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# The Determinants of Willingness to Pay for Improved Management of Water Projects among Households in Baringo County, Kenya

**Emmy Chelangat Rotich**
Post Graduate Student, Department of Quantitative Skills and Entrepreneurship Studies School of Human Resource Development, Moi University, Kenya
**Peter Isaboke Omboto**
Associate Professor, Department of Quantitative Studies, School of Human Resource Development, Moi University, Kenya
**Bernard Nassiuma**
Senior Lecturer, Entrepreneurship Development, Department of Quantitative Skills and Entrepreneurship Studies, Moi University, Kenya

***Abstract:***
*All over the world, water problem has not improved despite the fact that millions of shillings have been invested in building dams and pipe system to supply water to the households. This study sought to establish the willingness to pay (WTP) decisions among households in the county of Baringo to improve management of water projects. The study uses contingent valuation (CV) framework to assess the policy value of managing water projects in the County. A conventional payment card (PC) was used to draw preferences from households in order to estimate the mean and the median WTP for improved management of water projects in the county. This research adopted a quantitative technique method and household in Baringo were the unit of analysis. Data was collected from 155 respondents through simple random sampling procedure including key informants. Through interval regression analysis, the study found that households were, on average, willing to pay Kshs. 233.30 ($2.75) and a median of Kshs. 200 ($2.35) for improved management of water projects. Mean and median policy value of improving management of water projects were estimated at Kshs. 129.6M ($1.30) and Kshs 111.1M ($1.11). These amounts were significantly found to increase with education, income, water sources, quality of water, distance to water source, confidence with payment vehicle and fluorosis. However, amounts were found to decline with age, marital status and incidences of fluorosis. The study concludes that there were significant characteristics for improved management of water projects, which is vital for implementation of water management plans.*

***Keywords****: Contingent valuation, willingness to pay, payment card, water projects, improved management, Baringo*

## 1. Introduction

Millions of households all over the world are open to hazardous levels of biological contaminants and chemical pollutants in their drinking water. This could be attributed to poor management of urban, industrial or agricultural wastewater. According to Flanagan, *et. al.,* (2012), there is a high concentration of chemical hazards, like arsenic and fluoride, from natural sources which affect millions and cause conditions such as cancer and fluorosis.

In Africa, millions of people do not have access to quality water services due to poor management of water projects owing to biased distributions of water resources. Additionally this has been enhanced by environmental threats, climatic change, growing population, rapid urbanization and economic development (WHO, 2012). This has in turn increased water use conflicts, poverty, and environmental degradation, a situation which has created a vicious cycle that impairs the governance of water services. Funds for rural water supply development in Africa are dedicated to communal water points (for example bore holes with hand pumps), yet an estimated 36 percent of these are not in good working condition at any given time (RWSN, 2009).

According to the Government of Kenya (GoK) National Water Development Report of (2006), Kenya water resources have been mismanaged through unsustainable water and land use policies, laws and institutions, weak water allocation practices, growing pollution, and increasing degradation of rivers, lakes, wetlands, aquifers and their

catchments. This means that water resource supply does not meet the demand of water among households. There are serious water use conflicts in the last years, and these are a manifestation of a causal problem. This situation has created a vicious cycle that impairs the governance of water.

Most Kenyans in the rural areas have limited access to water services. They walk for long distances in search of this precious commodity and use it raw and untreated from rivers, lakes and dams (Marshall, 2011). Kenya has scarce water with future projections showing the available per capita water currently at 650m$^3$/year, will likely drop to 359m$^3$/year by 2020, as a result of population growth (WHO, 2011). This is below the global accepted value of 1000m$^3$ year per capita level. Hence, urgent action is required to improve on the capacity of the water availability and accessibility of clean and safe drinking water (RoK, 2006).

What was not well known however was whether households were willing to part with any amount and pay for improved management of water projects in Baringo County. The study examined the general features of the existing water management system, household WTP for improved accessibility to water services, and identifies the socio economic, demographic variables and other factors influencing WTP for improved management of water projects.

## 2. Theoretical Framework

Most empirical studies on peoples' WTP for accessibility to clean water services improvement have previously been conducted using non-market valuation methods. According to (Wang and Zang, 2008), the use of non-market valuation methods has been justified because accessibility to water is an environmental public good, hence un priced and with no established market for its trading (Du and Mendelsohn, 2011). These methods are broadly classified into two (Mendelsohn and Olmstead, 2009) a) the revealed preference methods (for example, travel cost and hedonic pricing) and b) the stated preference methods (for example, contingent valuation and choice experiments).

Under the revealed WTP methods, proxy markets were used indirectly to attach monetary values on policy proposals by finding correlations between the real market behaviour of individuals and the policy proposal in question. Under stated WTP methods, however, hypothetical markets are used directly to attach monetary values on policy proposals by asking people about their WTP for a policy proposal that enhances their welfare or willingness to accept (WTA) compensation for a proposal that decreases their welfare.

An important limitation of the revealed WTP methods is that they can only attach monetary values on policy proposals through the observation of real market transactions. In cases where it is impossible to observe real market transactions, the WTP methods are preferred (Bateman *et. al.,* 2002 and Venkatachalam, 2004). For this reason, this study will employ contingent valuation framework to assess peoples' WTP for improved accessibility to water services in the county of Baringo since real market transactions for water services improvements are unavailable and can only be proxy through contingent valuation. Moreover, this framework is preferred over the choice experiment approach because it will provide the total (use and nonuse) value of the policy proposals in question (Carson, 2000; Mitchel and Carson, 1989).

