, marketing/processing arrangements are available to give good prices	67.9	34.1	3.4	2.7	0.039	0.688
	Improved water availability & management lead to good profitability and incomes	64.2	55.9	3.4	3.2	0.166	0.084
Social Rationality	Changes have been made for bringing participation & inclusion of views of women	10.1	7.1	1.9	1.6	0.220 *	0.022
	People/women of all social groups have the opportunity to be members, participate, and be on executive committees/posts	33.0	61.8	2.4	3.3	0.013	0.893
Political Rationality	There is adequate representation of women in leadership roles	11.0	4.1	1.7	1.4	0.119	0.218
	The WUA is able to ensure fairness and justice	61.5	57.5	3.4	3.3	0.219 *	0.022
Organizational Rationality	The WUA general bodies and Executive Committees (EC) meet regularly	45.9	49.0	3.0	3.0	0.316 **	0.001
	The WUA leadership/staff is knowledgeable & competent in managing the WUA activities	65.1	61.4	3.5	3.4	0.267 **	0.005
Financial Rationality	There is no mismanagement, diversion, loss of funds, or disputes about funds	49.5	51.0	3.1	3.0	0.112	0.246
	The WUA receives sufficient funds and is financially sound	41.3	41.8	2.9	2.8	0.281 **	0.003
Government Rationality	The government controls & rules are reasonable/good	46.8	48.0	2.9	2.9	0.269 **	0.005
	The government officials help in planning, mobilizing, organizing, and implementation including in resolving disputes & problems	29.4	21.8	2.4	2.3	0.131	0.175

¹ Likert scale: strongly agree (5), agree (4), partially agree/disagree (3), disagree (2) strongly disagree (1). * and **—correlation significant at the 0.05 level and 0.01 level, respectively.

Table A2. Comparison between responses of women and men on WUA institutional features.

		% Agree		Mean Response ¹		Pearson Correlation	Sig. (2-Tailed)
		Women	Men	Women	Men		
Clear Objectives	Clarity of WUA objectives/purpose/roles to all	29.4	57.5	2.4	3.2	0.183	0.056
	Regular planning & action by WUA for achieving objectives	38.5	46.9	2.7	2.1	0.181	0.060
Good interaction	Regular & frequent meetings involving all social & farmer groups	56.9	44.1	3.3	2.9	0.407 **	0.000
	Good leadership helps and guides the interactions	64.2	49.2	3.3	3.0	0.267 **	0.005
Adaptiveness	Rules, plans and procedures often adapted to member needs, village conditions, water availability and environment variations	33.9	44.5	2.6	2.9	0.420 **	0.000
	Rules such as water timings/quantity/seasonal availability/plans were changed/adapted	33.9	32.5	2.6	2.6	0.301 **	0.001
Scale/Size	Appropriate scale/size/scope of operation of WUA	56.0	65.1	3.2	3.5	0.141	0.143
	Powers, resources & responsibility appropriately distributed between stakeholders	40.4	58.6	2.8	3.2	0.442 **	0.000
Compliance	WUA's rules and schedules not frequently broken by members/villagers	52.3	52.5	3.0	3.0	0.208 *	0.030
	WUA uses powers to bring compliance to the rules	39.4	27.6	2.7	2.5	0.07	0.468

¹ Likert scale: strongly agree (5), agree (4), partially agree/disagree (3), disagree (2) strongly disagree (1). * and **—correlation significant at the 0.05 level and 0.01 level, respectively.

Table A3. Comparison between responses of women and men on WUA performance.

	% Excellent/Good		Mean Response ¹		Pearson Correlation	Sig. (2-tailed)
	Women	Men	Women	Men		
Overall assessment of the performance WUA	43.1	45.3	3.0	3.0	0.506 **	0.000
Performance on water availability and economic/income benefits	39.4	31.2	3.0	2.8	0.504 **	0.000
Performance on equity in water distribution, and its benefits	45.0	35.3	3.2	2.9	0.522 **	0.000
Performance of the environmental impact and outcomes	33.0	40.0	3.1	3.1	0.389 **	0.000
Performance on financial management and control	24.8	21.6	2.9	2.6	0.507 **	0.000

¹ Likert scale: excellent (5), good (4) satisfactory (3), somewhat poor (2) very poor (1). * and **—correlation significant at the 0.05 level and 0.01 level, respectively.

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