Community Participation in Routine Borehole Maintenance Activities in Mandera County, Kenya.

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Abstract: Water as a resource on the earth surface is very crucial to living organisms without which they cannot survive. Community borehole water projects in Mandera South Sub-County, Kenya plays an essential role as they provide water for domestic use, livestock drinking and for small-scale farming. The whole Sub-County is generally dry with lack of surface water and the few water pans that are available dry up a few months just after the rainy season as a result of high dependency and high rate of evaporation. Due to this condition, various stakeholders such as the government, donors and the local community-based organizations (CBOs) have pulled resources together in an effort to provide safe and clean water to the residents by drilling community borehole water projects. However, there are cases of poor maintenance of the established boreholes by the community which has led to their breakdown barely a few months or years after they have been established. This research assessed the community participation in routine maintenance of borehole water supply in Mandera South Sub-County in Mandera County, Kenya. The study employed a descriptive survey research design within the 4 divisions in Mandera South Sub-County of Mandera County which included 1 randomly sampled borehole from every division. Borehole beneficiaries were sampled randomly from areas which were near to the borehole facilities. Adult beneficiaries both male and female were picked and questionnaires administered to them. All maintenance committee members were interviewed. The target population was 199 together with all the borehole maintenance committee members. The data obtained was statistically analysed by use of the Statistical Package for Social Sciences (SPSS). Results were discussed and presented in form of tables and graphs. The findings of the study revealed that where community participation in carrying out routine maintenance activities of community borehole water projects was high, the standard of the borehole in terms of sustainable maintenance was high and vice versa. An analysis of variance (ANOVA) test on the parameters used as indicators of sustainable maintenance of the borehole water supply projects revealed that, the differences in frequency in maintenance among the four projects were quite significant (F=1.7, P=0.2). Elwak borehole water project was ranked the highest in terms of maintenance with a mean of 1.5, Shimbiri-Fatuma 0.8 while Kutulo and Wargadut ranked the lowest both with a mean of 0.7. This study recommended that there is need to include the community in all borehole projects' undertakings in order to make them own the projects and thus participate fully in sustainable maintenance of the borehole projects.

Index Terms: *Borehole, community participation, maintenance, Mandera Sub-County, routine*

I. INTRODUCTION

Water is a very important natural resource whose sustainability must be adhered to at all costs. Obonyo (2009) notes that although there have been immense efforts and investments in the construction of water supply infrastructure, around 67% of Kenyan population have significantly lower water and sanitation coverage levels. The post construction operation and maintenance of water supply systems is cited as the major challenge especially in rural areas. This corroborates with Kenya Census (2009) which observed that around 63.1% of rural population (16.5 million people) relied on unsafe water notwithstanding the huge efforts and investments in the construction of water supply infrastructure in Kenya. As per the GoK (2013), Water Point Mapping report of eight counties in Kenya, almost one third of all rural water points are not functional in Kenya at any given time and 42% of the rural population depends on dirty water. Nearly 70% of the population in Kenya relied on ponds, wells, rivers and sand dams managed by volunteer Water User