Contingent valuation methodology is rooted in neo-classical welfare economic theory of consumer behaviour on expenditure minimization (Freeman, 1993; Mitchell and Carson, 1989). In this case, we will consider the following general expenditure function for an individual living in the county of Baringo:

$$e(p, q, u) = y \quad (1)$$

where p is a price vector, q is the improve accessibility to water services in the county, u is the level of utility, and y is the minimum income that is necessary to allow the individual to maintain utility level *u* given prices *p* and level of accessibility to water service *q*, in the county. Furthermore, consider the situation where a policy is proposed to improve management of water projects through improve accessibility to water services for household and community level. The policy outlaws activities which are detrimental to accessibility to water services. The individuals were then asked about the amount they were willing to pay to access regular water supply in order to improve management of water projects. The expenditure function for the initial period before the proposed policy will be:

$$e\,(p, q_0, u_0) = y_0 \quad (2)$$

where $u_o$ is the initial level of utility that the individual can enjoy given prices p, $q_o$ is the initial level of accessibility to water in the county and $y_o$ represents the minimum level of income required to attain utility level $u_o$. Since the new policy will be expected to improve accessibility to water services in the county, the new expenditure function will therefore, be of the form:

$$e\,(p, q_1, u_0) = y_1 \quad (3)$$

where $q_1$ is the accessibility of water after the implementation of the proposed policy and $y_1$ represents the minimum income, level required to attain utility level $u_o$ after the implementation of the proposed policy. The level of utility, $u_o$, is held constant since Hicksian welfare measures assume that utility remains constant. Hence, the individual's WTP for improved management of water services will be a compensating variation measure since an individual will have to part with a certain amount for the improvement to occur. The compensating variation (C) is equal to the individual's WTP and is given by difference between the expenditure functions $y_1$ and $y_0$:

$$C = WTP = y_1 - y_0$$
$$= \{e\,(p, q_1, u_0)\} - \{e\,(p, q_0, u_0)\} \quad (4)$$

Improved accessibility to water in the county after the implementation of the proposed policy, $q_1$, is supposedly greater than the initial accessibility to water, $q_o$. As utility and prices are held constant, $y_1$ (the minimum income level required to attain utility level $u_o$ after implementation of the proposed policy) is less than $y_0$. Therefore, the compensating variation will be negative meaning that an individual has to pay some dollar amount to attain the improved level of water management projects in the county of Baringo.

## 3. Research Methodology

### *3.1. Study Area*

The study was carried out in Baringo County being one of the 47 counties in Kenya and is located in the Rift Valley Province. The equator cuts the county at the southern part and is located between longitude 35 30' and 36 30' and latitudes 0 10' south and 1 40' north. The altitude for the region varies between 3000m mean sea level at it is highest points and nearly 700m above the mean sea level at it is lowest. Due to varied altitude, the county receives varied levels of rainfall ranging from 1500mm in the highlands to 600 mm at the low lands. It borders Turkana to the North, Samburu to the North East, Laikipia to the East, Nakuru to the South, Kericho and Uasin Gishu to the South West, Elgeyo Marakwet to the West, and West Pokot to the North West (BCDP, 2015/16). Baringo County covers 11,075.3 $km^2$ (4,276.2 sq mi) of which 165 sq Km is covered by surface water – Lake Baringo, Lake Bogoria and Lake Kamnarok. The county has six constituencies: Baringo Central, Baringo South, Tiaty, Baringo North, Eldama Ravine and Mogotio.

### *3.2. Population and Sample*

"According to Neuman (2011)," the primary purpose of sampling in Quantitative research is to create a representative samples. The county resident population is estimated at 555,561 people GoK (2009 census) consisting of approximately 50.24 per cent of males and 49.76 per cent of female with a growth rate of 3.3 per cent per annum. There are 110,649 households in Baringo county (KIRA, 2014), covering 1970.00 square per kilometer with a population density of 282. In that case, the simple random sampling was used to select a final sample of 155 respondents from each of the six sub counties within the county of Baringo. In the first stage, simple random sampling procedure was applied to select three representative sub counties. In the second stage, one ward area was randomly selected from each of the three sub counties selected in the first stage. In the third and final stage, simple random sampling procedure was used to select the final respondents for the interview process with each village contributing a share of 17 respondents into the final sample. This sampling method was chosen because it ensures high degree of representativeness by providing the respondents with equal chances of being selected into the sample (Ndambiri, et al 2010).

### *3.3. Survey Implementation*

A pre-test survey was conducted using the open ended value elicitation format following Haab and McConnell (2002) upon twenty respondents. The respondents were asked to comment on the appropriateness of the questions in the questionnaire, paying close attention to relevance, clarity, wording, and interpretation of each question in the survey among other anomalies. Bid ranges were also obtained from the pre-test from which the mean, median, minimum and the maximum WTP values were determined. A final survey questionnaire was prepared and administered to the 155 respondents basing it on the responses and comments provided by the respondents in the pilot test exercise.

### *3.4. Environmental Good Valued*

A policy proposal for improved management of water projects through improve accessibility to water services in Baringo constituted the public good of interest that was valued in the study. Conspicuously, accessibility to water services differs from one water source to another such that an accurate description of some definite level of improved accessibility to water service was difficult and could have been misleading. Due to this fact, a valuation question that sought for an overall improvement of accessibility to water services in the county was posed to respondents and the values they gave were used to estimate the mean and the median WTP values for the study sample.

### *3.5. Payment Vehicle*

Some modes of payment used by researchers in Contingent Valuation include amenity bills, fees, and also taxes. According to Morrison *et. al.,* (2000), some of these payment vehicles can be subjected to objection and protested responses among survey participants and hence, lead to biased results. Following Fonta *et. al.,* (2010), this study chose to use a special trust fund, a neutral kind of payment vehicle, so as to minimize objections and protest responses among participants. In this fund, respondents were hypothetically required to contribute once towards the exclusive purpose of improving management of water projects. It was expected that it would enhance the credibility of the hypothetical scenario posed as opposed to other alternative payment vehicles such as amenity bills, fees, or taxes often linked with protest responses in contingent valuation (Morrison *et. al.,* 2000; Sayadi *et. al.,* 2009).

