Natural Resources
FORUM

Natural Resources Forum 31 (2007) 142–150

Analysis of a rural water supply project in three communities in Mali: Participation and sustainability

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Abstract

This paper presents a qualitative assessment of the participatory water management strategies implemented at the community level in rural Mali through a water supply project — The West Africa Water Initiative (WAWI) — coordinated by World Vision International, a non-governmental and humanitarian organization. Data for the study were generated through a combination of primary and secondary sources in three villages. Results of the study indicate that while community-based rural water supply is a positive step in responding to the needs of rural Malians, the installation of boreholes with hand pumps informed merely by consultative participatory approaches and limited extension involvement will not necessarily proffer sustainable rural water supply in the region. A "platform" approach to rural water supply management that can mobilize the assets and insights of different social actors to influence decision making at all stages, including the design and choice-of-technology stages, in water supply interventions is instead advocated.

Keywords: Participatory water management; Rural water supply; West Africa Water Initiative (WAWI); Community participation and sustainability; Water supply management.

1. Introduction

In the semi-arid regions of the Sahel, water scarcity constitutes a significant limiting factor for sustainable development (Williams, 1998). Rural Africans have the lowest level of access to clean water and sanitation facilities compared to other developing areas of the world (UNESCO-WWAP, 2003). In Mali, a country in the Sahel, problems of water scarcity have become even more severe since the droughts of the 1970s and 1980s. A lack of access to water affects agricultural productivity, food security and people's livelihoods (Akuoko-Asibey, 1997). At the village level, water scarcity has triggered local "water wars" between villages, and conflicts among community members over competing priorities for water (Ostrom, 1990).

In the last decades, the provision of potable water for domestic and rural livelihood needs has moved to centre stage on the international development agenda and in the interventions of many non-governmental organizations and national governments (Narayan, 1993). The General Assembly of the United Nations drew critical attention to the importance of water to sustainable development and poverty alleviation by declaring 2003 the International Year for Freshwater. In that same year, the Millennium Development Goals targeted to reduce by half the proportion of people without access to safe drinking water and sanitation by 2015 in acknowledgement of this problem (UN, 2003).

Accomplishing these goals, however, constitutes a critical challenge as the results of water supply interventions in rural communities have been mixed so far. Some analysts have suggested that this is in part due to the engineering and technological determinism that has accompanied design considerations. In planning for water supply in poor communities in the developing world, technological design specifications have been dominated by the donor and implementing agencies, while communities have been typically left out of this critical design and planning phase. Emerging perspectives in the last decades have compellingly indicated that technology adoption and sustainable management of water supply innovations are determined by complex social forces and social relations that shape people's choice of technology, and water use behaviours (Vincent, 2003). Singh *et al.* (2005), for example, in a recent case study of a community water supply program in India crystallized the importance of overlapping socio-cultural factors (gender, ethnicity, caste, religion) as

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Published by Blackwell Publishing Ltd., 9600 Garsington Road, Oxford, OX4 2DQ, UK and 350 Main Street, Malden MA 02148, USA.

critical determinants of exclusion and access to water supply innovations. This suggests that for water supply management to be sustainable, local people must be encouraged to negotiate, communicate, learn and arrive at joint decisions that reflect community choices and preferences. This has been described as a platform approach in which extension is seen as among the most appropriate institutional mechanisms for facilitating such a process (Christoplos, 1996; Röling and Wagemaker, 1998).

Other studies have shown that change in water use behaviours and sustainable management of water supply is more likely when diverse community members authentically participate in decision making, negotiation and concerted action related to water supply innovations (Narayan, 1993). It has been shown also that when choice of technology is made by an outside agency, community demands are often not met, even when such demands have been duly assessed (Singh *et al.*, 2005). Vincent (2003) put it most aptly when she suggested that hydrological projects be challenged alongside the promotion of participatory processes and democratic partnerships in order to bring about poverty-focused actions for water management.

There is overwhelming convergence in the view that sustainability of water supply innovations such as hand pumps is engendered when diverse community stakeholders and local institutions are included as partners and take a central role in decision making for innovations design, planning and management (Mangin, 1991; Williams, 1998; Bah, 1992). Yet although these considerations for stakeholder participation in water supply management are being magnified at all levels, there are relatively few empirical assessments of how participatory processes actually operate within projects, and how different modes of participation affect water project outcomes or impacts.

People's participation in the management of natural resources has been shown to lead to a number of benefits, including increased effectiveness and acceptability of management actions (Esman and Uphoff, 1984), increased trust between communities and agencies (government and non-governmental) and reduced transaction costs (Uphoff and Wijayaratna, 2000). But, as has been widely critiqued, participation is neither a straightforward nor an inherently objective process or phenomenon (Cleaver, 2001; Mosse, 2001). For participation to be authentic, it must move beyond common definitions that equate social inclusion with democratic engagement. An authentic participatory resource management process can be viewed as one that acknowledges the existence of social locators, including caste, gender, age and ethnicity that differentially determine who participates, when, and how in decision making over access to resources in the community. An authentic participatory process is one that makes concerted efforts to bring all voices into deliberative decision making at all points in the decision making process. Such an understanding of participation can illuminate otherwise subsumed power relations, control and concealed interests in rural communities that if left unattended, undermine the long-term sustainability of development interventions.

This article presents a case study of participatory water resource management in three communities in central Mali, supported through a recent initiative, the West Africa Water Initiative (WAWI). The three communities — Yandianga, Benebourou and Ogodouroukoro — are in the Koro district, one of the WAWI target regions in the country. The study assessed the impact of stakeholder participation on the management of water sources; it examined (a) choice-of-technology preferences, and (b) water use patterns for domestic and agricultural purposes among stakeholders in the project intervention zone with a view toward its implications for sustainability in rural water supply.

2. Background

Mali is a landlocked nation covering an area of 1,240,000 km^2, the northern three-quarters of which lie within the Saharan and Sahelian zones (Figure 1). The country is home to approximately 11 million residents, 80% of whom live in rural areas. Agricultural activities, mainly cotton production and livestock husbandry, occupy 70% of Mali's labour force and provide 37% of the GDP (US Department of State, 2005). Cotton production activities typically take place in the southern parts of the country below the 13th parallel. This region is the most humid of the country with an average precipitation range between 800 and 1,500 mm per year. North of these sub-humid and humid regions, rain-fed subsistence farming of cereals (millet and sorghum), animal husbandry, and irrigated paddy rice cultivation along the major rivers remain the principal economic activities despite inherently poor soils and highly variable rainfall. The study region, Koro district, is characterized as semi-arid with an annual precipitation of approximately 500 mm per year, and daytime temperatures typically exceeding 33 °C throughout the year.

Koro's water resources are severely limited as there are no permanent rivers or lakes in the district. During the rainy season, small surface water reservoirs fill with water and become the primary sources of water for the villages of the district. At the onset of the dry season, these surface reservoirs begin to dry up and groundwater becomes the only available source of water for the remaining seven to eight months of the year, affecting tremendously the ability of households to meet their livelihood and food security needs.

Launched in 2003 by a consortium of 13 donors, development agencies and knowledge generating institutions, WAWI aims to provide tangible support to rural populations within Mali, Niger and Ghana through improved rural water supply, participatory natural resource management, and capacity building at community and organizational levels. It also focuses on hygiene promotion and sanitation around established boreholes within the selected communities in the target regions, of which Koro is one. The principal

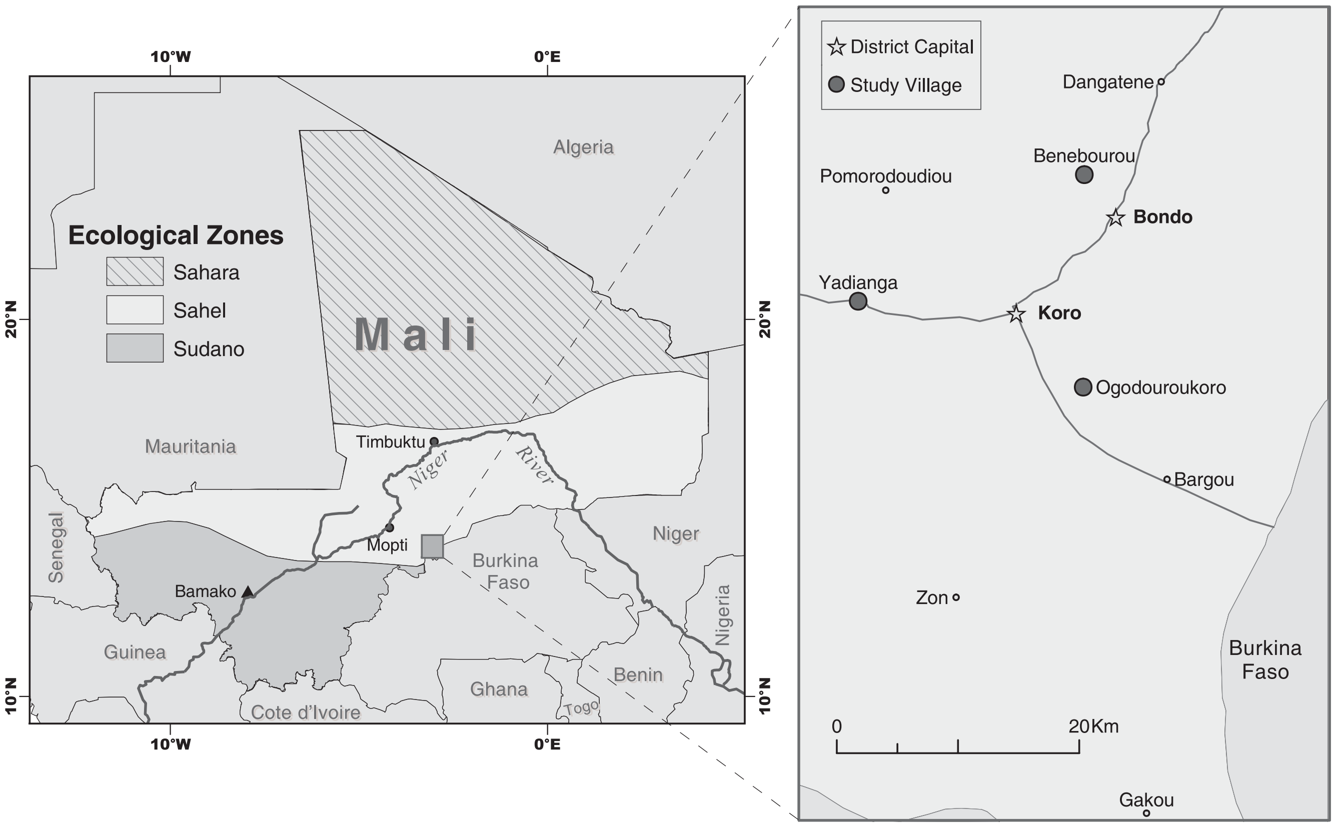

Figure 1. Map of study area.

and coordinating member of the WAWI consortium in Mali is World Vision. Their main activity within WAWI is to provide sustainable access to potable water by drilling boreholes, equipping these with India-Mali Mark II hand pumps and establishing community-based maintenance and hygiene groups. The WAWI target communities to receive boreholes are selected by World Vision in collaboration with local municipal governments. Pump selection (i.e., India-Mali Mark II) was based solely upon World Vision's previous rural water supply development experience in Ghana (World Vision — Ghana Rural Water Project) where the hydrogeological conditions are much more favourable than those found in the WAWI interventions zones in Mali (ARD, Inc., 2004). After installation of the hand pumps, World Vision maintains a stock of spare parts at their local headquarters and monitors the progress of the hygiene and maintenance groups for each community.

The three villages of the current study, Yadianga, Ogodouroukoro and Benebourou, are ethnically Dogon villages located within the WAWI intervention zone of Koro and are within 12 km of each other. While millet cultivation is the major livelihood activity for the populations of this region of Mali in general, the residents of each village have secondary income generating activities that are significantly different depending upon resource availability. Vegetable gardening is prominent in Benebourou due to an abundant and readily available water supply; selling of firewood and charcoal is more significant in Ogodouroukoro due to the proximity of a small scrub forest; and transportation and regional commerce is prominent in Yadianga due to its location along a major transportation axis (Mopti-Burkina Faso road).

3. Materials and methods

Data were generated through a combination of primary and secondary sources. The villages and households of study were selected in close consultation with World Vision field staff permanently residing in the region and familiar with the villages' dynamics. The main selection criteria for the villages were: 1) the existence of at least one manual pump and one large-diameter well; 2) a village population between 500 and 2,500; and 3) access to groundwater at significantly different depths.

The principal researcher spent approximately six weeks residing in each village studied and was able to directly observe water-use behaviour as well as conduct formal and informal surveys with residents of each village. The formal survey instrument developed included both structured and open-ended questions. This was administered to head women of 10 households per village (30 women total) with each sample cluster representing an ethnic group in each village. The rationale for this selection was in part informed by evidence-based published literature on women's major participation in water resource management, and through direct observation of women's primary role in water provision and distribution at the household level. Focus group sessions were held with the following groups in the communities studied: village council, village women's groups, village hygiene groups and World Vision extension staff operating in the specific communities. In addition, informal unstructured interviews were held with a randomly selected sample of 60 men (20 men per village). In all cases, consultation with World Vision and village representatives led to the selection of a representative cross-section of the study population that included all ethnic groups in the community.

It was deemed necessary to generate information from diverse stakeholders in order to reveal gender and other social determinants of participation in water use and water supply management. Thus key informant interviews were also undertaken with regional representatives of institutions involved in water management projects — World Vision, CARE International, the Direction Regionale de l'Hydraulique et de l'Energie du Mali–Mopti (DRHE–Mopti) — and district mayors and pump managers from each of the selected villages in order to capture their different perspectives.

4. Findings and discussion

4.1. Sources of water

The three villages studied relied entirely on groundwater and seasonal rainfall captured in small storage reservoirs to meet their water demands. Based on survey responses, groundwater is accessed through two primary sources — large-diameter wells (2 m diameter) and boreholes equipped with manual pumps.

These villages feature very different groundwater availability. The village of Yadianga (pop. 2,473 est. 2001) has yearly access to a superficial unconfined aquifer (28 m) and a deeper confined aquifer (54–82 m). The shallow aquifer is accessed via four community large-diameter wells (2 m diameter) and four boreholes equipped with India-Mali Mark I hand pumps to access the deeper aquifer. At the time of the study, either one or two of the hand pumps were operational and two were broken down and abandoned. During the dry season, the shallow aquifer begins to dry up and water availability can become a critical issue.

A similar shallow superficial aquifer does not supply a viable amount of water to the village of Ogodouroukoro (pop. 612 est. 2001). The only groundwater source for this village is the deeper confined aquifer (75–85 m). Three community large-diameter wells and one borehole equipped with a UPM hand pump (non-operational) access this deeper aquifer and provide water for most of the dry season. Towards the end of the dry season these wells do not provide sufficient water and women will often sleep in line beside the wells in order to collect water as it becomes available or they will walk ~4 km to a neighbouring village to use other large-diameter wells (personal interview data). Ogodouroukoro typically has an acute shortage of water at the end of the dry season. Due to the difficulty in drawing water from these deep wells as well as the reported need to conserve groundwater for the dry season, the community completely abandons the deep wells during the rainy season and all of their water needs are met by the seasonal ponds that form just outside the village (~100 m).

The village of Benebourou (pop. 1,570 est. 2001) benefits from a plentiful shallow aquifer (~5 m). There are 40+ community large-diameter wells accessing this aquifer. These wells are used to provide drinking water as well as irrigation water for their extensive gardens. One borehole equipped with an India-Mali Mark I hand pump accesses a deeper aquifer (94 m). Water shortage is not a critical issue for Benebourou (personal interview data).

In all three villages, water from large-diameter wells is drawn either by hand or with the use of animal traction (e.g., camel) and an access fee must be paid to the pump committee in order to utilize the pump-fitted boreholes. This access fee consists of an initial contribution as well as shared maintenance costs as they arise and thus the fee is variable (cost of repair ÷ number of households contributing) and could come at any time.

The method to access groundwater that people chose in the study villages depended upon the individual household's preference and the current state of the available hand pumps. In one of the study villages, Yadianga, 24-hour surveys of one primary large-diameter well and the two functioning hand pumps, showed that 80% of the village's water for domestic consumption was being secured from the large-diameter wells. A survey of the hand pump managers in Yadianga revealed that only 33 households (17%) in the village were using water from pump-fitted boreholes installed in the village although there were a total of 121 households (62%) among the entire population who had at some point in the past paid for use of the pump-fitted boreholes (Table 1). This indicated that 74 households (38%) had never paid for access to the pumps and that 45% of the total households no longer considered the pump-fitted boreholes to be a worthwhile investment. Numerous reasons were revealed during household and informal interviews for not paying or wanting to pay the required access fee to use the pumps, the three most common reasons being 1) that the pumps were unreliable and that users were not guaranteed that the pumps would not break down again, 2) that the flow rate from the pumps was too slow and that it took too long to fetch water from the pumps, and 3) that the access fee was too high (Table 2).

Other reported reasons for not using the pumps included difficulty in manually operating the hand pumps, distance

Table 1. Distribution of households using pump-fitted boreholes Yadianga, 2004

Households had:	Number of households	% of total households
Paid for and were using water from pump-fitted boreholes	33	17
Paid in the past but no longer paid	88	45
Never paid	74	38

Table 2. Reasons given for not using the hand pumps (3 study villages)

Main reason for not using the hand pumps	Number of respondents claiming each reason (n = 116)
Pumps were unreliable	34
Low flow rate	25
High access fee	23
Difficulty in using the pumps	22
Distance to the pump was too far	10
Preferred taste of well water	2

to the pump and a preference for the taste of well water. Those households which did not use the pump-fitted boreholes obtained their water from the large-diameter wells which, according to survey results, were more reliable and allowed numerous users (up to 10 at a time were observed during the study) access to water at the same time.

The fact that the primary reasons given for not using the hand pumps were design related shows the importance of appropriate design for the sustainability of a water supply intervention. Appropriate design depends upon the communities' needs and preferences and without input from the diverse members of the communities it is unlikely that an externally chosen infrastructure will be appropriate. The studied communities were not consulted during the design phases of the water supply development projects that had previously operated in their villages and thus the dissatisfaction with the design of the pumping infrastructure is not surprising.

4.2. Patterns of water use

Figure 2 shows the results of the assessment of domestic water use by activity in the three study villages. Domestic water use in this study refers to surface or groundwater collected and brought to the household for use.

It can be seen that bathing was the activity that consumed the most water. Drinking represented approximately 11% of the total water use and ranked as the fourth activity in respect to the quantity of water used. The most significant variance in water use was found in the water dedicated to livestock and for washing clothes. The former is attributable to water scarcity during the driest months of the year. That is to say, in villages with deeper and less permanent access to groundwater during the dry season, water supplies may not be sufficient to meet human consumption needs, and thus livestock are not typically kept at the household for risk of losing them during the dry months. Residents who own livestock typically entrust them to a herdsman who will keep them at pasture on the outskirts of the village or up to 300 km away, depending on water and fodder availability. The variance in water use for washing clothes is due to the fact that during the rainy season the women wash clothes in the seasonal ponds and do not transport any water to the household for that purpose.

Focus group sessions with different social groups in the three communities revealed that household water provision for domestic use is primarily the responsibility of female household members who invariably have the discretionary right to decide who to recruit in this effort. Often it is the younger sisters/brothers/daughters/sons, etc., who are called to the task of water provision. While women are

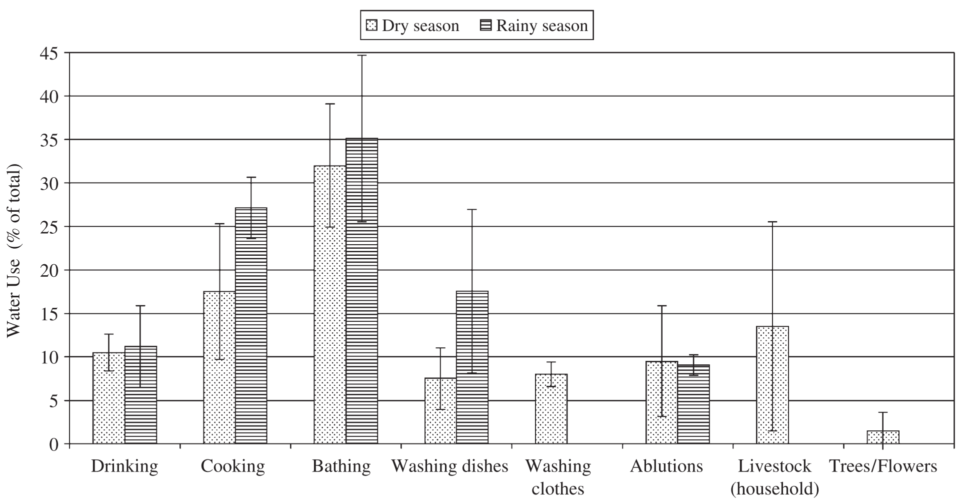

Figure 2. Average seasonal domestic water use by activity — Villages studied — 2004.

responsible for providing water for domestic use, it was found that men are typically the owners of the livestock and that they are responsible for watering their herds. The men typically call upon their sons or brothers to help them in provisioning water for livestock. It can thus be seen that in a village such as Yadianga where daily groundwater use for livestock and domestic purposes are roughly equal during the dry season (avg. 9,760 and 9,910 litres/day respectively), both men (herdsmen) and women are equally involved in the provisioning of water for their respective purposes and that both parties should be duly consulted when any decisions regarding the water supply infrastructure are being considered.

4.3. Patterns of participation in water supply development and management

Through in-depth interviews with field level staff and secondary reviews of technical reports, a picture of the participatory process employed by World Vision's WAWI Water Project in the Koro district was revealed. The process typically begins by contacting the local mayor's office to present World Vision's project objective of improving water access conditions in the region. If the mayor's office shows interest, World Vision requests from the mayor's office a list of the villages that are in most need of assistance. The lists are used as a general guide to decide where to drill boreholes and install pumps. The final decisions are then based upon three criteria: 1) the absence of a pump in the village, 2) the size of the village (population), and 3) in the case of an already existing pump, the degree of successful pump management. Once World Vision makes a final selection, the chosen villages are asked to indicate their willingness by contributing 100,000 FCFA (approx. US$ 175) to begin the process of drilling a borehole and installing an India-Mali Mark II hand pump in their village.

Based on the responses from the community development agents of World Vision and the local mayors, only India-Mali Mark II hand pumps were offered to the concerned communities and no alternative water supply options were offered. A plausible inference that can be made directly reflects what Pretty (1995) in his conceptual articulation of a typology of participation in development has described as consultative participation. Consultative participation in this context suggests that people have participated only by being consulted or asked to answer questions on decisions that have already been taken by a minority of stakeholders who have decision making power (in this case World Vision). While the WAWI World Vision Water Project may have embraced participation as a cornerstone strategy, concerted efforts need to be made to depart from a passive participatory approach that begins once the design of the water supply infrastructure has been determined and move towards a more interactive participatory process that involves the community in the design and planning phases of the project. Once again, the fact that the primary reasons given for non-use of previously installed hand pumps in the study villages were design related only seems to underscore the importance of involving the communities in a meaningful way during this key stage of the project.

4.4. Stakeholder preferences in water supply infrastructures

Opinions about the previously installed water supply infrastructure and that needed for sustainable development in the study area demonstrated that households have different preferences when it comes to choosing a water source for the community. For example, some women (44%, $n = 18$) from Yadianga stated that they would be more interested in paying fees for a centralized water tower project than for individual hand pumps that could only serve a small percentage of the village population, while most of the men interviewed (85%, $n = 20$) considered the large-diameter wells to be a sustainable and viable alternative that avoided the technical complications and high maintenance costs of the diesel/solar/wind pumps required for a centralized water tower project or of the hand pumps. These preferences, it was revealed, are determined by several intersecting factors: previous experience with various water supply infrastructures, financial status, gender, distance from the source, and water table depths.

For instance, surveyed women from Ogodouroukoro (85%, $n = 20$) who had used the UPM hand pump, installed under the FED VII (European Fund for Development project, 1996) until it became too difficult to use (i.e., until it broke down), and who depended upon groundwater from great depths (~75 m), were no longer interested in hand pumps and the three women who chose pumps qualified their statements by stating that they would only use a pump if it was easier to use than the UPM pump. The majority of the surveyed women from this village were primarily interested in investing in additional large-diameter wells which could increase the village's access to the groundwater during the dry season, or in more advanced pumping systems (wind/solar) which required much less manual effort than either the large-diameter wells or the previously installed UPM pumps. These views contrasted sharply with those of the majority of the interviewed women of Benebourou (73%, $n = 15$) who wanted to see the village invest in more hand pumps because the one that they had could not provide water for the entire village and yet the water quality of the hand pump was superior to that of the shallow large-diameter wells most residents used. It should be noted that all of the women who responded in this way had never used the hand pump, could not comment on the difficulty in using the hand pump and that their preference for hand pumps was thus influenced by their lack of previous personal experience with them. Due to the predominantly consultative mode of participation employed in the FED VII and WAWI projects, the opportunity for generating and benefiting from these unique and varied perspectives prior to the installation of hand pumps was and will continue to be lost.

Analysis of focus group transcripts also showed that women were the most adamant in demanding alternative water supply technologies, based on their belief that it would be more efficient in reducing the drudgery of drawing water. This is not surprising given the overwhelming social responsibility placed on women for the provision of water for domestic use. Overall, women based their decisions mainly upon ease of access to water rather than on technological design considerations related to water quality. A similar study in Nigeria showed that people were three times more likely to use a particular source of poor quality water that was closer to their homes than a good quality water source at a farther distance (Nyong and Kanaroglou, 2001). This is indicative of how people's priorities in choice of water supply interventions can have important implications in policymaking in a region.

Survey results and personal interviews showed that contrary to women, men's preferences were driven by economic factors such as the potential costs of maintaining water access points, and social relational factors such as ensuring access to neighbouring villages. For example, in Benebourou, the study village with the easiest access to water, the men of the village council's first priority for water supply development was to construct several large-diameter wells at the eastern edge of the village so that residents of a neighbouring village, Bondo, could enjoy similar ease of access to water. While this could be an indicator of historically strong norms of reciprocity, sharing and communal support enjoyed among neighbouring villages, social differences have been revealed to be a key source of conflicts over resources. Water access to neighbouring, less endowed villages provides a number of mutual benefits including conflict avoidance and bargaining power in future arrangements.

Respondents in the three villages surveyed generally indicated a strong preference for large-diameter wells, suggesting that they perceive them as a more appropriate long-term solution. There was much greater interest in increasing the number of wells than in the installation of manual pumps. This preference was similarly reflected in interviews held with village council members in the study villages, extension agents of World Vision and in interviews with public institutional stakeholders including the DRHE-Mopti, the regional government body for water supply infrastructure and management. In the three year development plan for the District of Bondo, for example, budget allocations indicated the construction of large-diameter wells was the highest water supply development priority, whereas the installation of new manual pumps was not mentioned within their top ten priorities.

Table 3 shows the success rates of the different manual pumps in the study area. The low success rates of the three types of manual pumps found in the region indicate a lack of commitment to maintaining the pumps as well as suggesting that certain pump types, specifically the UPM, were inappropriately chosen for this area. Interviews with local government officials revealed that a public document outlining the potential tradeoffs (costs and benefits) of the various available pumping options had been generated by the DRHE-Mopti in order to inform the various actors in the water supply development sector. However, as with the consultative participatory approach taken with the community residents, the information made available by the local government agencies was not considered during World Vision's choice-of-technology decision making process. Reluctance on the part of the implementing institutions to incorporate local perspectives and locally generated knowledge into the decision making process will most likely perpetuate the poor pump sustainability found in the region.

Table 3. Success rates of different manual pumps in the study area (May–June, 2004)

Manual pump type	Success rate[a]	Success rate[a] (%)
UPM	4/21	19%
India-Mali	6/11	55%
Vergnet	6/7	86%
Total	**16/39**	**41%**

Note: [a] Success was defined as a pump that was in-use by the community. If World Health Organization (WHO) minimum flow rate guidelines of 13 l/min are applied, the total success rate drops to 4/39 (10%).

Interviews held with the regional directors and field agents of World Vision revealed a fundamental difference between the official views of the organization on rural water supply, and field agents' personal views which were based on local experience through sustained interactions with communities. The interviews revealed that the official water supply development approach by NGO's working on water in the region — World Vision included — is the provision of potable water through boreholes fitted with manual pumps, a design criterion set forth by the WHO to meet standards of water quality. The experience of field staff however indicates that the potability of water and related water quality issues are overshadowed by the need for adequate quantities of water that can be more readily accessed through large-diameter wells with relatively lower maintenance demands. One local World Vision extension agent stated that he had had very limited success with hygiene education in villages using hand pumps because the residents complained that they did not have enough water to satisfy their primary needs and hygiene was a distant secondary concern. He maintained that if he could provide that same community with a large-diameter well, then training them to store and use their water in a hygienic manner would be much simpler as they would have a sufficient supply of water to be able to worry about hygiene. It is obvious that there is a critical need to reconcile the divergent views of the international development community and the local practitioners, while considering seriously the legitimate concerns of the different stakeholders in the process. In this realm both careful policy making and strategic ways of engaging community through authentic participatory learning processes and partnerships are called for.

4.5. Participation as learning approach in resource management

Several authors have emphasized the importance of learning in the development of community based resource management including the management of water supply infrastructures (Uphoff, 1992; Ostrom, 1990). In Mali and other Sahelian countries, competing priorities over water use for livestock, household use, agricultural and other rural livelihood activities require a deliberative process through which all stakeholders can have a “voice” in negotiating the design, norms of access, management and sustainability of their future water supply technologies. A platform approach which embraces social learning as a key element in stakeholder deliberation is increasingly being seen as a strategic niche for development interventions in such a context. According to Schusler *et al.* (2003), deliberation includes any process to communicate, raise and collectively consider issues, increase understanding and arrive at substantive decisions. In close consonance with the deliberative process is social learning that builds on pluralism — the recognition of others’ social positions, perspectives, and knowledge (Roling and Wagemaker, 1998; Leeuwis, 2004).

In this study, both previous (FED VII) and current (WAWI) water supply development projects have failed to account for the end-user choice-of-technology preferences and have ignored locally generated pump performance data (DRHE-Mopti). Additionally, women and herders, the main providers of household water and water for livestock respectively, were not found to be involved in the official management of the pumps. These findings demonstrate that the studied water supply development projects have for the most part neglected the concept of social learning and the perspectives and knowledge of local stakeholders.

Strengthening the role of participation as a platform for learning in water supply management should be seen as a cornerstone strategy in enhancing the sustainability of potable water supply. However effectiveness would require changes in the way development agents work, and fundamental changes in a mindset that understands development work as merely the promotion of innovations from the outside. Aside from the need to develop interactive communicative skills, conflict mediation, negotiation and facilitating concerted actions in social and culturally complex environments are critical competencies needed in supporting diverse stakeholders in the design and management of rural innovations, including water supply management.

5. Conclusions

Institutions involved in water supply management in rural communities need to be flexible in order to adeptly respond to diverse needs and preferences of “client” villages. Authentic participatory principles of engagement and interactive communication among socially differentiated stakeholders are needed to provide the most appropriate environment for taking actions that lead to sustainable management of water supply innovations. WAWI is a positive step in responding to the needs of rural Malians. However, the installation of boreholes with hand pumps informed merely by consultative participatory approaches cannot proffer a sustainable end to water supply interventions in the region.

The challenge is not so much how to facilitate adoption of potable water supply interventions in WAWI project zones, but how to mobilize the comparative assets and insights of differentiated social actors to influence decision making at all stages in water supply interventions in communities. Harnessing local institutions and community groups in the process to broaden interactive communication, social learning and deliberation among the diversity of stakeholders can engender community buy-in and legitimacy on the one hand, and lower transaction costs of adoption over the longer term.

Development agencies have historically been associated less with the management of shared natural and rural resources than with the promotion of technical innovations for development. A continuing challenge for WAWI is to be able to move beyond the technological priorities of installing hand pumps to more inclusively foster institutional partnerships that support interactive communication and participatory learning as platforms for improvements in community water supply management in the Sahel and in other water-deficient regions.

References

Akuoko-Asibey, A., 1997. Views of selected government officials on the impact of rural water supply program in Ghana. *Evaluation and Program Planning*, 20(2): 225–230.

ARD, Inc., 2004. Drilling costs survey: Report prepared for the West Africa Water Initiative (WAWI) project. Arlington, VA.

Bah, O.M., 1992. Community participation and rural water supply development in Sierra Leone. *Community Development Journal*, 27(1): 30–41.

Christoplos, I., 1996. Poverty, pluralism and extension practice. *Gatekeeper Series No. 64*. International Institute for Environment and Development: Sustainable Agriculture and Rural Livelihoods Programme, London.

Cleaver, F., 2001. Institutions, agency and the limitations of participatory approaches to development. In: Cooke, B., Kothari, U. (Eds.), *Participation. The New Tyranny?* Zed Books, London. Chapter 3.

Esman, M. and Uphoff, N., 1984. *Local Organizations:Iintermediaries in Rural Development*. Cornell University Press, Ithaca, NY.

Leeuwis, C., 2004. *Communication for Rural Innovation: Rethinking Agricultural Extension* (3rd Edition). Blackwell Publishing, Oxford.

Mangin, J.M., 1991. Rural water supply in southern Ethiopia: Failures and alternatives. *Canadian Journal of Development Studies*, 12(2): 297–312.

Mosse, D., 2001. People’s knowledge, participation and patronage: Operations and representations in rural development. In: Cooke, B.,

Kothari, U. (Eds.), *Participation. The New Tyranny?* Zed Books, London. Chapter 2.
Narayan, D., 1993. Focus on participation: Evidence from 121 rural water supply projects. UNDP–WB Water and Sanitation Program and Social Policy and Resettlement Division. World Bank, Washington, DC.
Nyong, A., Kanaroglou, P.S., 2001. A survey of household domestic water-use patterns in rural semi-arid Nigeria. *Journal of Arid Environments*, 49: 387–400.
Ostrom, E., 1990. *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge University Press, New York.
Pretty, J.N., 1995. Participatory learning for sustainable agriculture. *World Development*, 23(8): 1247–1263.
Röling N., Wagemaker, M. (Eds.), 1998. *Facilitating Sustainable Agriculture: Participatory Learning and Adaptive Management in Times of Environmental Uncertainty*. Cambridge University Press, Cambridge.
Schusler T., Decker, D., Pfeffer, M., 2003. Social learning for collaborative natural resource management. *Society and Natural Resources*, 15: 309–326.
Singh, N., Jacks, G., Bhattacharya, P., 2005. Women and community water supply programmes: An analysis from a socio-cultural perspective. *Natural Resources Forum*, 29: 213–223.
Tefft, J., 2003. Mali's white revolution: Smallholder cotton from 1960 to 2003. Conference paper no. 4 for the Conference on Successes in African Agriculture. Pretoria, 1–3 December.
United Nations, 2003. *United Nations Millennium Declaration (A/55/L.2)*. [Online] Available at: http://www.un.org/millennium/declaration/ares552e.htm. Last visited December, 2006.
United Nations Educational, Scientific and Cultural Organization — World Water Assessment Programme (UNESCO-WWAP), 2003. *Water for People, Water for Life: The United Nations World Water Development Report*. UNESCO and Berghahn Books, Barcelona, Spain.
Uphoff, N., 1992. Local institutions and participation for sustainable development. *Gatekeeper Series No. 3*. International Institute for Environment and Development: Sustainable Agriculture and Rural Livelihoods Programme, London.
Uphoff, N., C.M., Wijayaratna, 2000. Demonstrated benefits from social capital: the productivity of farmer organizations in Gal Oya, Sri Lanka. *World Development*, 28(11): 1890–2000.
US Department of State, 2005. *Background Note: Mali*. [Online] Available at: http://www.state.gov/r/pa/ei/bgn/2828.htm. Last visited March, 2006.
Vincent, L., 2003. Towards a smallholder hydrology for equitable and sustainable water management. *Natural Resources Forum*, 27(2): 108–116.
Williams, T.O., 1998. Multiple uses of common pool resources in semi-arid West Africa: A survey of existing practices and options for sustainable resource management *Overseas Development Institute (ODI)* 38.