Associations (WUAs). These associations are regularly met by management challenges of these sources and thus at any one time one third remain faulty and without operating. Marks and Davis (2012) opined that 40 percent of rural households in Kenya obtained water from hand pump boreholes and protected wells even though only 30% of all the hand pumps installed in Kenya were functioning. In addition, Tana Water Services Board report (2013) notes that 25% of the borehole hand pumps in Mbeere region in Kenya were not functioning due to technical breakdowns. Although relative success in the provision of new rural water infrastructure in the last two to three decades, evidence indicate that between 30 to 40 per cent of facilities either do not function or are operating below capacity (Alida, 2012). Alida (2012) further observes that in Kenya, about 25 to 30 per cent of the newly accomplished rural water projects facilities managed by the communities become dysfunctional within the first three years after their completion. Ogendi and Ong'oa (2009) noted that many water projects in Kenya are non-operational as a result of failure to engage the community entirely in their decision-making. Among the reasons for many water projects stalling is non-involvement of the community in all the phases of the project (Kavindu, 2018). Further, Kavindu (2018) opines that most water projects that are initiated in many parts of Kenya are poorly managed therefore they stall a few years after being implemented. According to Tiwari (2013) lack of or poor operation and maintenance arrangements for small rural water systems continues to be an obstacle to the feasibility and extension of water supply services. Draft National Water Policy (NWP) 2012 (GoK, 2012), observes that most of the rural water services systems are nevertheless unsustainable as a result of insufficient operation by communities causing breakdown of facilities and low access rate, poor water quality and increased clashes. Access to safe water supplies throughout Kenya is 59 percent with rural areas accessibility enduring as low as 47 percent, with dependence on unprotected wells, springs or informal water providers (Mwamburi, 2014). According to GoK (2012), inequalities in access to safe water are more harsh in the arid and semi-arid lands (ASALs). There have been several studies detailing Sustainable Rural Water supplies in Kenya for instance; GoK (2002) in its Water Act, stressed on socially responsible commercialization of water service provision but, poor management and maintenance has frequently led to their early breakdown in rural areas and hence unsustainable. This research was therefore formed on the basis that, for water supply investments to be sustainably maintained, the community should fully participate in various maintenance activities. Mandera County aims at providing sustainable clean water to all its residents but there exist a problem where the community is not promptly maintaining the already established water supply boreholes. For instance, there is a hitch on carrying out repairs on boreholes and even in some regions the community is not willing to maintain boreholes due to different attitudes. In order to address this problem, the research assessed the community participation in maintenance of borehole water supply in Mandera South Sub-County. This study will therefore form a basis for deciding proper maintenance measures to be employed in the Sub-County through community participation.

II. Materials And Methods

Research Site

The study was carried out in Mandera South Sub-County of Mandera County. The Sub-County has four divisions namely: Elwak, Kutulo, Wargadut and Shimbiri-Fatuma and it covers an area of approximately 5,502 Km^2 (GoK, 2009). Mandera is categorized as experiencing an arid climate under the Koppen climate classification system with a fairly erratic pattern of rainfall varying significantly in both time and space. The highest rainfall is experienced in December. The dry months are January, February, March, June, July, August and November with August being the driest month. Other forms of precipitation are very minimal. The county experiences hot temperatures throughout the year. Daily temperatures are approximately above 30^{o} C while at night they fall to 20^{o} C**.** The warmest month on average is March and the coolest month is July. Geologically, Mandera basin is made up of extremely thick Triassic sediments in the axial part and thinner younger succession of sedimentary rocks on both sides of the basin which suggests that the basin was a subsiding elongated area that was invaded by the sea in the early Mesozoic during the dismembering of Gondwana. The carbonate sediments that lie at the bottom contains shales, evaporates and sandstone deposits. Hence, this explains the differences in porosity and permeability characteristics of the area which in turn affects the rate of recharge of water in the aquifers (Kassim & Garmignani, 2002). According to the GoK (2007), Mandera basin is topographically flat which contributes to the regular flush floods that damage property and cause loss of life during rainy seasons in the region. Most of the floods originate from the Ethiopian highlands. The area has an average altitude of 460 meters above sea level which explains the high temperature and low rainfall received in the region. Nomadic pastoralism is the key economic activity carried out in Mandera South Sub-County due to lack of water and pasture. Residents own large herds of cattle, sheep, goats and camels which are grazed in the little available pastures (GoK, 2007).

Sample size and sampling procedure

The study used stratified random sampling to group the selected sample size into four groups based on the four divisions in the Sub-County so that each division is represented. Purposive Simple random sampling was then carried out in each division to ensure that different types of respondents are represented in order to avoid respondents with similar characteristics. The sampled groups were then administered with questionnaires differently. The sample size from the study population was arrived at using the survey system sample size calculator by Scott (2014) who uses the following formula:

$$\text{Sample size (n)} = \frac{Z^2 * p * 1-p)}{C^2}$$

Where:

n = total number of sampled population

Z = Z value of standard variant at 95% confidence level (1.96)

P = Percentage picking a choice expressed as decimals (0.5)

C = Confidence interval expressed as decimal (0.04)

Using the confidence level of 95%, confidence interval of 81% - 90% and a population of 247,619 people, 119 adult people were selected from the entire population and used for the study. All the borehole maintenance committee members were interviewed.