*3.6. Valuation Format*

The study used the PC format to elicit peoples' preferences based on a comprehensive policy proposal that would improve accessibility to water services in the county of Baringo. Under this format, respondents were given cards where they were asked to circle the highest amount they were WTP in order to improve accessibility to water services. Out of the responses given, inferences were made about their true WTP, which was equal to or greater than the circled value but less than the next higher value (Cameron and Huppert, 1989). This format is advantageous because respondents can easily and visually scan through a given set of value intervals (Cameron and Huppert, 1989) and hence, determine the range within which their WTP lie. Additionally, the kind of data obtained by PC format is less scattered and therefore, does not require larger samples to obtain robust estimates. The format does not suffer from yeah-saying and starting point bias like other contingent valuation formats (Mitchell and Carson, 1989). Although PC questions are theoretically vulnerable to range and mid-point bias, there is little empirical evidence of the existence of range or mid-point bias (Klose, 1999; Ryan *et. al.,* 2004). On the other hand, while the format still has the possibility of yielding protest zeros, it has not been found to give very high proportion of protest zero responses compared to other contingent valuation formats (Hanley *et. al.,* 2003; Klose, 1999). Thus, the valuation question was formulated as follows:

> *"Assuming the presented policy to improve management of water projects in the county of Baringo will actually be implemented to improve accessibility to water services, what is the maximum amount of money you would be willing to pay one-off to the special trust fund to achieve this? (Circle or tick a single amount on the card)."*

The PC included 11 different amounts in Kenya shillings, namely: Kshs. 0, 25, 50, 75, 100, 150, 200, 250, 300, 400, and finally Kshs. 500, in which case respondents were only required to circle one single amount on the card.

*3.7. Econometric Model*

Following Cameron and Huppert (1989), the interval regression model was used to estimate the mean and the median WTP values from responses generated through the PC format. Thus, letting $WTP_X$ be the maximum amount that a respondent would pay and $WTP_Y$ be the lowest amount that a respondent would switch to a 'No' rather than a 'Yes' response, the individuals WTP was therefore taken to lie somewhere in the switching interval ($WTP_X$ , $WTP_Y$). To adjust for the skewed distribution of WTP responses, the lognormal transformation of the WTP responses was preferred, hence:

$$Log\ WTP_i = R_i^{'}\psi + \varepsilon_i \quad (5)$$

where $R_i$ denotes the characteristics of the respondent or the valuation good in question, $\varepsilon_i$ stands for the normally distributed random variable with zero mean and standard deviation $\sigma$, and $\psi$ are regression coefficients. Assuming that WTP is a random variable (Welsh and Poe, 1998), the probability that a respondent would select a given monetary amount was:

$$Prob(yes) = prob(WTP_i \geq WTP_X) = 1 - \mathcal{M}_{WTP}(WTP_X) \quad (6)$$

where $\mathcal{M}_{WTP}(WTP_X)$ is the cumulative distribution function of the random WTP variable. The probability that the WTP would fall between any two monetary thresholds was:

$$Prob(WTP_Y > WTP_i \geq WTP_X) = \mathcal{M}_{WTP}(WTP_Y) - \mathcal{M}_{WTP}(WTP_X) \quad (7)$$

which results in the corresponding log-likelihood function for *n* number of respondents as:

$$Log(L) = \sum_{i=1}^{n} Log\left\{\mathcal{M}_{WTP}\left(\frac{WTP_Y - \psi R_i^{'}}{\sigma}\right) - \mathcal{M}_{WTP}\left(\frac{WTP_L - \psi R_i^{'}}{\sigma}\right)\right\} \quad (8)$$

With further assumption that the stochastic term is normally distributed, $\psi$ and $\sigma$ could be estimated and then used to compute the mean and median WTP values. Thus, the mean WTP = $e^{(R_i^{'}\psi + \sigma^2/2)}$ and median WTP = $e^{(R_i^{'}\psi)}$. Here, $R^{'}$ is taken as the vector of mean values of explanatory variables, $\psi$ as the vector of estimated coefficients and $\sigma$ as the estimated standard variance.

*3.8. Data Analysis*

The study generated quantitative data for analysis. This data was cleaned and coded appropriately for use in SPSS software v.21. Based on the interval regression framework, the STATA v.12 software was used to estimate the individuals' WTP for improved management of water projects in the county of Baringo together with the factors that influence the individuals' willingness to pay decisions. Descriptive statistics such as means, standard deviations, percentages and frequencies was derived from the information gathered using the SPSS software.

*3.9. Ethical Considerations*

The researcher obtained a research permit from National Commission for Science, Technology and Innovation (NACOSTI). Mutual understanding was established to ensure good working relationship between the research assistants and the respondents willing to be interviewed. To ensure high degree of ethical consideration in the research, the researcher and the assistants did not include the name or identity of the respondents in the questionnaire. Furthermore, in order to capture the required information, the researchers sought informed consents from the participants which was done using legally accepted ways. No respondent was coerced by force or by reward into giving out information. The report was confidential to the researcher and was not shared with anybody else. Furthermore, no attempt was made to disclose the identity of the respondents.

## 4. Results

*4.1. Knowledge of Water Management*

Majority of respondents have knowledge of water management with 78.8 percent while 21.2 percent has no knowledge of water management. Most respondents define water management as the planning and coordination of water resources under set policies and regulations. Some define it as provision of clean water by the government.

*4.2. Causes of Poor Accessibility to Water Services*

Causes of Poor Accessibility to Water Services are shown on Figure 1. The researcher sought to find out what the respondents think is the main cause of poor accessibility to water services and the outcome showed that most of the respondents related the problem to poor management of water projects with a 53 percent. On the other hand, the issue of lack of community participation took a share of 5 percent as the reason for poor management of water projects. Other anticipated causes such as drought and lack of resources represented 17 and 25 percent respectively.

