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Opportunities and Challenges of Community-Based Rural Drinking Water Supplies

An Analysis of Water and Sanitation Committees in Ghana

Yan Sun

Felix Asante

Regina Birner

Environment and Production Technology Division

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

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AUTHORS

Yan Sun, International Food Policy Research Institute
Research Analyst, Environment and Production Technology Division
y.sun@cgiar.org

Felix Asante, Institute of Statistical, Social and Economic Research
Research Fellow

Regina Birner, International Food Policy Research Institute
Senior Research Fellow, Development Strategy and Governance Division

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ABSTRACT

Providing safe drinking water in rural areas is a major challenge because it is not easy to establish institutional arrangements that will ensure that drinking water facilities are provided, maintained, and managed in an efficient, equitable, and sustainable way. Like many other countries, Ghana has adopted a community-based approach to meet this challenge. Community-based water and sanitation committees (WATSANs) are in charge of managing drinking water facilities at the local level. They are supported by water and sanitation teams of each district administration and by the Community Water and Sanitation Agency, an independent agency that has been created to facilitate the community-based approach. This paper is based on the analysis of two survey datasets of WATSANs and households in rural Ghana. The paper confirms some findings of the earlier literature on this topic. For example, communities that have a higher level of existing community groups are more likely to have functioning WATSANs, while ethnically diverse communities are less likely to have these organizations. The paper also indicates that WATSANs have a positive effect on the mobilization of payment for water services. Using empirical data on local leaders, the paper shows that leadership also matters for the provision of safe drinking water. In particular, the paper suggests that female leaders seem to be effective in this respect.

Keywords: community-based resource management, drinking water supply, participation, sustainable development, decentralization

JEL code: Q25; O13; H54

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ABBREVIATIONS AND ACRONYMS

CWSA	Community Water and Sanitation Agency, Ghana
DA	District Assembly, Ghana
CWSP	Community Water and Sanitation Project
GWSC	Ghana Water and Sewage Cooperation
NCWSP	National Community Water and Sanitation Program
WATSAN	Water and Sanitation Committee
WRC	Water Resources Commission

1. INTRODUCTION

Water, sanitation, and hygiene are essential to sustainable development and poverty reduction. In Africa, the number of people in rural areas without an improved water supply is six times higher than in urban populations (Baur and Woodhouse 2009). This directly affects the welfare of rural people. Lack of access to safe drinking water also has indirect negative effects, such as reduced productivity in agriculture and other sectors.

Providing safe drinking water in rural areas is a major challenge because it is not easy to establish institutional arrangements that will ensure that drinking water facilities are provided, maintained, and managed in an efficient, equitable, and sustainable way. In fact, providing safe drinking water in rural areas is subject to both market and government failures. The private sector does not usually have sufficient incentives to invest in rural water supplies due to the high costs of infrastructure development in areas with low population density and the high transaction costs of collecting fees for drinking water in such areas, especially if the awareness of the value of safe drinking water is limited and if people can easily resort to other (although unsafe) water sources. If drinking water is provided by the government, there are major challenges to ensure that government staff has sufficient funds and incentives to manage rural water facilities in a sustainable way. Community-based approaches have been widely adopted to meet this dual challenge of market and government failures. However, it is well-known that communities may also fail to provide services effectively due to problems such as elite capture and limited capacity.

Against this background and using Ghana as an example, this paper aims to assess the potential benefits and challenges of community-based water management. Ghana is a largely agricultural country with a population of about 20 million people. It is estimated that one-half of the population has access to safe water resources (Bohman 2005). About 65 percent of the Ghanaian population lives in rural areas with very limited access to pipe water (Gyampoh, Idinoba, and Amisah 2008).

In the past, the water supply in Ghana was operated by the central government. Similar to other countries, Ghana faced budget constraints, low revenues, and shortfalls in operation and maintenance, which resulted in insufficient expansion of the system and failure to satisfy rural water needs (Engel, Iskandarani, and del Pilar Useche 2005). Ghana implemented the Decentralization Act in 1983 as part of a national reform, and since then district assemblies have gradually assumed more responsibilities. Ghana also has transformed the structure of its rural water supply and transferred responsibilities for water management both to the district assemblies and to community-based organizations that operate outside the local government structure. Ghana was one of the first countries to introduce a community-based approach to rural water supply on a large scale (Engel, Iskandarani, and del Pilar Useche 2005). Ghana's approach is in line with current drinking water policies in many countries, which are based on the paradigm that rural drinking-water supply facilities, such as improved hand-dug wells or hand pump–fitted boreholes, are best managed by local water users. This paradigm also entails the principle of "treating water as an economic good," which assumes that water users are willing to pay for water services if appropriate management approaches are used (Kleemeier 2000).

Ghana's new water policy was introduced in 1998 with the National Community Water and Sanitation Program (Eguavoen 2008b). Under this approach, the central government withdrew from supplying water and operating water-related infrastructure, and it limited its role to perform regulatory and facilitating tasks. Communities were encouraged to take responsibility for their own water supply; nongovernmental organizations and the private sector became providers for the design, construction, and maintenance of water supplies (Baur and Woodhouse 2009). By 2000, district assemblies in rural Ghana had come to play a significant role in planning water facilities and allocating funds for this purpose, the private sector had become active in drilling and other water supply services, and communities had been assigned the full responsibility for maintaining their supply facilities (Kleemeier, 2002).

So far, few studies have been conducted on community-based water management in rural Africa. The available evidence on the effectiveness of it, which is summarized in the next section, shows rather mixed results. Therefore, this paper aims to help to address knowledge gaps on the following questions: Which factors affect the functioning of a community-based approach? Which factors influence the access

of households to safe drinking water? Which factors promote payment for drinking water? Which factors influence household participation in the management of water services?

The paper is structured as follows: Section 2 reviews the literature for community-based approaches in rural areas. Section 3 reviews the background and history of the rural water policy in Ghana. Section 4 describes the data sources. Section 5 presents a descriptive analysis, and section 6 presents the results of a regression analysis of the survey data. Section 7 offers a conclusion.

2. LITERATURE REVIEW

One important example of a community-based approach to provision of rural water is South Africa's national water and sanitation program, which is one of the largest in Africa. It started in 1994. The goal of this program was to provide free basic water nationally. The government provides 100 percent of capital costs for both water and sanitation (Lane 2004). The Department of Water Affairs and Forestry was handed responsibility for implementation to local governments. The Water Services Authority was created as the local regulator of water services. According to Mackintosh et al. (2004), the program provided water infrastructure for 10 million additional people in 10 years (from 1994 to 2004). However, Lane (2004) found that local governments have limited capacity to implement and finance the free, basic water policy (Lane 2004).

Using survey data from Sri Lanka and India, Isham and Kahkonen (2002) found that well-designed and well-constructed water services are two significant factors for effective community-based approaches. The authors found that it is important to involve household members in the design process and in the final decision about the type of system to build. Likewise, systems work better if the households' contribution to construction (for example, cash or labor) is monitored. Social capital was found to be associated with the above two factors. In communities with higher levels of social capital (for example, with more active community groups), community members were more likely to engage in design as well as monitoring.

Analyzing the performance of water systems in six countries (Benin, Bolivia, Honduras, Indonesia, Pakistan, and Uganda), Katz and Sara (1997) found that the community-based approach significantly increased sustainability. The authors established a strong linkage between participation of the household members and sustainability of the projects. The most important factors contributing to success can be summarized as information accessible to the households, capacity building at all levels, training in operations and maintenance, control over funds, and good quality construction. The study also observed that the approach did not work consistently well among the communities. In some cases, the projects were supply driven (for example, not offering communities different options). In other cases, community representatives failed to consider the demands of disadvantaged groups.

Newman et al. (2002) reviewed 18 rural water projects in two regions in Bolivia and found that community-level training (for example, on cleaning water tanks, repairing water tubes, and managing user fees) was critical for improving water quality. In a study of Zimbabwe, Cleaver (1999) found that the empowerment and long-term effectiveness of participation approaches was rather complex. Cleaver identified limitations of communities in mobilizing the necessary resources, either through collecting funds from community members or lobbying government officials. These problems prevailed even where communities were well motivated and organized.

Narayan (1995) analyzed lessons from 121 rural water-supply projects funded by different agencies in 49 developing countries. This study identified the participation of local communities as an important factor for project effectiveness and community empowerment. As main problems, the study identified the reluctance of central governments to give up control and invest in the capacity of local organizations. It also noted the lack of women's involvement.

In summary, the literature suggests that the following factors are important for the success of community-based approaches to drinking water supply: (1) involvement of the communities in design, construction, evaluation, operation, and maintenance of the water projects; (2) household contributions to water projects in the form of cash and labor; (3) social capital and local leadership; and (4) provisions to ensure women's participation.

3. THE RURAL WATER SUPPLY IN GHANA

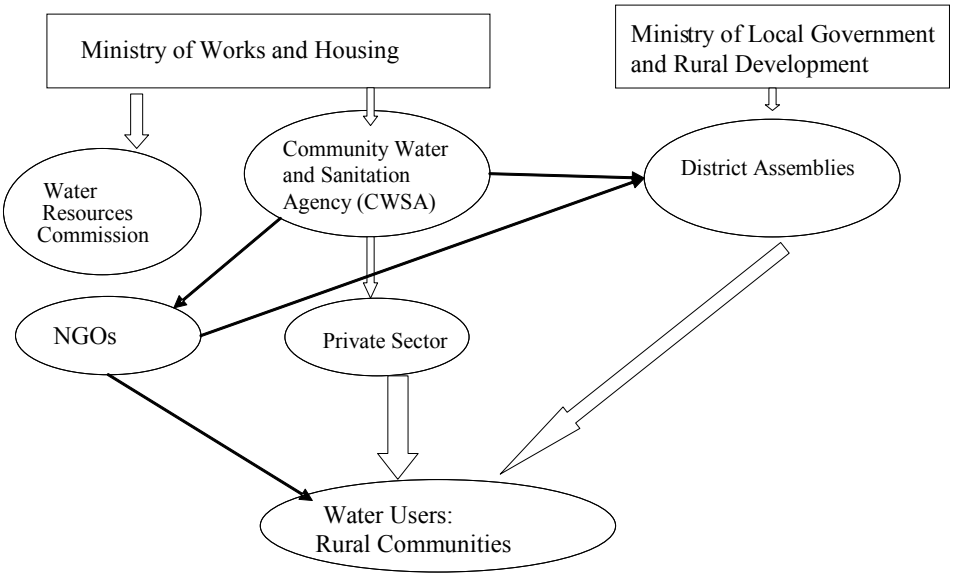
Structure of the Water Sector before the Reform

Before the reform, the state-owned and centrally managed Ghana Water and Sewage Cooperation (GWSC), which was established in 1965, was in charge of the rural and urban water supplies (Bohman 2005). The public sector also dominated construction. The majority of rural water supplies were boreholes fitted with hand pumps. The GWSC and nongovernmental organizations (NGOs) carried out most of the drilling in Ghana. There was only one Ghanaian private drilling company before 2000 (Kleemier, 2002). GWSC focused its attention on urban supplies and did not have enough staff and revenues for hand pump maintenance and rural pipe operations. Finally, it failed to ensure long-term sustainability of the rural water-supply facilities (Eguavoen 2008a).

Water Policy Development since 1998

In 1998, the government implemented the National Community Water and Sanitation Program, which provided the basis for a new water policy. As Figure 1 shows, the new national program comprises different levels of implementing bodies. The private sector, district governments, and communities have emerged as important players with primary responsibility for planning and implementation (Kleemier, 2002).

Figure 1. Organizations of rural water sector in Ghana



Source: Baur and Woodhouse (2004).
Note: NGO refers to *nongovernmental organization.*

The Community Water and Sanitation Agency

The GWSC was converted into a 100 percent state-owned limited-liability company, referred to as "the Ghana Water Company." However, this company is only responsible for the urban water supply. The Community Water and Sanitation Agency (CWSA) was created as an independent agency that is responsible for the rural drinking-water supply and for facilitating the implementation of the national community and sanitation strategy. The CWSA adopted a fundamentally different approach than the GWSC: coordinating and facilitating—not implementing—a community-managed water supply (Lane

2004). The CWSA has offices at the regional level but relies on assigned district-assembly staff for implementation at lower levels.

Water and Sanitation Committees

The basic unit for promoting the community-based approach is the village.[1] At the village level, a gender-balanced water and sanitation committee (WATSAN) is to be formed. The WATSAN is in charge of collecting the initial community contribution for construction costs and is responsible for the maintenance and operation of the water and sanitation systems. The committee is supposed to work closely with the district assemblies. Day-to-day management and operational issues, such as the definition of access, allocation of water, and maintenance of the pump site and hand pumps, are also major tasks of the committee (Eguavoen 2008a).

Communities accepted responsibility for operation and maintenance of their water supplies, including financing. Participating communities have to contribute up to 5 percent of total capital costs in cash. The capital costs cover facility construction, the installation of an elected pump committee, water tariffs, and bookkeeping (Eguavoen 2008a). The local government pays another 5 percent of the capital cost. The remaining 90 percent is provided from the CWSA's (mostly donor funded) budget (Lane 2004). Communities can collect fees either through monthly water fees or through a per-bucket fee at water service points.

Private Sector and Nongovernmental Organizations

As the government has withdrawn from drilling, the CWSA is now contracting both private firms and NGOs for borehole construction and supervision (Kleemier, 2002). Thus, the private sector and NGOs participate in rural water-supply provision through the construction and maintenance of facilities and the provision of equipment (Engel, Iskandarani, and del Pilar Useche 2005). Before the reform, communities had to wait for the government to send out a repair team in case of problems with drinking water facilities. Now, the communities can hire local hand-pump mechanics to do repairs that are beyond their own capacity (Kleemier, 2002).

Literature about Community-Based Water Management in Ghana

Only one major quantitative study on community-based water supply in Ghana could be identified. Using a household survey carried out in the Ghanaian Volta basin during 2001, Engel, Iskandarani, and de Pilar Useche (2005) examined participation decisions for an improved water supply. They found that among the households with access to improved water, a considerable proportion (about 43 percent) continued to use unsafe sources as their main domestic water source. To analyze supply and demand characteristics, the authors use a discrete choice model where the dependent variable is a household's decision to choose the improved water source. The authors found that charging a fee per bucket had a highly significant negative effect on both the decision to use the improved water and the quantity of improved water consumed. The perception that the alternative water source (for example, river water) was of quality discouraged farmers from buying improved water. The authors also found that about 40 percent of the households participated in decisions on location or technology. The regression analysis revealed an extreme effect in this respect. The poorest and least educated as well as the richest and most educated segments of the community were more likely to participate in decision making for the improved domestic-water supply. The explanation offered by the authors is that better off and better educated members are motivated by their high bargaining power, while the participation by poor segments of the community could be driven by the CWSA's strong emphasis on the need to include the poor.

[1] Ghana has a three-tier system of local government comprising the district assembly, the town or area councils, and the unit committees. The district assembly is the highest tier in the local government system, and the unit committee is the lowest tier. A unit committee has elected representatives from several villages. According to the community-survey conducted for this survey, a village generally has 40 to 80 households.

4. DATA SOURCES

The analysis presented in this paper combines two datasets: IFPRI survey (2005) and IFPRI survey (2008). The first dataset is from the project Integrating Knowledge from Computational Modeling with Multi-stakeholder Governance in Ghana.[2] The fieldwork was undertaken from June to October of 2005. The study area was the upper east region of Ghana, the poorest of the 10 administrative regions of Ghana. The dataset includes surveys of households, communities, and WATSANs. The households were randomly sampled to be representative for the upper east region. The community and WATSAN survey covered the locations of the households that were selected.

The second dataset was collected under the project Gender and Governance in Rural Services: Insights from India, Ghana, and Ethiopia. It was funded by the World Bank and by International Food Policy Research Institute's Ghana Strategy Support Program, which is financed by the U.S. Agency for International Development and other donor agencies. In this project, six districts were selected purposely to cover the three different agro-ecological zones: the forest zone, the transition zone, and the savannah zone. For each agro-ecological zone a pair of neighboring districts was selected. In these districts, a sample of 90 electoral areas was selected.[3] In each electoral area, three communities were selected randomly and surveyed. In one of the three communities selected in each electoral area, a random sample of approximately 12 to 13 households was selected for a head of household and spouse survey. In each of the electoral areas where the household survey was conducted, one WATSAN representative was interviewed if this organization was present. In the following, the surveys conducted under this project are referred to as "2008 surveys" and those conducted under the previous project as "2005 surveys."

[2] The Challenge Program on Water and Food, an initiative of the Consultative Group on International Agricultural Research, contributes to efforts of the international community to ensure that global diversions of water to agriculture are maintained at the level of the year 2000. It is a multi-institutional research initiative that aims to increase water productivity for agriculture—that is, to change the way water is managed and used to meet international food security and poverty eradication goals—in order to leave more water for other users and the environment. The research was led by the International Food Policy Research Institute in collaboration with the University of Hohenheim in Germany; the Institute for Statistical, Social and Economic Research; and the Water Resources Institute, the latter two based in Accra, Ghana.

[3] See World Bank and IFPRI (2010) for a more detailed explanation of the sampling strategy adopted for this project.

5. DESCRIPTIVE STATISTICS

This section presents descriptive statistics of the community-based water and sanitation committee (WATSAN) and household surveys conducted under the two projects.

Water and Sanitation Committee Surveys

The 2005 WATSAN survey covers 61 WATSANs in the upper east region and the 2008 WATSAN surveys covers 49 WATSANs in the following three regions: the northern region (savannah zone), Brong-Ahafo region (transition zone), and the western region (forest zone) . For a detailed distribution of WATSANs, see appendix A. Both of the survey questionnaires were answered by executive committee members of the WATSANs, with chairpersons and secretaries accounting for the majority of respondents for both surveys.

Drinking Water Facilities

Table 1 shows that, except for the northern region, the majority of the water facilities under WATSAN supervision are boreholes with pumps. The 2008 WATSAN survey also showed that the formation of WATSANs is linked to the construction of boreholes with pumps (Table 2). Only 4 percent of the surveyed communities had such a facility before WATSANs were formed.

Table 1. Type of drinking water facility supervised (percentage)

Type of drinking water facility	Region (%)			
	Upper East *n* = 60	Northern *n* = 17	Brong Ahafo *n* = 16	Western *n* = 14
Shallow well	4	6	6	0
Hand-dug well, no pump	6	24	13	0
Hand-dug well with pump	3	6	6	7
Borehole with pump	87	29	56	79
Small-town water system	0	0	13	14
Other	0	35	6	0
Total	100	100	100	100

Source: IFPRI survey, 2005; IFPRI survey, 2008.

Table 2. Type of drinking water facility supervised (percentage) before and after WATSAN

Type of drinking water facility	Northern, Brong Ahafo, and Western Regions (%)	
	Before WATSAN formed *n* = 47	After WATSAN *n* = 47
Shallow well	7	4
Hand-dug well, no pump	23	12
Hand-dug well with pump	0	6
Borehole with pump	4	54
Small-town water system	2	9
Other	64	15
Total	100	100

Source: IFPRI survey, 2008.

Construction and Rehabilitation of the Water Facilities

Table 3 shows the construction time of water facilities in four regions. For the upper east region, the majority of facilities were constructed in the 1970s and the 2000s, while in the other three regions, the water facilities were mainly constructed in the 2000s.

Table 3. Period of construction of water facility (percentage)

Year	Region (%)			
	Upper East	Northern	Brong Ahafo	Western
	n = 59	*n* = 17	*n* = 17	*n* = 14
1950s	2	0	0	0
1960s	7	0	6	0
1970s	35	0	0	7
1980s	12	6	24	7
1990s	12	12	18	14
2000s	32	82	52	72
Total	100	100	100	100

Source: IFPRI survey, 2005; IFPRI survey, 2008.

Table 4 shows that a large part (62 percent) of the water facilities in the upper east region has been rehabilitated. On the contrary, only a small proportion of water facilities in the Brong Ahafo, northern, and western regions have been rehabilitated, which may be linked to their more recent establishment.

The survey included the question as to whether there was a formal application procedure through which communities could express their demand for the construction or rehabilitation of a drinking water facility. As Table 4 shows, this was the case for less than one-half of the surveyed WATSANs.

Table 4. Rehabilitation of water facilities and application procedure for construction (percentage)

Action	Region (%)			
	Upper East	Northern	Brong Ahafo	Western
Rehabilitation	*n* = 60	*n* = 17	*n* = 17	*n* = 14
	62	24	47	7
Application procedure	*n* = 55	*n* = 16	*n* = 17	*n* = 13
	47	37	41	31

Source: IFPRI survey, 2005; IFPRI survey, 2008.

In the upper east region, the rehabilitation usually involved the change of the metal pipes (97 percent) or digging a deeper hole (3 percent). In the latter three regions, the most important reason for rehabilitation was to replace the pipes or to change the pump. In the upper east region, the community members usually took the first step (55 percent) in planning the construction or rehabilitation of the facility, which is consistent with the idea of a demand-driven approach. In the other three regions, it was usually the assembly person or a WATSAN representative who took the first step in applying for the rehabilitation.

In the regions covered by the 2008 survey, the majority of the communities (about 90 percent) contributed to the construction, either by labor or in-kind[4] or cash. Most of the communities (76 percent) contributed 10 percent or less of the total cost. Occasionally, some communities contributed more (up to

[4] "In-kind" in this paper is referred to food or material provided by the village.

100 percent). There were cases where wealthy individuals within the community paid a substantial share of the community contributions.

Election and Training of Water and Sanitation Committees

Except for in the Western region, the most popular method to choose a WATSAN chairperson was by consensus. Competitive elections were used most in the western region and ranked second in the upper east region. This method was used only occasionally in the northern and Brong Ahafo regions (Table 5).

Table 5. Methods of choosing a chairperson (percentage)

Method	Region (%)			
	Upper East $n = 60$	Northern $n = 15$	Brong Ahafo $n = 17$	Western $n = 13$
Elected by users	32	7	17	46
Informal agreement among users	13	0	0	8
Consensus reached by users	50	67	71	31
Appointed by chief	3	19	0	15
Other	2	7	12	0
Total	100	100	100	100

Source: IFPRI survey, 2005; IFPRI survey, 2008.

The upper east sample also shows that only 18 percent of the WATSANs hold regular elections every three, four, or five years to elect executives. The remaining WATSANs either have irregular elections or the other WATSANs elect a new member only when they are discontent with the performance of a member or a member passes away.

In the three regions covered by the 2008 survey, about one-half of the members of WATSANs only meet when a need arises and only a few WATSAN members meet regularly (for example, weekly, biweekly, monthly, or quarterly). In these regions, about one-third of WATSAN members have received recent training regarding the management of the drinking water facility. Also, about one-third of the WATSANs implement training in the community. Most of the trainings are focused on health and hygiene, technical maintenance and repair, community organization, and financial management.

Maintenance of Water Facilities and Payment for Water

For all regions, water fees are decided mainly by consensus in a meeting with the executive committee (Table 6). In the upper east region, a decision of the executive committee in consensus ranks second. In the other three regions, it is decided during a meeting with the executive committee that involves voting.

Table 6. Water fee decision-making process (percentage)

Decision Making	Region (%)			
	Upper East $n = 46$	Northern $n = 11$	Brong $n = 12$	Western $n = 5$
By executive committee	37	0	8	0
During meeting with executive committee in	50	55	58	60
During meeting with executive committee in a vote	11	36	34	40
Other	2	9	0	0
Total	100	100	100	100

Source: IFPRI survey, 2005; IFPRI survey, 2008.

In the three regions covered by the 2008 survey, water fees are collected either by bucket or on a monthly basis. There are usually other fees charged. WATSAN members (for example, the chairperson, secretary, caretaker, or organizer) collect the payment for water. In these regions, it is usually the caretaker and a group of women who are responsible for cleaning and maintaining the water facility. About 70 percent of the communities have access to a mechanic to undertake minor repairs. About two-thirds of the mechanics live in the community. When repairs need external assistance, the community usually contacts the area mechanic, the assembly person, or a staff member of the district administration or the Community Water and Sanitation Agency (CWSA).

Evaluation of Construction and Rehabilitation

As shown in Table 7, most of the WATSAN members did not have the opportunity to express their opinion on the contractor selected to construct or rehabilitate the facility. This percentage was especially high in the northern region.

Table 7. Percentage of WATSAN with opportunity to express opinion on the contractor selected to construct the facility

Ability of WATSAN to express opinion on the contractor	Region (% of WATSAN)			
	Upper East *n* = 57	Northern *n* = 16	Brong Ahafo *n* = 16	Western *n* = 14
Yes	32	6	31	35
No	68	94	69	65
Total	100	100	100	100

Source: IFPRI survey, 2005; IFPRI survey, 2008.

In the upper east region, 71 percent of the WATSANs hold a meeting to evaluate the work of the contractors. Usually, community representatives (including those from the WATSAN, unit committee, and District Assembly) and government agencies (including the regional CSWA, district administration, and nongovernmental organizations) were present for the meeting with the contractor. However, 81 percent of the respondents said that problems regarding construction of the facility were not addressed during the meeting. In the other three regions, the survey results show that problems were communicated to the contractor either through the district assembly or directly through a WATSAN member.

Household Surveys

This section presents descriptive statistics from the household survey. The 2005 household survey covered 292 households in the upper east region. The 2008 household survey covered 390 households in the northern region, 389 households in the Brong Ahafo region, and 388 households in the western region.

Primary Water Sources

About two-thirds of the households in the four regions have access to improved drinking water, including boreholes, protected dug wells, or public standpipes (Table 8). The upper east had the highest access (76 percent) and western region had the lowest access (57 percent) to improved water sources. The upper east region had the highest number of households using boreholes (58 percent) and fewest number of households using surface water. In the other three regions, there are more households who fetch water from surface water sources (river, lakes, and ponds), more households using public standpipes, and fewer households using boreholes compared with households in the upper east region. This difference is probably due to the existence of alterative water sources in the northern, Brong Ahafo, and western regions.

Table 8. Primary water source of households (percentage)

Water sources	Region (%)			
	Upper *n* = 161	Northern *n* = 295	Brong *n* = 359	Western *n* = 125
Improved drinking water				
Boreholes	58	24	35	30
Protected dug wells	18	10	8	16
Public standpipes	0	32	22	11
Subtotal	76	66	65	57
Unimproved water sources				
Surface water (for example, river, lake,	5	24	31	34
Others (vender, tanker, unprotected	19	10	4	9
Subtotal	24	34	35	43
Total	100	100	100	100

Source: IFPRI Survey, 2005; IFPRI Survey, 2008.
Note: we have missing observations for the primary water source of households, so the number of observations in this table is less than the total sample size.

The average time to fetch water was around 20 to 30 minutes. Households with male household heads in all four regions spent less time fetching water than households with female household heads (Table 9).

Table 9. Average time to access water (in minutes) by household head (gender)

Household head (gender)	Region (access in minutes)			
	Upper East	Northern	Brong Ahafo	Western
Female	25	20	15	17
	(*n* = 41)	(*n* = 32)	(*n* = 69)	(*n* = 109)
Male	20	14	13	16
	(*n* = 250)	(*n* = 336)	(*n* = 315)	(*n* = 241)

Source: IFPRI survey, 2005; IFPRI survey, 2008.

The 2008 survey also asked for the level of satisfaction with the improved drinking water. A considerable share of households expressed satisfaction with unimproved surface-water sources (Table 10). Respondents are more content with the quantity than with the quality of surface water, which may indicate some awareness of the value of water quality.

Table 10. Households' satisfaction with quantity and quality of water (percentage)

Water source	Quantity per Region (%)			Quality per Region (%)		
	Northern	Brong Ahafo	Western	Northern	Brong Ahafo	Western
River, lake, spring	74	94	76	48	65	74
Borehole/well with pump	86	92	80	94	97	81
Well without pump	94	94	61	85	87	58
Public standpipe	90	99	84	98	99	85

Source: IFPRI Survey, 2008

Besides the WATSAN and household surveys, the 2008 surveys also included a community survey that provided information about the number of communities that have WATSANs. Merging this information with the household survey, one can compare the satisfaction of households who reside in WATSAN communities with the satisfaction of households in communities without a WATSAN. The results are presented in Table 11. Households located in communities with WATSANs are more satisfied with drinking water, both regarding quantity and quality. The difference is statistically significant (all p values are significant at 10%). While this can be seen as a possible indication for the effectiveness of WATSANs in improving drinking water supply, a simple comparison of means is not sufficient to establish causality in this regard.

Table 11. Percentage of households satisfied with the quantity and quality of water from primary sources

	All water sources (%)	Borehole with pump (%)
Quantity		
Community with WATSAN	87	88
	(*n* = 468)	(*n* = 175)
Community without WATSAN	78	79
	(*n* = 357)	(*n* = 85)
P-Value for Pearson's chi-squared	0.001***	0.052*
Quality		
Community with WATSAN	85	96
	(*n* = 443)	(*n* = 161)
Community without WATSAN	77	85
	(*n* = 298)	(*n* = 74)
P-Value for Pearson's chi-squared	0.005***	0.005***

Source: IFPRI Survey, 2005; IFPRI Survey, 2008.
Note: * denotes statistical significance at 10 per cent level; *** denotes statistical significance at 1 per cent level

Payment for Water

Table 12 presents the survey findings regarding the payment for water. The contribution to construction ranged from 79 percent in the upper east to 11 percent in the western region. Payment by volume was most common in the Brong Ahafo region.

Table 12. Type of payment for use of water (percentage of households)

	Region (% households)			
Type of payment	Upper East	Northern	Brong Ahafo	Western
Contribution toward construction	79	45	43	11
Pay for maintenance and repair	N/A	38	11	11
Payment for use of water (time unit)	N/A	44	6	7
Payment for use of water (volume)	N/A	37	67	31

Source: IFPRI Survey, 2005; IFPRI Survey, 2008.
Note: N/A means nonavailable.

Household Participation in Improving Water Services

In the three regions covered by the 2008 survey, 10 percent of the households indicated that they approach somebody if they are dissatisfied with the water quality or quantity. As shown in Table 13, most approach the district assembly member. On average, only about 11 percent of households would approach WATSANs, which may be linked to the limited presence of the WATSANs. Household members who approach WATSANs tend to be more satisfied with the action taken than household members who approach others. In the upper east region, a similar survey question was asked. In this region, the traditional chief, or other traditional official, was considered by the households as most helpful with regard to addressing water-related problems.

Table 13. Action taken when dissatisfied with water quality or quantity (percentage of households that contacted agent)

Authority approached	Total	Region (%)			Percentage satisfied
		Northern	Brong Ahafo	Western	
	n = 100	*n* = 38	*n* = 16	*n* = 46	
WATSAN member	11	13	19	7	80
Unit committee member	9	11	6	9	50
District Assembly member	52	45	56	56	65
Other	28	31	19	28	50
Total	100	100	100	100	

Source: IFPRI Survey, 2005; IFPRI Survey, 2008.

Table 14 indicates the extent to which household members participate in meetings related to water services. In the three regions covered by the 2008 survey, about one-third of the household members attend meetings to discuss water payments or maintenance of water resources. About one-fourth of the household members attend community meetings called by the WATSANs. In the upper east region, the survey asked whether households participate in meetings held to evaluate the work of the contractor. Sixty-eight percent of the surveyed households participated in such meetings.

Table 14. Participation in water-related meetings (percentage of households)

Type of meeting	Household Participation (%)
Meeting to discuss water payments or maintenance of water resources	35
Community meeting called by the WATSAN committee	25
Meeting of the WATSAN committee (for committee members)	10

Source: IFPRI Survey, 2008.

6. REGRESSION ANALYSIS

This section presents the findings of a set of regression analyses. These analyses were conducted only for the 2008 survey data because the 2005 survey did not include sufficient information on the variables of interest for this analysis. Because the dataset consists of cross-sectional data rather than a panel, the possibilities to establish causality are limited. However, the analyses provide interesting findings on variables that are associated with outcomes of interest and that can be further explored in future studies.

Community Level Analysis

This section compares the characteristics of communities that have a functioning WATSAN with communities without a functioning WATSAN. A WATSAN is considered functioning if the members have met at least once in the year prior to the survey. The survey covered 220 communities, out of which 200 had a WATSAN. However, only 90 communities had a WATSAN that had met at least once during the previous year (accounting for 45 percent).

Table 15 examines whether the differences in the means of variables capturing community characteristics are significant. We found statistically significant differences in means of the following variables between communities with and without functioning WATSANs: contribution of labor or cash, the number of ethnic groups in the village, and the number of community groups in the village. In line with the findings from the literature, a higher number of community groups had a positive effect. A high number of ethnic groups in the village had a negative effect, which might be linked to lower levels of social capital in villages with more ethnic diversity.

Table 15. Main characteristics of communities with and without functioning WATSANs

Community's main characteristics	Total		Functioning WATSAN		Unfunctioning WATSAN		Difference P-value
	Mean	Obs.	Mean	Obs.	Mean	Obs.	
Contribution of land	0.52	199	0.56	89	0.48	110	0.262
Contribution of labor	0.64	199	0.72	89	0.58	110	(0.044)**
Monetary contribution	0.36	199	0.45	89	0.29	110	(0.021)**
Contribution in-kind	0.11	199	0.11	89	0.10	110	0.778
Ethnic groups	3.14	196	2.87	87	3.36	109	(0.049)**
Community groups	2.46	194	3.15	88	1.89	106	(0.000)***

Source: IFPRI Survey, 2005; IFPRI Survey, 2008.
Notes: 1) * denotes statistical significance at 10 per cent level;** denotes statistical significance at 5 per cent level; *** denotes statistical significant at 1 per cent level. 2) "OBS." stands for observations.

To further explore the impacts of community characteristics, the following regression model (reduced form) was estimated:

$$Function = \beta_0 + \beta_1' X + \beta_2' D + \beta_3' Z + u \quad . \tag{1}$$

Function is the dependent variable, which is the functioning index for the WATSAN explained above is a vector of basic community characteristics, including the community's location, its contribution to the water source, and some measures of social capital, which are further specified in appendix Table A.2. is a vector of the district dummies (for the six districts covered by the 2008 survey). Because local leadership has been identified in the literature as an important factor, the regression also includes a vector, which captures leadership. The community survey included a question on opinion leaders in the village. The pre-test for the survey showed that this is a commonly used and well-understood term in rural Ghana. The respondents of the community survey listed the recognized opinion leaders in their village, including their age, gender, occupation, ethnic group, other positions held, and length of time for which the person

had been recognized as an opinion leader in the community. Appendix Table A.3 displays a matrix that shows the correlations between the leadership variables and the variables that measure social capital: the number of community groups and the number of ethnic groups. Except for the negative correlation between length of leadership and ethnic groups, the correlations between the respective variables are rather low.

Table 16 presents the findings of the probit estimate for the functioning of a WATSAN in the community. Column (1) presents the regression results with only basic community characteristics as explanatory variables. In column (2), district dummies are added as controls. In column (3) the local leadership variables are included. From column (1) to column (3), both the Pseudo R square and Wald chi (2) statistics are increasing, implying that both district differences and local leadership matter for predicting whether or not a WATSAN is functioning.

Table 16. Probit estimation of functioning WATSANs

Dependent variable: Functioning WATSAN	(1)		(2)		(3)	
	Coeff.	Mar. Eff.	Coeff.	Mar. Eff.	Coeff.	Mar. Eff.
Community location						
Distance to school	-0.098	-0.039	-0.104	-0.041	-0.1	-0.039
	(1.72)*		(2.03)**		(1.93)*	
Distance to health facility	-0.007	-0.003	-0.012	-0.005	-0.015	-0.006
	(0.73)		(1.10)		(1.38)	
Community contribution						
Contribution of land	-0.065	-0.026	-0.146	-0.057	-0.163	-0.064
	(0.28)		(0.59)		(0.67)	
Contribution of labor	0.126	0.054	0.148	0.058	0.128	0.05
	(0.53)		(0.61)		(0.53)	
Monetary contribution	0.447	0.176	0.409	0.161	0.37	0.146
	(2.07)**		(1.86)*		(1.68)*	
Contribution in-kind	0.135	0.054	0.154	0.061	0.097	0.038
	(0.42)		(0.46)		(0.29)	
Community social capital						
Ethnic groups	-0.098	-0.039	-0.067	-0.026	-0.087	-0.034
	(1.67)*		(0.85)		(1.10)	
Community groups	0.235	0.093	0.220	0.087	0.233	0.092
	(4.38)***		(3.42)***		(3.46)***	
District dummies	No		Yes		Yes	
Community local leaders						
Leader numbers					0.079	0.031
					(1.36)	
Leader age					0.011	0.004
					(1.05)	
Female leader proportion					-1.192	-0.469
					(1.51)	
Leader duration					-0.071	-0.028
					(1.73)*	

Table 16. Continued

Dependent variable: Functioning WATSAN	(1)		(2)		(3)	
	Coeff.	Mar. Eff.	Coeff.	Mar. Eff.	Coeff.	Mar. Eff.
Constant	-0.544		-0.953		-1.318	
	(1.74)*		(2.24)**		(1.64)	
Observations	189		189		187	
χ^2	36.61		41.91		50.05	
Pseudo-R square	0.1291		0.1657		0.1877	
Log pseudo likelihood	-113.09		-108.31		-104.51	

Source: IFPRI Survey, 2005; IFPRI Survey, 2008.
Note: 1) Definition and descriptive statistics of the variables are listed in Appendix A2; 2) "coeff." means coefficient; "Mar. Eff." means marginal effect; 3) * denotes statistical significance 10 per cent level; ** denotes statistical significance at 5per cent level%; *** denotes statistical significance level at 1 per cent level; 4) Robust z statistics in parentheses

The analysis suggests that communities that are better connected, indicated by a lower distance to a school, are more likely to have a functioning WATSAN. The indicator distance to a health facility did not show a similar effect. A monetary contribution to the drinking water facility was also significantly associated with the functioning of a WATSAN, whereas other contributions did not have a significant effect.

A higher number of community groups, as an indicator of social capital, was significantly associated with a functioning WATSAN as well. The community groups covered in the survey include groups engaged in shea butter extraction and groundnut processing, farmer based organizations, traditional drumming groups, communal labor groups, youth groups, women's groups, and others. The number of ethnic groups was only significant in the first specification (without district dummies).

Among the leadership variables, the variable indicating the duration for which the leaders had been in their position, was significantly and negatively associated with the functioning of the WATSAN. Even though it is not possible to interpret this finding without further information, it may indicate that leaders who have been in their position for a shorter period of time are more enthusiastic about supporting WATSANs.

Household Level Analysis

This section examines the factors associated with three household variables: access to safe drinking water, payment for water services, and involvement in water management. The following model is used for this analysis:

$$Y = \alpha_0 + \alpha_1 'V + \alpha_2 'W + \alpha_3 'D + \varepsilon \quad (2)$$

Y stands for the three outcomes to be examined: access of water, payment for water, and involvement in water management. *V* is a vector of household characteristics, including household demographics and wealth. *W* is a vector of community characteristics, including community infrastructure, ethnic groups, community groups, the presence of a WATSAN in the community, and leadership information; *D* is a vector of district dummies.

The descriptive statistics for the household variables are presented in Appendix Table A.4. Four variables are used to control for family wealth: Productive assets, general assets, access to electricity, and political connectedness, indicated by a family member who holds, or has held, a political position.

Use of Safe Drinking Water

Access to safe drinking water is largely a community characteristic, but households still have to make a decision to use safe drinking water. The literature quoted above indicates that even if households have access to safe water sources, they may still decide to use unsafe sources, for example, because they want to avoid paying fees.

Table 17 presents the estimation results for the use of safe drinking water. Column (1) only includes household characteristics (demographics and wealth). In columns (2), (3), and (4), general community characteristics, local leadership characteristics, and district fixed effects are added, which improves the pseudo R-squared.

The only significant household characteristic is share of young children. This may indicate that families with young children are more concerned about safe drinking water and hygiene issues. Household wealth does not have any impact on household access to water.

Table 17. Probit estimation of household's access to safe drinking water

	(1)		(2)		(3)		(4)	
	Coeff.	Marg. Eff.	Coeff.	Marg. Eff.	Coeff.	Marg. Eff.	Coeff.	Marg. Eff.
Household demographics								
Household head age	0.016	0.006	0.019	0.007	0.016	0.006	0.016	0.006
	(0.90)		(1.02)		(0.87)		(0.85)	
Household head age (squared)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(1.00)		(1.15)		(0.88)		(0.92)	
Female household head	0.044	0.017	0.137	0.051	0.076	0.029	0.181	0.067
	(0.35)		(1.04)		(0.56)		(1.29)	
Household head education	0.081	0.031	0.136	0.052	0.052	0.020	0.127	0.048
	(0.84)		(1.32)		(0.49)		(1.12)	
Share of young children	0.156	0.061	0.125	0.048	0.387	0.147	0.502	0.191
	(0.62)		(0.49)		(1.49)		(1.89)*	
Share of old people	0.190	0.073	0.214	0.082	0.297	0.113	0.367	0.139
	(0.64)		(0.71)		(0.92)		(1.15)	
Household wealth								
Productive assets	0.036	0.014	0.030	0.011	0.037	0.014	0.043	0.016
	(1.23)		(1.00)		(1.20)		(1.36)	
Durable assets	0.025	0.010	0.023	0.009	0.020	0.007	0.003	0.001
	(1.25)		(1.12)		(0.94)		(0.15)	
Electricity	0.214	0.081	0.161	0.061	0.210	0.079	0.154	0.058
	(2.16)**		(1.57)		(2.00)**		(1.40)	
Political capital	0.191	0.072	0.172	0.064	0.126	0.047	0.099	0.037
	(1.64)		(1.45)		(1.03)		(0.79)	

Table 17. Continued

	(1)		(2)		(3)		(4)	
	Coeff.	Marg. Eff.	Coeff.	Marg. Eff.	Coeff.	Marg. Eff.	Coeff.	Marg. Eff.
Community characteristics								
Amount of infrastructure			0.051	0.019	0.016	0.006	0.012	0.005
			(1.33)		(0.38)		(0.29)	
Ethnic groups			0.017	0.007	-0.012	-0.004	0.055	0.021
			(0.54)		(0.36)		(1.39)	
Community groups			0.054	0.021	0.047	0.018	-0.010	-0.004
			(2.01)**		(1.70)*		(0.27)	
WATSAN (dummy, 1 = WATSAN in community)			0.582	0.228	0.540	0.212	0.428	0.168
			(3.81)***		(3.37)***		(2.55)**	
Community leadership								
Leader numbers					0.100	0.038	0.125	0.047
					(4.44)***		(4.84)***	
Leader age					-0.010	-0.004	-0.011	-0.004
					(1.97)**		(2.13)**	
Female leader proportion					1.572	0.598	1.573	0.597
					(4.23)***		(3.95)***	
Leader duration					0.021	0.008	0.018	0.007
					(1.02)		(0.77)	
Constant	-0.424		-1.353		-1.605		-1.822	
	(0.97)		(2.83)***		(2.49)**		(2.82)***	
District dummies	No		No		No		Yes	
Observations	833		833		821		821	
χ^2	20.71		50.67		100.11		118.19	
Pseudo-R square	0.02		0.05		0.09		0.11	
Log pseudo likelihood	-546.16		-529.71		-497.34		-487.42	

Source: IFPRI Survey, 2008.
Note: 1) Definition and descriptive statistics of the variables are listed in Appendix A4; 2) "coeff." means coefficient, "mar. eff." means marginal effect; 3) * denotes statistical significance 10 per cent level ** denotes statistical significance at 5per cent level%; *** denotes statistical significance level at 1 per cent level; 4) Robust z statistics in parentheses.

A WATSAN in the community has a strong and significant impact for a household's use of safe water. If a household is located in the community with a WATSAN, the household is 17 percent more likely to use to safe drinking water (when other factors are kept constant). This could be due to two factors: First, communities that have WATSANs are more likely to have safe drinking water facilities. Second, WATSAN members may encourage families to use safe drinking water.

Community leadership also contributes to the use of safe water. If the community has more leaders, especially more female leaders, the households in it are more likely to use safe drinking water. On average, 14 percent of local leaders were female. If the proportion of female leaders rises by one

percent, the household's use of safe water increases by 0.6 percent. Again, this could be due to two reasons: First, female leaders may place more emphasis on having safe drinking water facilities established in the village. Second, female leaders may be more effective in convincing household members to use safe drinking water. Leadership age also seems to matter. The analysis suggests that younger leaders may be more effective in promoting the use of safe drinking water, which could be due to a higher awareness of younger leaders regarding the value of safe drinking water.

Payment for Water

This section provides examples of two types of payment for water services: the one time contribution for either construction or maintenance of the water source and the continuous payment for water use either based on water volume or time. In the sample, 35 percent of households had made a one-time contribution for the construction or maintenance of the water facility, and 47 percent of households paid for water use on a continuous basis.

The regression results are presented in Table 18. The first four columns cover the one-time contribution, and the other four columns cover continuous payment for water use. Columns 4 and 8 report the marginal effects of the final regressions.

The analysis indicates that female household heads and less educated household heads are less likely to make the one-time contribution to the facility, but this finding is not robust across all specifications. Political capital is the only household characteristic that is significant for all specifications. If the household has a member holding a political position in the village, the probability that this household contributes to the construction or maintenance of the water facility is 10 percent higher than for a household without such a member. This may indicate that political office holders mobilize their families to contribute to drinking water facilities. This also applies for the continuous payment for water. While wealth does not seem to matter for the one-time contribution, it seems to matter for the continuous contribution, as households with access to electricity and households with more assets are more likely to pay. Households with a larger share of older people are less likely to pay, which indicates a lower ability or willingness of such households to pay for drinking water.

In communities with a WATSAN, and in communities with more community groups, households are more likely to make a one-time contribution and to pay on a continuous basis. Leadership seems to matter as well. The number of leaders, the age of leaders, and the proportion of female leaders were all positively associated with both one time and continuous payments for water services.

Table 18. Probit estimation of household payment for water

	Contribution for water services				Payment for use of water			
Dependent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Coeff.	Coeff.	Coeff.	M. E.	Coeff.	Coeff.	Coeff.	M. E.
Household characteristics								
Household head age	-0.017	-0.005	-0.001	0.000	0.003	0.012	0.004	0.002
	(0.83)	(0.23)	(0.06)		(0.12)	(0.58)	(0.18)	
Household head age (squared)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.77)	(0.10)	(0.10)		(0.41)	(0.10)	(0.25)	
Female household head	-0.457	-0.383	-0.233	-0.080	-0.182	-0.013	0.173	0.069
	(3.24)***	(2.51)**	(1.46)		(1.36)	(0.08)	(1.09)	
Household head education	-0.304	-0.219	-0.129	-0.046	-0.052	0.032	0.019	0.008
	(2.87)***	(1.88)*	(1.04)		(0.50)	(0.28)	(0.16)	
Share of young children	-0.113	-0.188	-0.200	-0.071	-0.109	-0.04	0.134	0.053
	(0.41)	(0.65)	(0.67)		(0.41)	(0.14)	(0.44)	

Table 18. Continued

Dependent variable	Contribution for water services				Payment for use of water			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Coeff.	Coeff.	Coeff.	M. E.	Coeff.	Coeff.	Coeff.	M. E.
Share of old people	-0.048	0.122	0.146	0.052	-0.940	-0.667	-0.765	-0.304
	(0.14)	(0.34)	(0.40)		(2.59)***	(1.77)*	(1.87)*	
Productive assets	0.013	0.017	0.017	0.006	-0.024	-0.035	-0.020	-0.008
	(0.41)	(0.53)	(0.49)		-0.78	-1.05	-0.56	
Durable assets	0.003	-0.004	-0.011	-0.004	0.059	0.068	0.042	0.017
	(0.15)	(0.18)	(0.49)		(2.86)***	(3.00)***	(1.78)*	
Electricity	-0.039	0.095	0.049	0.018	0.402	0.489	0.312	0.124
	(0.37)	(0.83)	(0.39)		(3.83)***	(4.27)***	(2.56)**	
Political capital	0.219	0.220	0.260	0.096	0.107	0.037	0.143	0.057
	(1.74)*	(1.67)*	(1.94)*		(0.85)	(0.28)	(1.06)	
Community characteristics and leadership								
Amount of infrastructure		-0.053	-0.093	-0.033		0.024	-0.018	-0.007
		(1.06)	(1.71)*			(0.52)	(0.37)	
Ethnic groups		-0.048	0.000	0.000		-0.009	0.069	0.027
		(1.26)	-0.01			(0.23)	(1.48)	
Community groups		-0.007	-0.093	-0.033		0.146	0.104	0.041
		(0.21)	(2.30)**			(4.08)***	(2.38)**	
WATSAN (dummy, 1 = WATSAN in community)		0.473	0.470	0.152		0.749	0.929	0.325
		(2.45)**	(2.43)**			(4.04)***	(4.01)***	
Leader numbers		0.061	0.094	0.034		0.043	0.072	0.029
		(2.39)**	(3.09)***			(1.63)	(2.44)**	
Leader age		0.023	0.017	0.006		0.009	0.005	0.002
		(4.15)***	(2.91)***			(1.64)	(0.85)	
Female leader proportion		0.930	0.877	0.314		1.862	1.558	0.619
		(2.42)**	(2.17)**			(4.55)***	(3.20)***	
Leader duration		0.034	-0.025	-0.009		0.066	0.065	0.026
		(1.52)	(0.94)			(2.88)***	(2.33)**	
Constant	0.163	-2.400	-2.466		-0.590	-3.689	-3.758	
	(0.34)	(3.32)***	(3.32)***		-1.21	(5.03)***	(5.06)***	

Source: IFPRI Survey, 2008.
Note: 1) Definition and descriptive statistics of the variables are listed in Appendix A4; 2) "coeff." means coefficient, "mar. eff." means marginal effect; 3) * denotes statistical significance 10 per cent level; ** denotes statistical significance at 5per cent level%; *** denotes statistical significance level at 1 per cent level; 4) Robust *z* statistics in parentheses.

Involvement in Water Management

This section presents the factors associated with three types of household involvement in drinking water management: attending a WATSAN meeting; attending a water-related meeting; and communication with a WATSAN member. The first two types are binary choices, and the last one is a ranked discrete choice (covering the following categories: never, a few times a year, once or less than once per month; several times a month). The estimation results are presented in Table 19.

With regard to household characteristics, both productive assets and political connectedness are significantly and positively associated with all three forms of participation. Households with more young children are more likely to attend water-related meetings, which—as indicated above—may reflect a higher awareness among those households. Female-headed households are less likely to engage in any of the three forms of participation, which may be related to the high opportunity costs of time or social constraints of female household heads to engage in these types of interaction.

Regarding community characteristics, the regression indicates that communities with more leaders, especially with more senior leaders, and with leaders who have been in that position for longer periods of time, tend to have more households involved in water management. Moreover, the existence of a WATSAN encourages the household to attend water-related meetings.

Table 19. Estimation of household involvement in water management

Dependent variable	Probit Model						Ordered Probit	
	Attend WATSAN meeting			Attend water-related meeting			Talk to WATSAN	
	Coeff.	Coeff.	M. E.	Coeff.	Coeff.	M. E.	Coeff.	Coeff.
Household characteristics								
Household head age	0.013	0.027	0.009	0.013	0.033	0.013	-0.002	0.005
	(0.58)	(1.03)		(0.57)	(1.40)		(0.11)	(0.30)
Household head age (squared)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.09)	(0.89)		(0.19)	(1.10)		(0.49)	(0.03)
Female household head	-0.697	-0.048	-0.016	-0.404	-0.047	-0.019	-0.790	-0.605
	(4.59)***	(0.26)		(2.82)***	(0.30)		(5.83)**	(4.17)***
Household head education	-0.455	0.045	0.016	-0.280	0.053	0.021	-0.188	-0.007
	(4.06)***	(0.31)		(2.50)**	(0.41)		(1.98)**	(0.06)
Share of young children	0.528	0.326	0.113	0.728	0.573	0.225	0.322	0.367
	(1.73)*	(0.93)		(2.42)**	(1.76)*		(1.31)	(1.38)
Share of old people	-0.747	-0.043	-0.015	-0.412	-0.029	-0.011	-0.541	-0.363
	(1.83)*	(0.09)		(1.15)	(0.08)		(1.94)*	(1.20)
Productive assets		0.076	0.026	0.081	0.074	0.029	0.122	0.137
		(2.09)**		(2.51)**	(2.11)**		(4.48)**	(4.53)***
Durable assets		-0.018	-0.006	-0.025	-0.022	-0.009	-0.011	-0.024
		(0.67)		(1.14)	(0.90)		(0.53)	(1.09)
Electricity		-0.089	-0.030	-0.148	-0.023	-0.009	0.05	0.022
		(0.62)		(1.33)	(0.18)		(0.51)	(0.20)
Political capital		0.443	0.162	0.422	0.401	0.159	0.413	0.424
		(3.09)***		(3.24)***	(2.88)***		(3.81)**	(3.80)***

Table 19. Continued

Dependent variable	Probit Model						Ordered Probit	
	Attend WATSAN meeting			Attend water-related meeting			Talk to WATSAN	
	Coeff.	Coeff.	M. E.	Coeff.	Coeff.	M. E.	Coeff.	Coeff.
Community characteristics and leadership								
Amount of infrastructure		0.092	0.032		-0.077	-0.030		0.022
		(1.70)*			(1.43)			(0.55)
Ethnic groups		-0.035	-0.012		-0.032	-0.012		-0.014
		(0.66)			(0.67)			(0.36)
Community groups		0.029	0.010		0.027	0.011		0.031
		(0.63)			(0.63)			(1.03)
Leader numbers		0.043	0.015		0.055	0.022		0.077
		(1.33)			(1.81)*			(3.09)***
Leader age		0.024	0.008		0.018	0.007		0.013
		(3.49)***			(2.86)***			(2.52)**
Female leader proportion		0.529	0.183		0.753	0.296		0.509
		(1.09)			(1.62)			(1.44)
Leader duration		0.105	0.036		0.010	0.004		0.017
		(3.40)***			(0.35)			(0.73)
WATSAN (dummy, 1 = WATSAN in community)					0.653	0.235		
					(3.40)***			
Constant	-0.703	-4.908		-0.706	-3.661			
	(1.27)	(5.23)***		(1.32)	(4.54)***			
District dummies	No	Yes		No	Yes		No	Yes
Observations	635	623		647	635		749	737
χ^2	42.63	146.64		57.33	124.43		120.19	191.25
Pseudo-R square	0.07	0.25		0.07	0.15		0.07	0.12
Log pseudo likelihood	-377.55	-300.03		-411.91	-370.16		-817.15	-763.74

Source: IFPRI Survey, 2008.
Note: 1) Definition and descriptive statistics of the variables are listed in Appendix A4; 2) "coeff." means coefficient; "mar. eff." means marginal effect; 3) * denotes statistical significance 10 per cent level; ** denotes statistical significance at 5per cent level%; *** denotes statistical significance level at 1 per cent level; 4) Robust *z* statistics in parentheses.

7. CONCLUSIONS

The analysis of the community-based approach to provide drinking water in Ghana confirms some of the findings of the earlier literature on this topic. Water and sanitation committees (WATSANs) are more likely to function in communities that already have higher levels of social capital, as indicated by the number of functioning community-based organizations. This study indicates that communities with more ethnic diversity may have more difficulties in establishing functional WATSANs, a finding that is in line with other recent findings on the link between ethnic diversity and rural service provision (Akramov and Asante 2009). Already existing elements of community infrastructure, such as schools, may also promote the functioning of WATSANs.

The analysis also indicates that communities that manage to establish a functioning WATSAN benefit from WATSAN activities. There is a tendency of higher satisfaction with drinking water quantity and quality in communities with WATSANs, and WATSANs seem to encourage households to use safe drinking water and to pay for it on a regular basis. They also seem to be effective in mobilizing funds for the construction of drinking water facilities. Where they exist, WATSANs are also channels for addressing community members' problems with drinking water facilities, and the community members who use this channel tend to be more satisfied with their action than those who approach other officials.

While confirming earlier findings, the study adds some new aspects to the literature on community-based drinking water management. The descriptive results suggest the WATSANs do not necessarily function because of regular competitive elections, even though they are usually set up according to this logic. It seems that community recognition creates a stronger mechanism for accountability, as is indicated by the large share of WATSANs that do not hold regular competitive elections, but rather elect a new member only when WATSANs become dissatisfied with the performance of a WATSAN member or when a member passes away.

This paper also highlights the role of local leadership. While this factor is also mentioned in other papers on this topic, this paper goes one step further by using empirical data on local leadership. The analysis suggests that in addition to WATSANs, the number, gender, age, and length of tenure of local leaders matter for different aspects of drinking water supply. Of importance, female leaders seem to play a role in supporting access to and use of safe drinking water. This finding is in line with a paper by Chattopadhyay and Duflo (2004), which indicated that female political leaders are effective in providing public services valued by women.

The study also revealed some limitations regarding the authority that has been transferred to WATSANs. In particular, the study indicates that WATSANs are hardly involved in the choice of the contractors in charge of establishing drinking water facilities. Likewise, neither they nor the community members have adequate opportunities to express discontent with the contractor's work when they observe problems. Addressing this shortcoming might be important to support the functioning of the WATSANs because the literature reviewed for this paper suggests that the success of such community organizations depends on their involvement in all stages of establishing an improved drinking-water supply and on the quality of the construction of the drinking water facilities.

Future research may be useful to find out why female-headed households are less likely to participate in water-related activities, such as WATSAN and other water-related meetings. According to this study, female household heads are also less likely to contact WATSAN members. Further research may throw light on the question of whether this is due to limited time availability of female household heads, social constraints, or other reasons. It may also be useful to find out to what extent female spouses of male-headed households participate in water management activities. On this basis, strategies for increasing women's involvement in decisionmaking on water management could be developed.

Finally, the paper suggests that more research is needed on how to improve the drinking water supply in those communities that do not have conditions that are conducive for forming WATSANs. Communities that are ethnically diverse and communities that have a low level of other community-based organizations are in this category. Future research may concentrate on the question of whether higher levels of community facilitation and a more intensive training of WATSAN members can address the problem of whether other approaches are needed to make sure that all communities gain access to safe drinking water.

APPENDIX: SUPPLEMENTARY TABLES

Table A.1. Distribution of surveyed WATSANs by region and district

District	WATSAN
Upper East Region (2005 survey)	
Bawku Municipal	6
Bawku West	6
Bolgatanga	6
Bongo	19
Builsa	6
Garu	5
Kasena Nankana	8
Talensi-Nabdam	5
Subtotal	*61*
Northern Region (2008 survey)	
Tolon Kumbungu	12
West Gonja	5
Subtotal	*17*
Brong Ahafo Region(2008 survey)	
Kintampo South	7
Wenchi	10
Subtotal	*17*
Western Region (2008 survey)	
Amenfi East	4
Wassa West	11
Subtotal	*15*

Source: IFPRI Survey, 2005; IFPRI Survey, 2008

Table A.2. Definition and descriptive statistics for community variables

Variable	Definition	Obs.	Min.	Max.	Mean
Dependent variable					
WATSAN function index	Dummy, 1 = WATSAN had at least one meeting held last year	200	0	1	0.45
Independent Variables					
Location					
Distance to school	Distance from the community to primary school, km	199	0	19	0.51
Distance to health facility	Distance to health facility (hospital, clinic, etc.), km	199	0	70	5.13
Contribution					
Contribution of land	Dummy, 1 = community has contributed land to infrastructure	199	0	1	0.52
Contribution of labor	Dummy, 1 = community has contributed labor to infrastructure	199	0	1	0.64
Monetary contribution	Dummy, 1 = community has contributed money to infrastructure	199	0	1	0.36
Contribution in kind	Dummy, 1 = community has contributed in-kind to infrastructure	199	0	1	0.11
Social capital					
Ethnic groups	Total number of ethnic groups in the community	196	1	6	3.13
Community groups	Total number of community groups (farmer org., women's group, etc.)	194	2.5	0	9
Local leadership					
Leader numbers	Number of opinion leaders in the community	200	1	10	6.43
Leader age	Average age of opinion leaders in the community	198	29	94.3	55.7
Female leader proportion	Proportion of female leaders numbers to the total leader numbers	200	0	0.75	0.14
Leader duration	Average year of opinion leaders' duration in the position	199	0.50	10	7.61

Source: IFPRI Survey, 2008.

Table A.3. Correlation between social capital and leadership in communities

	No. of leaders	Age of leaders	Female leader (proportion)	Duration in the position	No. of community groups	No. of ethnic groups
No. of leaders	1.0000					
Age of leaders	-0.1601	1.0000				
Female leader proportion	0.2391	0.0279	1.0000			
Duration in the position	-0.1225	0.2720	-0.1327	1.0000		
No. of community groups	0.1069	0.0092	0.1977	0.1507	1.0000	
No. of ethnic groups	0.1918	-0.1639	0.1758	-0.3548	-0.1936	1.0000

Source: IFPRI Survey, 2008.

Table A.4. Definition and descriptive statistics for household variables

Variable	Definition	Obs.	Min.	Max.	Mean
Dependent variables					
Access to water	Dummy, 1 = household access to safe drinking water, 0 = otherwise	849	0	1	0.61
Contribution	Dummy, 1 = household makes contribution for either construction or maintenance of water source, 0 = otherwise	725	0	1	0.35
Payment	Dummy, 1 = household pays for use of water, either based on volume or time, 0 = otherwise	725	0	1	0.47
Water meeting	Dummy, 1 = household participates in water-related meetings or discussions, 0 = otherwise	660	0	1	0.44
WATSAN meeting	Dummy, 1 = household participates in WATSAN committee meeting	647	0	1	0.33
Water talk frequency	Frequency of household members who talk to WATSAN member, 1 = never, 2 = a few times a year, 3 = once or less than once per month, 4=several times a month	762	1	4	1.95
Independent Variables					
Household Demographics					
Household head age	Age of household head	834	18	91	47
Female household head	Dummy, 1 = female household head, 0 = otherwise	847	0	1	0.18
Household head education	Dummy, 1 = household head can read, 0 = otherwise	847	0	1	0.46
Share of young children	Proportion of children (6 years or younger) to the total number of household members	850	0	0.8	0.17
Share of old people	Proportion of old people (60 years or older) to the total number of household members	850	0	1	0.08
Household Wealth					
Productive assets	Total number of household agricultural assets (for example, donkey cart, plow, ax, etc.)	850	0	10	2.8
Durable assets	Total number of household durable assets (for example, TV, radio, bicycle, watch, etc.)	850	0	14	3.6
Electricity	Dummy, 1 = the main source of lighting for the dwelling is electricity, 0 = otherwise	850	0	1	0.36
Political assets	Dummy, 1 = someone in the household has held political or village office, 0 = otherwise	850	0	1	0.19

Source: IFPRI Survey, 2008.

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2033 K Street, NW
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Fax: +1-202-467-4439
Email: ifpri@cgiar.org

IFPRI ADDIS ABABA

P. O. Box 5689
Addis Ababa, Ethiopia
Tel.: +251 11 6463215
Fax: +251 11 6462927
Email: ifpri-addisababa@cgiar.org

IFPRI NEW DELHI

CG Block, NASC Complex, PUSA
New Delhi 110-012 India
Tel.: 91 11 2584-6565
Fax: 91 11 2584-8008 / 2584-6572
Email: ifpri-newdelhi@cgiar.org