Data Collection & Analysis

The researchers surveyed the sampled boreholes then pre-tested questionnaires on a sample of 10 respondents in a pilot study and made necessary changes. The questionnaires were self-administered but translators were used because the researchers did not speak similar language with the community members. Before the questionnaires were administered, the translators were trained on questioning skills, rules to be observed and the objectives of the study. There was a follow up interview questions session to the borehole maintenance committee members regarding their views on the relationship between community participation and sustainable maintenance of borehole water projects. Cleaning of data was done before it was collected. Examination of questionnaires was done to ensure that they were comprehensive and consistently filled. Data was then coded and summary tables prepared indicating all the responses. It was then analysed statistically using Statistical Package for Social Sciences (SPSS). Finally, results obtained was discussed and presented in form of graphs and tables.

III. Results and Discussion

A. Consistency in Carrying out Annual Check-up of System Output

The study wanted to establish consistency of the community in carrying out annual check-up of system output to check water level before and during pumping, testing of coli-form bacteria and nitrates, pump water performance and general water odor and cloudiness. The respondents were asked to tick the number that best described how frequent they participated in carrying out these maintenance activities on their borehole water supply projects where 5 was equivalent to Always, 4= Often, 3= Sometimes 2= Rarely and 1= Never. The findings of the study were as shown in figure 1.

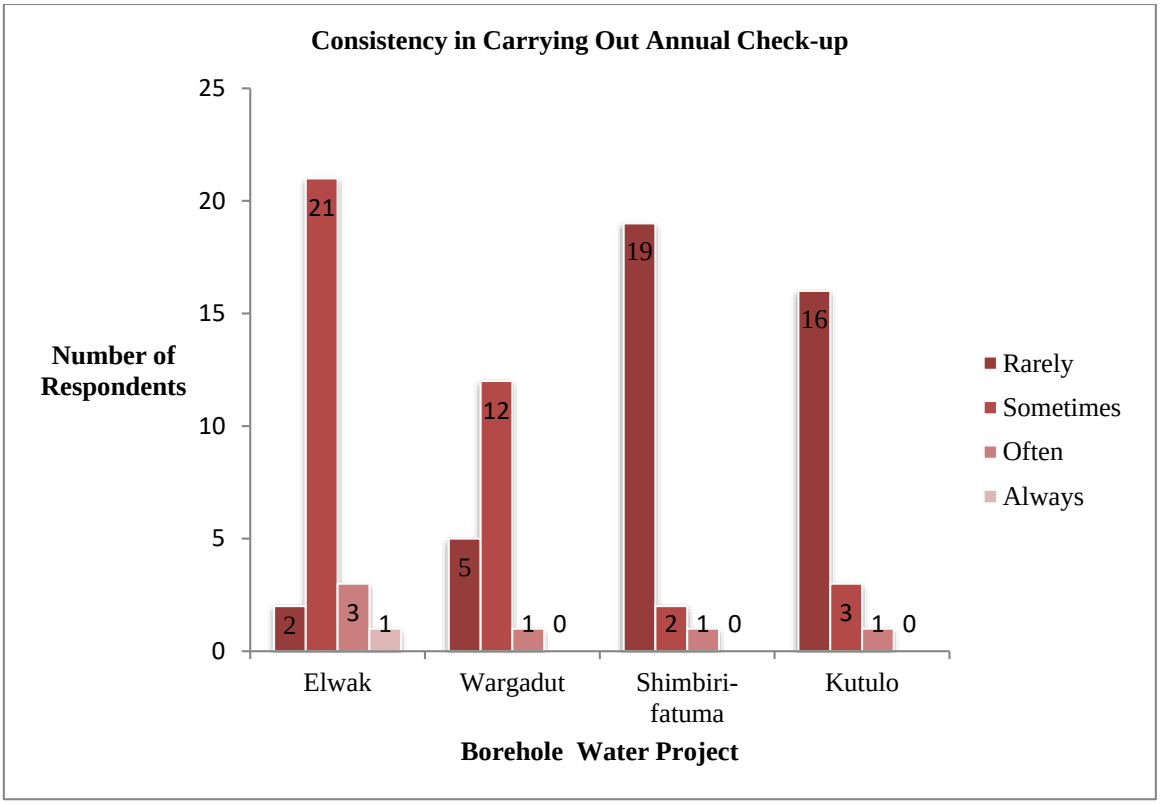

Figure 1: Consistency in Carrying out Annual Check-up of System Output

Source: Field Survey (2016)

The findings revealed that, 2 (2.30%) respondents from Elwak, 5 (5.75%) respondents from Wargadut, 19 (21.84%) respondents from Shimbiri-Fatuma and 16 (18.39%) respondents from Kutulo indicated that they rarely carried out annual check-up of the system output on their borehole water supply projects consistently. The findings further revealed that, 21 (24.14%) respondents from Elwak, 12 (13.79%) respondents from Wargadut, 2 (2.30%) respondents from Shimbiri-Fatuma and 3 (3.45%) respondents from Kutulo indicated that they sometimes consistently carried out annual check-up of the system output on their borehole water supply projects. Additionally, 3 (3.45%) respondents from Elwak, 1 (1.15%) respondent from Wargadut, 1 (1.15%) respondent from Shimbiri-Fatuma and 1 (1.15%) respondents from Kutulo indicated that they often consistently carried out annual check-up of the system output on their borehole water supply projects. Only 1 (1.15%) respondent from Elwak borehole water project indicated that he always participated in carrying out annual check-up of the system output on the borehole water project.

B. Regular Inspection of Borehole Equipment

The study sought to find out how consistent the respondents were in carrying out regular inspection of the borehole equipment in order to ensure that the borehole was hygienic and met local code requirements. The survey findings were presented as shown in figure 2.

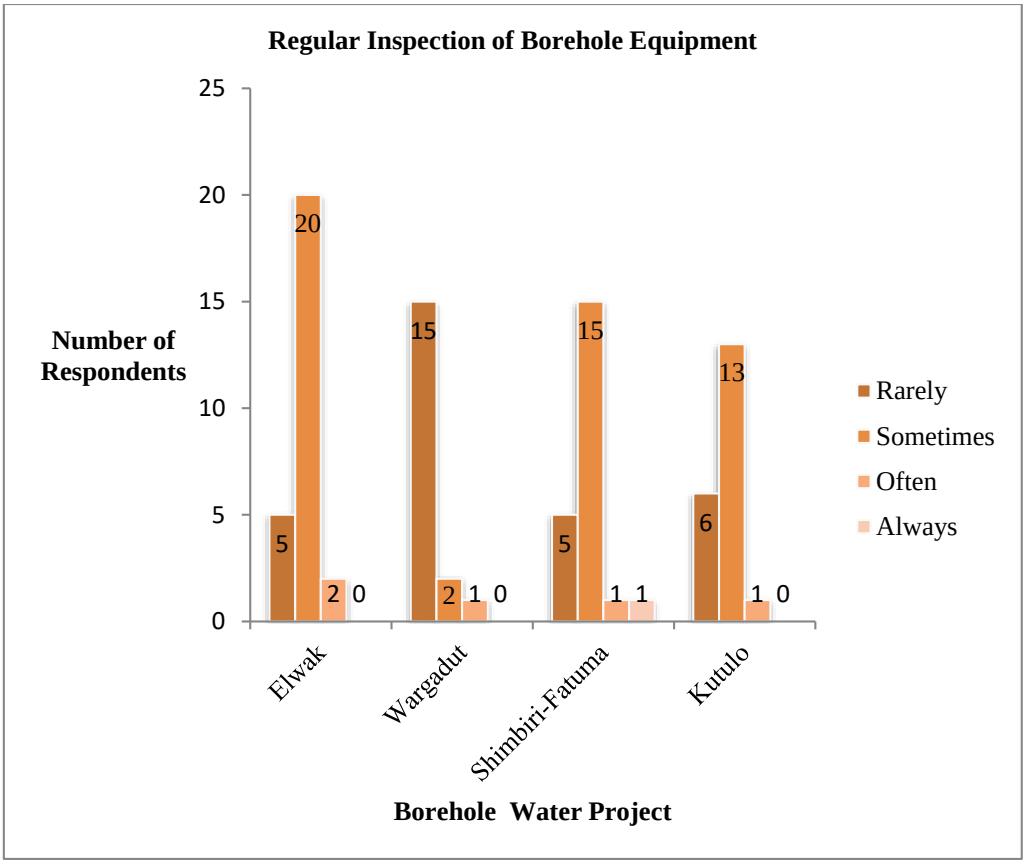

Figure 2: Consistency in Carrying out Regular Inspection of Borehole Equipment
Source: Field Survey (2016)

From the result findings, 5 (5.75%) respondents from Elwak, 15 (17.24%) respondents from Wargadut, 5 (5.75%) respondents from Shimbiri-Fatuma and 6 (6.90%) respondents from Kutulo indicated that they rarely carried out regular inspection of their borehole equipment. The findings further revealed that, 20 (22.99%) respondents from Elwak, 2 (2.30%) respondents from Wargadut, 15 (17.24%) respondents from Shimbiri-Fatuma and 13 (14.92%) respondents from Kutulo indicated that they sometimes consistently carried out regular inspection of their borehole equipment. In addition, 2 (2.30%) respondents from Elwak, and 1 (1.15%) respondent from Wargadut, Shimbiri-Fatuma and Kutulo respectively indicated that they often carried out regular inspection of their borehole equipment. Only 1(1.15%) respondent from Shimbiri-Fatuma borehole water project indicated that she always carried out regular inspection of her borehole equipment. The reason for not inspecting the borehole equipment as reported by some respondents from Wargadut was linked to the fact that more often, the respondents are engaged in their daily chores which include herding which leaves them with little time to carry out regular borehole inspection.

C. Regular Reporting following Check-ups

The researchers also sought to find-out consistency of the respondents in reporting following the check-up to explain results, recommendations and laboratory test results. The survey findings were presented as shown in figure 3.

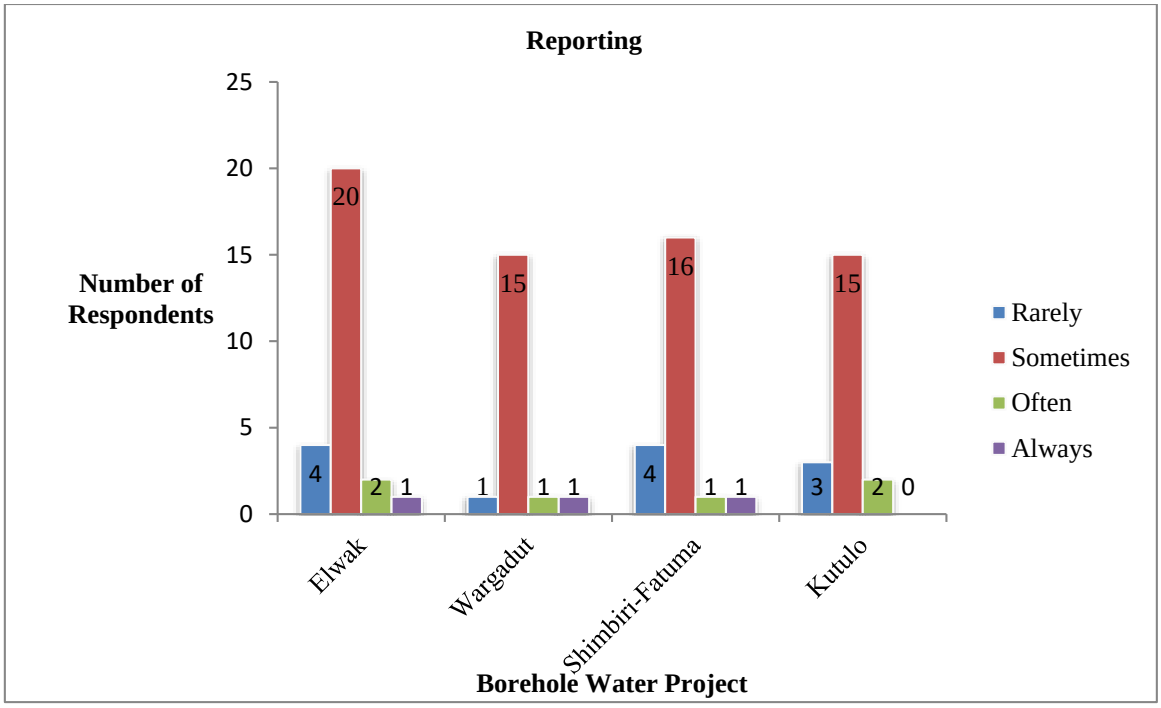

Figure 3: Regular Reporting following Checkup Systems
Source: Field Survey (2016)

The findings revealed that, 4 (4.60%) respondents from Elwak, 1 (1.15%) respondent from Wargadut, 4 (4.60%) respondents from Shimbiri-Fatuma and 3 (3.45%) respondents from Kutulo indicated that they rarely reported following the check up to explain results, recommendation and laboratory test results and linked the failure to illiteracy and the pastoral life led by the respondents in the four divisions which leaves them with little time to carry out the reporting. On the other hand, 20 (22.99%) respondents from Elwak, 15 (17.24%) respondents from Wargadut, 16 (18.39%) respondents from Shimbiri-Fatuma and 15 (17.24%) respondents from Kutulo indicated that they sometimes reported following the checkup. Moreover, 2 (2.30%) respondents from Elwak, 1(1.15%) respondent from Wargadut, 1 (1.15%) respondent from Shimbiri-Fatuma and 2 (2.30%) respondents from Kutulo indicated that they often reported following the checkup. Only 1 (1.15%) respondent from Elwak, Wargadut and Shimbiri-Fatuma borehole water projects respectively indicated that they always reported regularly following the check up and linked it to community participation and sacrifice.

D. Test of Significance of the General Hypothesis

The general hypothesis of this study assumed that there were no cases of poor routine maintenance activities on the existing boreholes in Mandera South Sub-County. The researchers therefore tested the hypothesis based on the significance of the results obtained in figure 1, 2 & 3 using Chi-square test statistic method and the results were as shown in table 1.

Table 1: Test of Significance of the General Hypothesis

Area of respondent	Consistent Participants	Inconsistent Participants	Row totals

Elwak	24 (24.83) p= 0.03	3 (2.17) p=0.32	27
Wargadut	17 (16.55) p=0.01	1 (1.45) p=0.14	18
Shimbiri-Fatuma	20 (20.23) p= 0.00	2 (1.77) p=0.03	22
Kutulo	19 (18.39) p=0.02	1 (1.01) p=0.23	20
Column Totals	**80**	**7**	**87**

From the results, the calculations established that the Chi- square statistic was 0.777, the P- value was 0.854955 and the results were not significant at $p<0.05$ and therefore the general null hypothesis of the study was rejected.

IV. CONCLUSION

The research findings of this study demonstrated that community participation in routine borehole maintenance activities is key in determining sustainability of community borehole water projects. For communities to achieve sustainable maintenance of their borehole water projects, they must be informed on the need to frequently and actively carry out all routine maintenance activities on their borehole water supply projects as a way of enhancing efficiency.

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