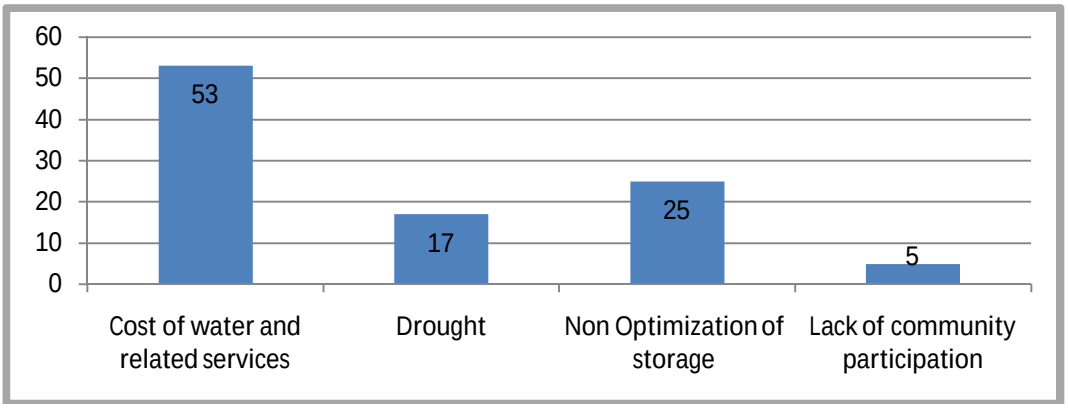


*Figure 1: Causes of Poor Accessibility to Water Services*
*Source: Field Data 2016.*

*4.3. Problems Associated with Poor Management of Water Projects*

Results in Table 1 shows the main problems associated with causes of poor accessibility as corruption and financial incapacitation with 30 percent and 25.8 percent respectively. Human resource incapacitation and lack of sensitization represented 18 percent. Poor supply and lack of sensitization had 12 percent and 12.2 percent respectively. Other factors like lack of storage tanks, stakeholder participation, and government interference, minority of the respondents associated this to poor management of water projects.

| Problems Associated with Poor Management | Frequency | Percent |
|---|---|---|
| Human resource incapacitation e.g. poor training, leadership and planning; and unmotivated staff | 28 | 18.00 |
| Corruption | 47 | 30.00 |
| Poor supply and storage systems, and facility problems | 18 | 12.0 |
| Financial incapacitation in supply and demand sides | 40 | 25.8 |
| Lack of sensitization on water management and conservation of environmental resources | 19 | 12.2 |
| Inadequate or lack of stakeholder participation | 1 | 0.7 |
| Government interference | 1 | 0.7 |
| Population Expansion | 1 | 07 |
| Total | 155 | 100.0 |

*Table 1: Problems of Poor Management*
*Source: Field Data 2016*

*4.4. Perceptions of Households about Water Shortage*

The respondents sampled positively perceived that Baringo suffers from water shortage. About 90 percent of the respondents acknowledged that indeed Baringo suffers from problem of water shortage. This is not surprising since 53 percent of the interviewed households linked this problem to poor management, limited resources and long distance to water source. One would expect it to be so because Baringo is Arid and Semi-Arid Land.

*4.5. Perceived Issues in Accessing Water Services*

Since the county suffers from acute shortage of water, the majority of the households perceived that the main problem in accessing water services is due to poor management of water service and the limited water source with a 21 percent and 19 percent respectively. Drought, poor distribution and long distance to water point took a share of 14, 15 and 16 percent respectively. Other problems to which the minority of the respondents associated the problem with, were cost of water and human activities along the upstream terrain which represented 10 and 5 percent respectively. The information is represented on Figure 2.

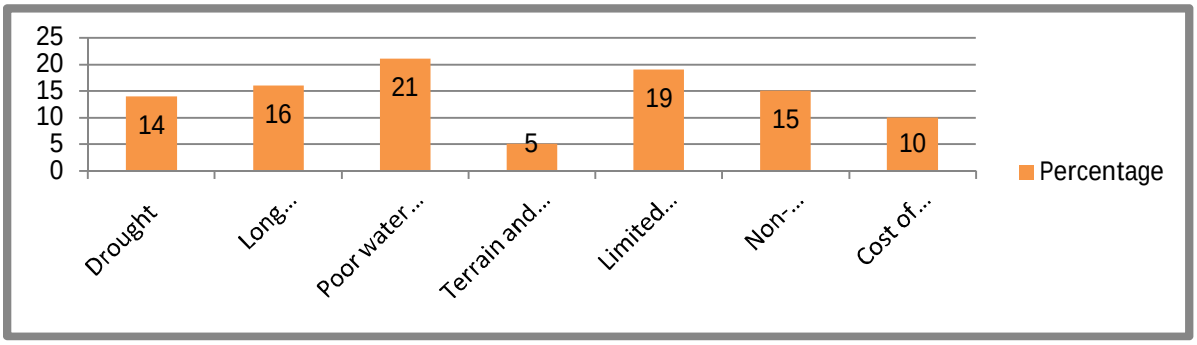


*Figure 2: Perceived Problems in Accessing Water Services*
*Source: Field Data 2016*

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*4.6. Categorization of Water Problems*

Respondents were asked how they categorize the water problem in the county. Out of the 155 respondents interviewed, majority (34.7 percent) reported it as an environmental problem while a few (7.5 percent) are of the opinion that the problem is a social problem. Other respondents at a closer range associated the problem to political and others as economic which represented 26.3 percent and 31.4 percent respectively. This has led households to think that this problem concerns other people.

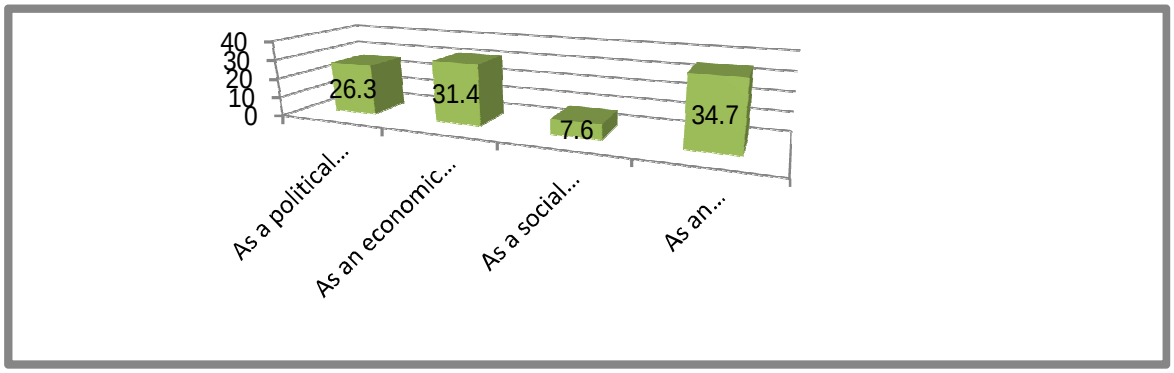


*Figure 3: Respondents' Categorization of Water Problem*
*Source: Field Data 2016*

*4.7. Perceived Responsibility for Management of Water Problems*

Figure 4 shows that 59.5 percent of the respondents' perceived responsibility of water problems to be for government organization and 19.5 percent of the respondents perceived it as the responsibility of every citizen in the county. 4 percent of the respondents who formed the minority are of the opinion that non-governmental organizations are responsible while on the other hand 17 percent of the respondents think it is the responsibility of the local community. This is because the government has been responsible for providing water services which is considered to be a public good.

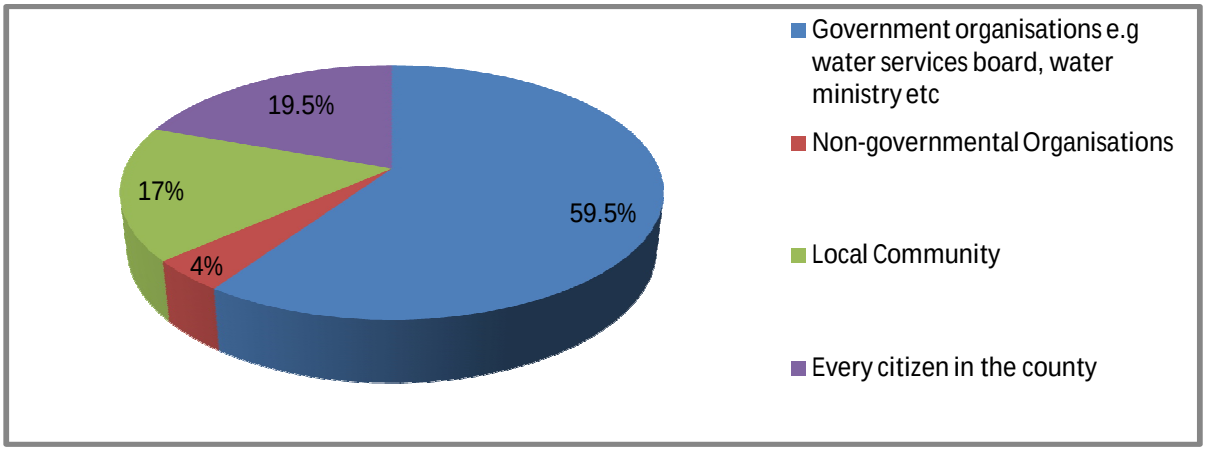


*Figure 4: Perceived responsibility for management of water projects.*
*Source: Field data 2016*

*4.8. Accessibility to Water Services*

The respondents were asked about the accessibility of water services so as to ascertain the degree of seriousness. Table 2 shows that the frequency of those who regarded the problem to be very serious was high with 59 percent and those who perceived the problem of accessibility to be less serious were 3 percent. 38 percent of the respondents interviewed were of the opinion that accessibility to water service is just serious. This could be associated to the fact that 89 percent of the respondents admitted that water problem is serious in the county of Baringo.

| | Frequency | Percent |
|---|---|---|
| Very serious | 91 | 59.0 |
| Serious | 59 | 38.0 |
| Less serious | 5 | 3.0 |
| Total | 155 | 100.0 |

*Table 2: Accessibility to Water Services*
*Source: Field Data 2016*

*4.9. Perceived Attention by Authorities on Improving Water Accessibility*

The researcher further sought to understand how the residents of Baringo County perceived the attention of the authorities in improving accessibility to water services. Figure 5 shows that households in Baringo do not agree that the

government has given a lot of attention to water problem with a minority representation of 4 percent. 9 percent of the respondents agree that the authorities have given no attention at all. On a close range are those who perceive that local authorities have given some attention at 44 percent while on the hand 43 percent are of the opinion that they have not given too much attention to the problem.

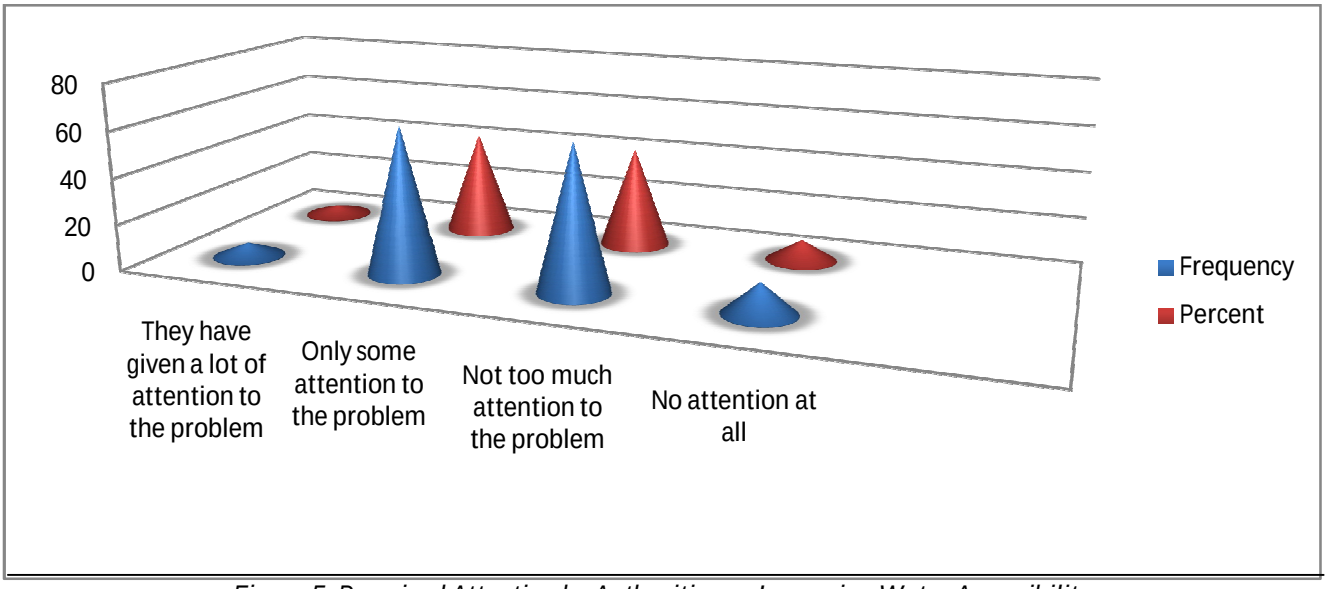


*Figure 5: Perceived Attention by Authorities on Improving Water Accessibility*
*Source: Field Data 2016*

*4.10. Proposed Measures to Manage Water Projects*

The respondents were asked to give one measure among the suggested measures which according to them should be applied in the county of Baringo to manage water projects. The response as seen in Figure 6 is evident that majority prefer an improvement in water supply system with 65 percent representation, followed with 13 percent which represent building a water filtration tank to improve water quality. This could have been influenced by the fact that most residents complain of poor accessibility to water despite the fact that existing dams like Kirandich and Chemususu has a lot of water but the residents still suffer from ineffective and inefficient water accessibility.

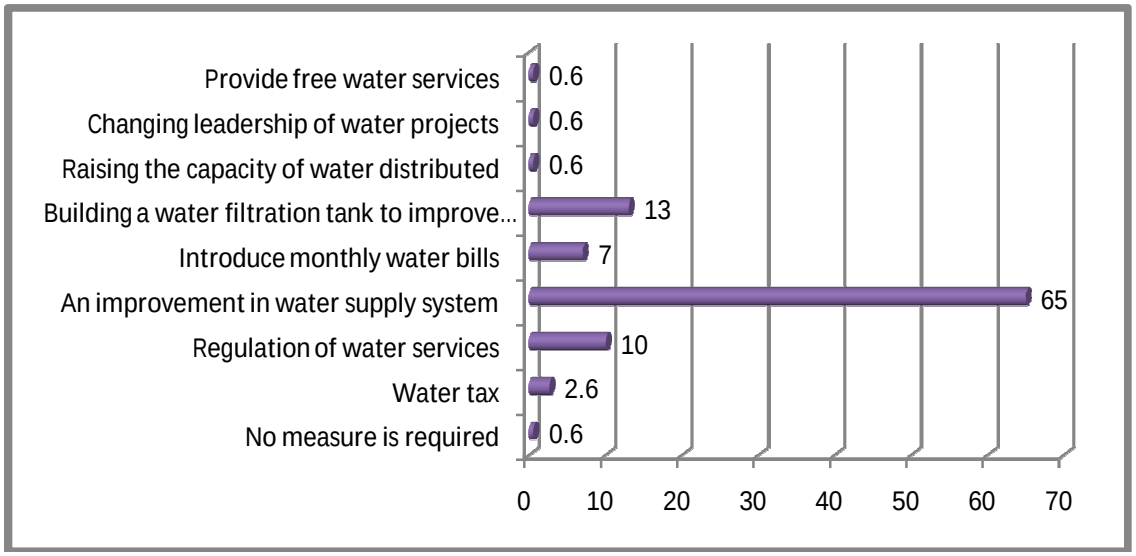


*Figure 6: Proposed Measures to Manage Water Projects*
*Source: Field Data 2016*

*4.11. Preferred Payment Method*

The researcher sought to know the preferred payment method the respondent would like to use if indeed they are willing to pay for special fund to improve accessibility to water services. Figure 7 shows that the minority would prefer to pay through environmental tax deduction but on the other hand the majority would prefer to pay through water

amenity bills with 7.6 and 37.5 percent respectively. Special water funds and donation were close with 28.5 and 27.5 percent respectively. The high preference of water bill could be associated with the fact the same method has been used for years by the county government to collect water revenue.

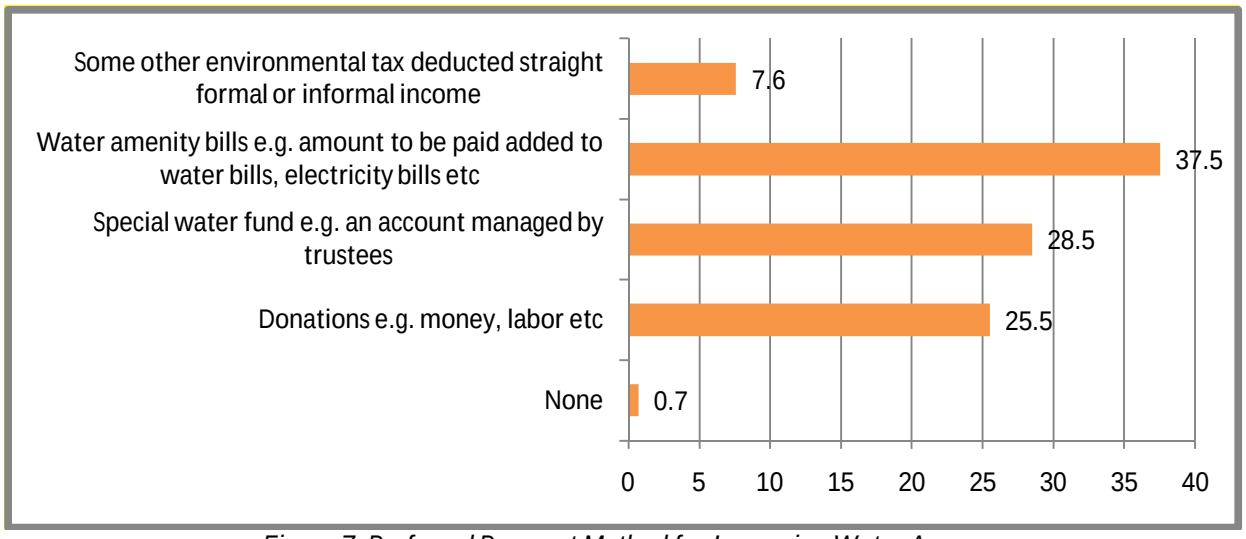


*Figure 7: Preferred Payment Method for Improving Water Access*
*Source: Field Data 2016*

*4.12. Determinant Factors of Mean Willingness to Pay*

As shown in Table 3, the study found out that respondents are, on average, willing to pay Kshs. 233.30 ($2.75) with a median value of Kshs. 200.00 ($2.35) to improve water management in the county. In order to assess the factors influencing individuals WTP, several socio demographic characteristics of respondents, namely, age, gender, education, marital status, household size, income, living in own house, type of house built, type of water source, quality of water, proximity to the market, distance to the nearest water source, confidence with payment vehicle, and fluorosis in the household, were regressed against the grouped data on WTP. Table 3 give more results of the interval regression analysis.

| Variable | Coefficient | Std. Errors |
|---|---|---|
| Age | -4.48E-05** | 0.007 |
| Gender | 0.021 | 0.143 |
| Education | 0.004* | 0.064 |
| Marital status | -0.035* | 0.186 |
| Household size | -0.001 | 0.029 |
| Household income | 0.008** | 0.091 |
| Source of income | 0.020** | 0.143 |
| Living in own house | 0.018 | 0.134 |
| Type of house built | 0.019 | 0.138 |
| Type of water source | 0.020*** | 0.142 |
| Perceived quality of water | 0.026** | 0.162 |
| Proximity to market centre | -0.024 | 0.154 |
| Distance to the nearest water source | 0.001* | 0.032 |
| Confidence with payment vehicle | 0.020*** | 0.140 |
| Fluorosis in the household | 0.017** | 0.132 |
| Constant | -0.673*** | 0.820 |
| Log likelihood | -400.103 | |
| Number of observations | 144 | |
| LR chi2 (15) | 22.57 | |
| Probability > chi2 | 0.000 | |
| | | |
| Mean WTP in Kenya shillings (US$) | 233.30 | |
| Standard error | 12.38 | |

| | |
|---|---|
| Bootstrapped 95% confidence intervals | 209.05 – 257.99 |
| Median WTP in Kenya shillings (US$) | 200.00 |
| Standard error | 11.78 |
| Bootstrapped 95% confidence intervals | 172.50 – 235.12 |

*Table 3: Interval Regression Results on Factors Explaining Individual Willingness to Pay*
*Notes: *, ** and *** denote p < 0.1, p < 0.05 and p < 0.01*
*Source: Field Data 2016*

As indicated in Table 3, it was hypothesized that age of respondents would have a positive relationship with the individuals' WTP. This is because older people may sometimes be vulnerable to water borne diseases and may be WTP for clean drinking water than the younger generation. Aged people may, on the other hand, have a lower WTP because of the other preferences they may have to make within the household, such as paying school fees. However, the results show the negative relationship between the age of respondents and their WTP, which implies that younger people are more willing to pay for improved water management projects than older people.

Positive relationship between gender and the WTP was also hypothesized and the results came out as expected. It means that men are more willing to pay for improved management of water projects than women. The most probable reason for this is the fact that men have more access to information than women and would therefore be more knowledgeable on the negative effects of poor accessibility to water services than women. Another reason is that men earn more than women and they also control budgets within the household since they have more disposable income. This outcome does not correlate well with the ones of Genius, *et. al.,* (2008), whose results pointed out that female respondents were WTP. These results are similar to those of *Odusina, et. al., (2012)* who claim that variables like sex, significantly influence household's willingness to pay for better access to potable water.

WTP for improved accessibility to water services was expected to be positively related to education. The findings prove this right, and this can be associated to the fact that the longer times in formal schooling (years), the more people understand the consequence of poor management of water projects which leads to consuming poor quality water. Therefore, the educated are more willing to pay than the illiterate. Dauda *et. al.,* (2014) found similar results that higher education highly influenced the household willingness to pay decisions.

The study also established an inverse relationship on WTP between the married and those who are single, divorced, widows and widowers households heads. The likely reason could be that married couples feel obliged to live in a clean environment by providing access to clean water to their households. The findings produced are similar to those of Brouwer *et. al.,* (2009), who found out that unmarried are more price sensitive and not WTP anything more as compared with the married household heads that have disposable household income.

Household size was expected to be inversely related to WTP. It was assumed that big households would be willing to pay relatively less due to the associated high running costs (i.e. budgetary constraints). Thus the study expected the sign of its coefficient to be negative. The result proves it correct with a negative coefficient. The results do not correlate to those of Genius *et. al.,* (2008), whose results point out that household with children are willing to pay more. This could be associated with the fact household would prefer accessibility to clean water in order to mitigate the risks of the children getting sick, despite the fact that they have other financial obligations which they have to achieve. As Teklewold *et. al.,* (2006) and Tizale (2007) note, household size is a proxy to labor availability. Therefore, larger households are likely to have a lower probability to accept WTP decisions since households with many family members are likely to divert labor force to fetch water for both commercial and domestic use to ease pressure imposed by a large family size and may therefore, not willing to participate.

Household income is another important variable used in the study to explain individuals' decisions to pay for improved management of water projects. It was expected that individuals with higher incomes would be more willing to pay for improved management of water projects than those with lower incomes, which would conform to economic theory Loomis & Ekstrand, (1998). The results are positive and theoretically validate the outcome of the study just like Odusina *et. al.,* (2012) outcome that household income has a significant influence on WTP. A similar outcome is found in many other CV studies including Carlson and Johansson-Stenman (2000), Wang *et.al.* , (2006), and Wang and Zang (2008).

Positive correlation was expected between home ownership and the WTP, because of the public willingness to improve management of water projects. The results came out as expected household owners are found to be more willing to pay for improved accessibility to water service than non-homeowners. However, the results differ from those by Firoozzarea and Ghorbani (2011) who found out that non-home owners are more willing to pay than home owners. Type of house built was hypothesized to be positively related to WTP. There is a high chance that people residing in a permanent build house will be willing to pay for improved accessibility to water service unlike their counterparts who reside in a semi-permanent house. The results were positively as hypothesized.

The study further established that the type of water source was positively hypothesized. People prefer getting water from the public source unlike other source because they tend to be more reliable unlike seasonal rivers, dam, waters pans etc. Since most household fetch water from the public hence they are WTP in order to enhance accessibility

to water services. With regard to perceived quality of water, it is hypothesized that the higher the level of water quality awareness the more the respondent would appreciate the consequence of improved management of water projects and more value an individual would give in order to avoid the risk of inaccessibility to water services. The results came out as expected meaning that households are WTP in order to get good quality water.

With regard to the proximity to the nearest market centre, the study results indicate that household residing further away from the nearest market were less WTP to improve accessibility to water service. In addition, households residing far away from the nearest market were less likely to accept the WTP decision for improved accessibility to water service than households residing shorter distances to the nearest market. The observation is likely because household head access information on management of water projects broadens their information base and hence the probability to accept to pay. These results are in line with an observation made by Madison (2006) that long distances to markets decrease the probability of households WTP in Africa and that markets provide an important platform to households to gather and share information.

The distance to the nearest water source variable was used to assess whether or not the WTP would vary with distance since the perceived effects of poor accessibility to water were likely to vary with the distance. The findings give evidence of positive, though statistically insignificant relationship meaning that residents living closer to nearby water source are not willing to pay for improved management of water projects in the county than their counterparts residing further away from the water source. This finding can be attributed to the fact that people residing far from the source have been affected by shortage and inaccessibility to water supply and, therefore, are more willing to pay for water service improvements. Studies by Carlson and Johansson-Stenman (2000) and Wang *et. al.,* (2006) also reveal similar findings that people residing further away from the nearest market were less likely to have access to rivers, borehole and also dams.

In regards to distance from existing water point, WTP for improve management of water projects is expected to be positively and negatively related to a case when the distance is far and when is near consecutively. This observation is probably because household living near the water source can generates income by selling water. They tend to embrace WTP participation among the residence of the research area. The study also examines whether or not individuals 'were confidence with payment vehicle would have a positive effect on the WTP variable and, as predicted, it was found that individuals who are confident about the payment vehicle are more willing to pay than those who does not have confidence with the payment vehicle in question. Similar findings are also reported in Fonta *et. al*., (2010). Those who express their reservations regarded water services as a privilege to them and should be provided by the government.

Finally, the study also reveals positive relationship between the fluorosis in the household and individuals' WTP. This observation may be due to the fact that fluorosis is a major problem in the county of Baringo, causing dental mottling and high levels of crippling skeleton fluorosis. Hence residents are WTP so as to avert diseases caused by inaccessibility to water services. According to Kunze, (2012), defluoridation filters for household and community level were developed by the water quality program of the catholic diocese of Nakuru (CDN WQ), Kenya, to prevent fluorosis which is a severe disease caused by high fluoride consumption.

*4.13. Summary of Willingness to Pay Respondents*

Table 4 presents the analysis of various types of WTP responses derived from the study. The survey included a total of 155 respondents. Out of the total number, about 129 respondents (83%) indicated a positive WTP for improved management of water projects and 15 respondents (10%) gave a zero WTP value. In order to separate protest responses from true zeroes, a closed-ended debriefing question was presented to respondents to justify why they had a zero WTP for water management improvements. Thus, four possible alternatives were presented to respondents, namely: a) because water quality improvements have no value to me hence am satisfied with the status quo: b) because it is the responsibility of the Government: c) because I have many other basic financial commitments: and d) because it is the responsibility of the political leaders.

| WTP Responses | Frequency | Percent |
|---|---|---|
| Positive willingness to pay responses | 129 | 83 |
| True zero willingness to pay responses | 15 | 10 |
| Analytical sample size | 144 | 93 |
| