Rural Economics and Development

Determinants of Households' Participation in the Collective Maintenance of Publicly Provided Water Infrastructure in Oyo State, Nigeria

ADEOTI A. I.[1*]

[1]*Department of Agricultural Economics, University of Ibadan, Ibadan*

Abstract

The provision of safe drinking water has been a major concern of government over the decades and boreholes have been drilled in many rural areas in Nigeria. Despite this, the proportion of Nigerians in rural areas with access to safe drinking water is about 50%. This paper evaluates participation in collective maintenance of boreholes and factors that influence it in Oyo state. Through a multistage sampling procedure, 109 households were selected from 5 communities that have been provided with boreholes by the state Local Empowerment and Environmental Management Project. Data collected from these households were analyzed using descriptive statistics and the probit model. Results reveal that rural households participate well in collective maintenance with a greater number making financial contribution. Education of household head, reliability of water, and perception on transparency of management show plausibility of increasing the probability of participation in collective maintenance of boreholes. Distance from the water source, having alternative source of water, male household head, household monthly income and enforcement of rules reduces probability of participation. The marginal effects show that gender, distance to water, having alternative source of water, enforcement of rules and perception on transparency and accountability of management have the highest effect on probability of participation. It is recommended that adult education should be intensified and training of management team on management and administration be done. This is to engender trust and increase participation thereby improving maintenance of the boreholes.

Key words*: Collective action, Water infrastructure, Rural households, Institutions, Participation*

**Correspondence E-mail: jadeoti@yahoo.co.uk; Telephone number: +2348062088389*

Introduction

Water is essential for all forms of life and access to safe water is imperative for human safety. Inspite of its importance, there is a global paucity of safe water (UN, 2002; UNEP, 2002; WHO and UNICEF, 2004). Nigeria has adequate surface and ground water resources to meet current demands for potable water though the temporal and spatial distribution of water has led to scarcity in some locations especially in the north. Rapid population growth has not been accompanied by an increase in the delivery of essential urban services such as water supply, sewage and sanitation, and collection and disposal of solid wastes. Despite this, many households in the urban centers, often the poorest, end up purchasing water from private vendors which are much more expensive than from the public supply. In many parts of rural Nigeria, women and children spend substantial part of their productive time looking for water. They resort to alternatives categorized as untreated and unsafe sources such as rivers and surface water (Alaba and Alaba, 2001). During the rainy season, rainwater harvesting serves as a supplement to these sources.

After almost sixty years of water supply development in Nigeria, it is regrettable that only 60% of the population has access to safe drinking water, and in rural areas less than 50% of the households have access to good portable water (Nigeria Millennium

Development Goals Report, 2006). Rural people in the country still depend very much on rivers, streams, ponds, and shallow wells for their water needs. During the dry season, some of these sources dry up and households have to invest a substantial amount of their resources to get water of doubtful quality. This has very serious implications for the health of the people and economic development in the country. First, there is tremendous economic waste involved in people spending so much time and effort in search of water. Secondly, lack of water often means relatively low levels of personal hygiene and environmental sanitation. Thirdly, because water is needed for most productive activities, inadequate access to water limits the livelihood options of the people, particularly in rural areas (IDRC, 2002).

Systematic development of water supply and management in Nigeria dates back to the colonial times. Although there was a steady increase in the percentage of the total government expenditure spent on water between 1975 and 1992; between 1992 and 1996, there was a 50% decrease in the total budgetary allocation for water supply (Areola and Akintola, 1997; Falusi and Gbadegesin, 1998). The implication of this is that between 1992 and 1996, the total water supply for industrial, agricultural and domestic use increased at a rate of about 1.0% whereas population growth rate was 2.84% (NPC, 1991). Apart from the relatively low level of financial commitment to water supply development in general, successive governments in the country also laid emphasis on urban water supply while rural areas are almost completely neglected. The Federal Government, through the River Basin Development Authorities (RBDAs) in 1976 and Directorate of Food, Roads and Rural Infrastructure (DFRRI) in 1986 attempted to address the problem of rural water supply in the country. Through the two strategies, a large number of boreholes with manual and powered pumps were sunk in various parts of the country. Pipe borne water was also extended to some rural areas through the state water corporations, but this option was hardly used because of the high cost of laying pipes to rural communities which are generally separated by large distances (NEST, 1991; Akintola *et al*., 1980). Regrettably, these efforts did not last up to a decade. Many of the rural communities that were served with boreholes were unable to derive maximum benefits from them. Some of the problems identified include lack of public participation in the management of the boreholes, technological problems, ignorance of the people, and corruption (NEST, 1991). This has led among other reasons to the cancellation of the DFRRI while the focus of the RBDAs has now been limited to the provision of water for agricultural purposes (Falusi and Gbadegesin, 1998). The government is now partnering with communities in the provision and management of water infrastructure to ensure sustainable development through availability and accessibility of water to rural households. The Local Empowerment and Environmental Management Project (LEEMP) in providing portable water in rural areas drilled boreholes in communities that demanded for it. This was done in partnership with the communities. This is in addition to boreholes that had been drilled through previous efforts to supply water in rural areas. However, these boreholes were not properly maintained and over time, some are no longer operational. Management of water infrastructure poses as a problem and hinders sustainability. Under the LEEMP project, the communities are responsible for the maintenance of the boreholes. This is to ensure the sustainability of the project. Economic researchers have proposed a number of empirical models in assessing water management in rural settings (Cárdenas and Ostrom, 2004; McCarthy *et al*., 2004; Meinzen-Dick *et al*., 2004; Krishna, 2003; Berhanu *et al*., 2002). However, there is a dearth of empirical evidence in Nigeria from an economic perspective. This paper intends to fill this knowledge gap. By understanding how collective action can work for public goods provision and maintenance, it will be easier to plan social policy and aid programs. This paper examines the collective participation of the public in the maintenance of the boreholes provided. Specifically, it examines factors that contribute to the likelihood that households will participate in the collective maintenance of this infrastructure.

2. *Literature review*

This section draws largely from the work of Meizen-Dick *et al.*, (2004). Collective action is about collective decision-making, setting rules of conduct of a group and designing management rules, implementing decisions, and monitoring adherence to

rules. Collective action involves costs, both in time and money. Any group that attempts to obtain a public good must have the resources to cover these costs. It must also have mechanisms in place to extract payment from its members. Members can contribute in various ways to achieve the shared goal: money, labour or in kind contributions (food, wood). The action can take place directly by members of a group, or on their behalf by a representative or even employee. The coordination can take place through a formal organization, through an informal organization, or, in some cases, through spontaneous action. Thus, an organization may contribute to collective action, but the two are not the same.

The theories of collective action suggest that individuals under certain institutional arrangements and shared norms are capable of organizing and sustaining cooperation that advances the common interest of the group in which they belong (Ostrom, 1990). Marshall (1998) defines collective action as an action taken by a group (either directly or on its behalf through an organization) in pursuit of members perceived shared interests. These definitions imply that collective action requires the involvement of a group of people with a shared interest within the group and it involves some kind of common action which works in pursuit of that shared interest. McCall (1987) distinguishes between three levels of community participation as: i) a means to facilitate the implementation of an external intervention; ii) a means to mediate in the decision making and policy formulation of external interventions; iii) an end in itself, the empowerment of social groups to gain control over resources and decision making. Community participation within rural water projects have evolved to encompass this third level of involvement, including granting communities control over operations, maintenance and cost sharing (Lockwood *et al.*, 2004). This also marked an important institutional policy change in international development towards basing the provision of services on demand, rather than the conventional supply driven model, and complemented efforts to create ownership of development processes on the part of local communities (Nicol, 2000). Today, collective action is a reputable model for managing rural water supply because of an acceptance from multiple stakeholders within rural development circles with different agenda and priorities. Multinational lenders such as the World Bank and USAID saw community management as a general transition from supply to demand-driven approaches, which also fits within broader trends towards decentralization of government services and transfer of responsibilities to lower levels of government and ultimately to communities themselves (Nicol, 2000).

McCarthy *et al.* (2004) assessed the determinants of collective action in natural resource management in Burkina Faso. They hypothesize that the success of collective action will be a function of individual's incentives to contribute to maintenance and abide by rules and regulations, the capacity of the community as a whole to cooperate and to manage these incentives, and the overall policy environment in which these institutions must operate. Using regression analysis, the specific factors hypothesized to affect collective action are demographic and agro-ecological (size of the community, size of the community squared, heterogeneity in cattle holding, ethnic groups, percentage of adults migrating, percentage of households with public education, rainfall variability), institution's structure (percentage of rules made by the chief only, percentage of rules made in collaboration with members , percentage of rules made without the chief), projects before 1986, projects between 1986-1993, projects between 1994-2001, distance to regional capital, and external pressure (sharing pasture). Several of the variables were significant except ethnic groups, percentage of rules made by chief only, percentage of rules made without the chief, projects between 1986-1993**,** projects between 1994-2001 and sharing pasture. Marzo (2006) investigated how public goods are maintained by the households in urban and peri-urban areas of Lima, Peru in six types of community organizations. The study used the Logit model where the endogenous variable is a binary variable defining whether collective action has been met with success or not. It was hypothesized that larger groups, higher monetary costs, higher time costs, higher degrees of heterogeneity, rural geographic origins, potential beneficiaries from outside the group and attempts at new development would all have a negative effect on collective action. Also, the presence of coercive mechanisms, a federated structure, higher educational levels and the presence of a shock would all have a positive effect on collective action. Various

logit models were tested by him using different combinations of the explanatory variables. The best regression model chosen revealed that success in collective action is a function of group size, heterogeneity and time cost. Masako *et al.* (1999) identified factors underlying success and failure in organizing collective action for the management of local commons, of the irrigation scheme in the Philippines. Using the cross-section survey data on the activities of irrigators' associations a regression analysis was conducted to identify factors underlying the success and failure in farmers' organizing collective actions for maintenance and operation of gravity irrigation systems. The findings call for government to play the active role of enhancing local communities' organizational capacity in the process of handing over to them the management of local commons.

Takashi (2005) investigated the determinants of collective action involved in development initiatives based on community-based organisations (CBO) under devolution. In 2001, a scheme called Citizen Community Board (CCB) was initiated and under the programme, local people proposed development projects to the local government through forming a CCB. Upon approval, the local government funds 80 percent of the project cost. Villagers organise collective action to form a CCB when their expected benefit from CCB registration is greater than its costs. In line with Meinzen-Dick *et al.*, (2004), benefits and costs of such collective action were hypothesized to depend on the village and union characteristics such as economic and political activities, infrastructure, rules and leadership. The regression results using a cross-section dataset in a district in Pakistan Punjab in 2004-05 suggest that the rules within a CCB and the type of leadership are key to the success of CCB initiatives. Shittu (2007), examined the evolution of collective action in some selected communities in south-western Nigeria. Also investigated was the roles of rural dwellers (as a group) and the local government in the provision and maintenance of facilities. He found that rural communities in south-western Nigeria through self-organized arrangements provided rural facilities at the cost of N26,204,000 (98.3%) of the total figure thus constituting the prime mover for rural facilities development, while Local Governments contributed N450,000 (1.7%) on the same facilities. The lesson is that if these institutions are so accountable to their members, then there exists the opportunity to conceptualize how they can be used to re-constitute order from the bottom up and complement the state structure of governance. This review reveals that household demography, economic factors, institutional structure and group characteristics are factors that determine collective action.

3. Methodology

3.1. Study area

The study was carried out in Oluyole Local Government area of Oyo state. Oyo State is located in the South Western part of Nigeria and has 33 Local Government Areas. The Local Government Area has a mix of rural and urban settings. The study focused mainly on the rural areas where boreholes were drilled for the residents under the LEEMP project. The people are predominantly small scale farmers. They also engage in trading while few rear livestock. In addition, a lot of processing of agricultural products takes place.

3.2. Data and sampling

A multistage sampling procedure was adopted for the study. The first stage involved the purposive selection of communities in the study area that are provided with boreholes under the state LEEMP. These communities include Onipe, Akorede, Egbejoda-Mokore, Olubi and Latunde with 3, 1, 2, 1 and 3 boreholes respectively. In the second stage, households were randomly selected and interviewed with the aid of questionnaires. The questionnaires were distributed in sizes proportionate to the number of boreholes in the different communities. The distribution is as follows: Onipe (34), Akorede (10), Egbejoda-Mokore (20), Olubi (10) and Latunde (35). In Onipe and Latunde, the number of respondents exceeded the proposed sample by 4 and 5 respectively

as they volunteered to be interviewed. Data were collected on household's socioeconomic characteristics, characteristics of the groups formed to manage the boreholes, the rules guiding the use of the boreholes, characteristics of the leaders of the group, transparency and accountability of the leaders, reliability of the water source, households' form of participation or non-participation in collective maintenance.

3.3. Analytical method

Descriptive analysis was used for the general description of the socioeconomic characteristics of the household head, household characteristics and group characteristics. The determinants of participation are considered at two levels. First, the determinants of participation are considered and secondly, the form of participation is estimated. The determinants of participation in a collective maintenance is analysed using a dichotomous dependent model. A household - level regression model is estimated thus:

$$\text{Prob}(Yi = 1) = f(b_k Xk + biXi + ui). \ldots \ldots \quad (1)$$

where *Yi* is the dummy variable for household *i* to participate in the maintenance of the water infrastructure. Three models of participation were investigated: participation in collective maintenance irrespective of form of participation, participation through financial contribution and participation through labor contribution. Labour contribution could be in the form of labour hours devoted to administration and management or to manual work. *Xk Xi are* vectors of exogenous variables affecting household decision to participate. Dutilly-Diane *et al*., (2003) identified these factors to include household characteristics, community characteristics, economic and institutional characteristics. In this paper, we hypothesize that household characteristics, economic characteristics, group and institutional characteristics affect the decision to participate in collective maintenance. Also, b_k and b_i are vectors of parameters to be estimated, *ui* is a zero-mean error term, and *f*(.) is a probit or logit function. Gujarati (2003) argues that in most applications, both probit and logit models are quite similar. The main difference however, is that the conditional probability P_i approaches zero or one at a slower rate in logit than in probit. He concludes that there is no compelling reason to choose one over the other, and in practice, the choice depends on the ease of computation, which is not a serious problem with sophisticated statistical packages that are now readily available. The model estimates are in 0-1 range and these probabilities are non-linearly related to the explanatory variables. In this paper, the probit model is employed to estimate the parameters of the model. Variables included in the model are presented as follows:

Y_1 = 1, If household participates in collective action and 0 otherwise.

Household characteristics

X_1 = Age of household head in years

X_2 = Household size

X_3 = Gender of household head (male=1, female=0)

X_4 = Years of education of household head

X_5 = Household distance from borehole in km

X_6 = Household has alternative source of water (Yes=1, otherwise =0)

Economic characteristics

X_7 = Household monthly income in Naira

Group characteristics

X_8 = Membership heterogeneity by tribe (Yoruba =1, otherwise = 0)

X_9 = Education of the leader of the borehole management team (1 for possession of at least primary education, 0 if otherwise)

Institutional factors

X_{10} = Reliability of water availability (Reliable = 1, 0= otherwise)

X_{11} = Enforcement of rules and regulation related to use of borehole (Yes =1, No = 0)

X_{12} = Perception on transparency of management(transparent = 1, 0= otherwise)

A priori, we expect age of household head to have a positive relationship with the probability of participation. However, older members may be discouraged in participating due to previous negative experience in managing common resource particularly by the Government therefore we hypothesize that the direction of the effect is indeterminate. The larger the household size, the more the need for water which should serve as an incentive to participate. We expect a positive relationship. Also, female household heads are expected to be willing to participate more since women are the primary water collectors in developing countries. We expect a negative relationship between the variable and participation. Education is also expected to have a positive relationship with the probability of participation. It is believed that the educated will appreciate more the import of potable water and also be able to contribute to the administration of the infrastructure. The more the distance from the water infrastructure, the less the likelihood of participation, therefore, a negative relationship is expected. The effect of alternative source of water is indeterminate. Though, some households may have alternative source of water, they may prefer water from the borehole since it is considered safe. The effect of this variable can therefore be either way. The effect of income is indeterminate because households with high income may invest in alternative source of water like constructing wells but also may be able to make financial contribution to the maintenance of the borehole. In general, it is expected that there would be a positive relationship between participation and the institutional variables.

4. Results and discussion

The household heads are middle aged with a mean of about 54years and are still economically active as shown in Table 1. Almost two third of the household heads are male which is typical in many African culture. The mean years of schooling is seven which reveals that they have at least primary school education and therefore they are expected to appreciate better the import of safe drinking water. The household size averages about seven with a mean monthly income of about N9, 736. The mean income for a family of seven may make it challenging to make substantial financial contribution. However, since households can contribute labor also, the large household size serves as a ready source of labor. Only 68% of the households stated that obtaining water from community borehole is reliable, 35% stated that rules are well enforced while 41% perceive that management is transparent. The percentage that stated that the institutions are performing well is less than half of all households. This suggests that institution is weak in the communities studied.

Table 2 shows various uses of water by different households. Water is for multiple uses including domestic, agricultural and commercial uses. Specifically, water is used for drinking, culinary, crop and livestock production, washing of motorcycles, cars amongst other uses. The need of water for domestic uses in particular underscores the importance of potable and safe water in view of its health implications. All the households responded positively to the need of potable water for drinking. In addition, since many do not purify water before drinking, all the respondents expressed their preference for water from boreholes over alternative sources of water.

Table 3 shows that 86% of households participate in collective maintenance of the boreholes. This reveals a high level of participation and supports the latest approach of ensuring that communities have a sense of ownership of infrastructure for successful management. The form of participation reveals a higher level of financial contribution than labour contribution.

Table 4 shows the estimated coefficients of the explanatory variables and the marginal effects of a unit change in these variables on the probability of household's participation in collective maintenance. Two of the variables were dropped in the estimation and they were mainly the group characteristics. These are education of the leader of management team and heterogeneity by tribe. The data reveals that all the leaders of the management team in the communities sampled had at least primary school education and also

Table 1: Socio-economic characteristics of households and their perception of management of boreholes

Variable	Mean	Standard Deviation	Percentages
Age (years)	54.14	11.75	-
Household Size	6.89	1.679	-
Gender of household head	-	-	Male: 65 Female: 35
Education (years)	7.38	4.82	-
Distance to water point (km)	0.60	0.45	-
Household monthly income (Naira)	9,735.96	3,588	-
Reliability of water	-	-	68
Enforcement of rules	-	-	35
Management transparency	-	-	41

Table 2: Distribution of households by their various water use

Uses of water	Frequency	Percentage
Drinking & Culinary	25	22.9
Drinking, Culinary & Crop production	32	29.4
Drinking, Culinary & Livestock	12	11.0
Drinking, Culinary & Washing of Okada/Car	11	10.1
Drinking, Culinary, Crop production & Livestock	4	3.7
Drinking, Culinary, Crop production & Washing of Motor cycle (Okada)/Car	5	4.6
Drinking, Culinary, Crop production, Livestock & Washing of Motor cycle (Okada)/Car	20	18.3

Table 3: Distribution of households by form of participation in collective action

Status in participation	Participants		Non-participants	
	Frequency	Percentage	Frequency	Percentage
Participate in collective action	94	86.2	15	13.8
Financial participation	71	65.1	38	34.9
Labor participation	48	44.0	61	56.0

91% of the respondents were Yorubas which means low level of heterogeneity. The diagnostic statistics reveals that the chi square value for the model is significant at the 1% level which means that the explanatory variables jointly influence household's participation. The signs show the direction of change in the probability of participation given the change in the explanatory variables. A positive sign shows increase in the probability of participation while a negative explains the converse.

Eight of the variables are significant at different levels. These are gender of household head, education of household head, distance from the water source, having alternative source of water, household monthly income, reliability of water, enforcement of rules and perception on transparency of management. The gender variable has a negative sign which means that female household head have higher probability of participating in maintenance than men. Education is positively signed and it agrees with the a priori expectation. This finding is in line with that of Meinzen-Dick *et al*., (2004) which found out that coupled with the external recognition; education enhances participation in collective action. The household distance from water source has an inverse relationship with the probability of participation. The farther the household is from the water source, the less the probability of participation. This is not unexpected considering the drudgery of collecting water particularly on long distances. Having alternative source of water also has a negative sign which implies that the probability of participation reduces with increase in access to alternative sources. Income has a negative effect on probability of participation. Well-off households may prefer to have their own source of water independent of the community and therefore may not be willing to participate in collective maintenance. The institutional factors as measured by the reliability of getting water and perception of households of transparency and accountability of management have positive signs. Transparency and accountability promotes trust and goodwill and increases the probability of participation. Ostrom (1994) stated that trust is important for successful organization. This underscores the importance of institutional factors in increasing the probability of participation. However, enforcement of rules decreases the probability of participation. This result is surprising and probably reflects the extent to which households are willing to be sanctioned in event of breaking rules that guide collective use and maintenance of the boreholes.

The variables that were not significant are age of household head and household size. Nonetheless, the signs of these variables are important. Contrary to a priori expectation, the age of the household head is negatively signed. It is possible as earlier explained that the older ones are reluctant to participate due to previous negative experiences. Household size has a positive sign and agrees with a priori expectation. The marginal effects show that gender, distance to water, having alternative source of water, enforcement of rules and perception on transparency and perception of transparency and accountability of management have the highest effect on probability of participation. This shows that a unit change in these factors will have a greater change on the probability of participation than other significant variables.

The estimated coefficients and the marginal effects of the same explanatory variables on the probability of making financial contribution to collective maintenance are presented in Table 5. All the variables are significant except the variable on having alternative source of water.

The result shows that the variables that increase the probability of making financial contribution are age of household head, education, household income, reliability of water and perception on management transparency. This implies that the older the household head and also the more the years of schooling of the household head, the greater the probability of financial participation. In addition, households with more income have greater probability of participating. It is same for households that perceive water supply is reliable and those who believe that the management committee is transparent. The variables that reduce the probability of making financial contribution are household size, gender, distance to water and enforcement of rules. Large households and male headed households have less probability of contributing financially. The farther a household is from the borehole, the less the probability of financial participation. Enforcement of rules reduces the probability of participation. The marginal effects of gender, distance to water and the institutional factors were more than for other significant variables.

Table 4: Factors affecting participation in collective action

Variable	Coefficient	Standard error	Marginal effect
Age	-0.041	0.029	-0.008
Household_size	0.160	0.161	0.034
Gender	-0.789*	0.445	-0.156
Education	0.204***	0.065	0.043
Distance to water	-1.142**	0.480	-0.244
Have alternative source of water	-0.940***	0.301	-0.201
Household income	-0.038*	0.023	-0.008
Reliability of water	0.369*	0.205	0.073
Enforcement of rules	-1.184***	0.367	-0.254
Perception on mgt transp	0.723*	0.459	0.133
Constant	6.829***	1.955	

Chi square= 57.62 Log likelihood = -135.32 Pseudo R^2 =0.449
**** significant at 1% , ** significant at 5% , * significant at 10% ,*

Table 5: Factors affecting financial contribution in the maintenance of boreholes

Variable	Coefficient	Standard error	Marginal Effect
Age	0.050*	0.029	-0.011
Household size	-0.331*	0.188	-0.075
Gender	-2.399***	0.701	-0.458
Education	0.319***	0.077	0.072
Distance to water	-1.351***	0.504	-0.308
Have alternative source of water	0.124	0.280	0.028
Household income	0.010***	0.003	0.003
Reliability of water	4.109***	1.016	0.588
Enforcement of rules	-0.921**	0.439	-0.210
Perception on mgt transp	1.157*	0.705	0.149
Constant	5.420***	1.854	

Chi square= 74.21 Log likelihood = -83.35 Pseudo R^2 =0.526
**** significant at 1% , ** significant at 5% , * significant at 10%*

Table 6: Factors affecting labor contribution in the maintenance of boreholes

Variable	Coefficient	Standard error	Marginal effect
Age	-0.010	0.019	-0.004
Household size	0.145	0.127	0.056
Gender	0.257*	0.134	0.099
Education	-0.014	0.040	0.005
Distance to water	0.067	0.331	0.026
Have alternative source of water	-0.349	0.230	-0.136
Household income	-0.003***	0.001	-0.015
Reliability of water	1.096***	0.354	-0.382
Enforcement of rules	-0.803**	0.279	-0.312
Perception on mgt transp	1.389***	0.439	0.152
Constant	0.670	1.237	

Chi square= 43.91 Log likelihood = -52.83 Pseudo R^2 =0.293

**** significant at 1% , ** significant at 5% , * significant at 10%*

Table 6 presents the estimated coefficients and marginal effects of factors that affect contributing labor in collective maintenance. Only five of the variables are significant which are gender, household income, reliability of water, enforcement of rules and perception of management transparency. Male headed households have greater probability of contributing labor to collective maintenance. Household income is inversely related to the probability of participation which implies that as income increases, the probability of contributing labour decreases. Except enforcement of rules, other institutional variables are positively related to the probability of contributing labour.

5. Conclusion and recommendation

Provision of safe drinking water has remained germane to government's rural development efforts. Although boreholes have been drilled in many rural areas, access to safe drinking water remains a challenge in these areas. This is partly as a result of the breakdown of this water infrastructure due largely to maintenance among other reasons. The recent approach is to give communities a sense of ownership by demanding and contributing to the provision of rural infrastructure. In addition, these communities are responsible for their maintenance. This study reveals that two third of the households are male with an average of primary school education. The mean monthly income is N9, 736 and is considered low to enable households to make substantial financial contribution. Only a third of the households stated that rules are enforced while about 41% believe that management team is transparent. There is a high level of participation in collective action with a higher level of financial contribution relative to labour contribution. Education of household head, reliability of water, and perception on transparency of management will increase probability of participation. Distance from the water source, having alternative source of water, male household head, household monthly income and enforcement of rules reduces probability of participation in collective maintenance of boreholes. The marginal effects show that gender, distance to water, having alternative source of water, enforcement of rules and perception on transparency and perception of transparency and accountability of management have the highest effect on probability of participation in collective maintenance of boreholes.

The probability of making financial contribution increases with age of household head, education, household income, reliability of water and perception on management transparency. It reduces with household size, gender, distance to water and enforcement of rules. The marginal effects of gender, distance to water and the institutional factors were higher than for other significant variables. The probability of making labor contribution increases with

male headship, reliability of water and perception of management transparency but decreases with income and enforcement of rules.

It is concluded that rural households participate well in collective action although the depth of participation was not investigated. Also, a greater number make financial contribution than labor. Participation will increase generally with education, improvement in reliability of water supply and transparency of the management team. It is recommended that adult education should be intensified and training of management team not only on minor repairs but also on management and administration to engender trust and increase participation thereby reducing inefficient maintenance of the boreholes.

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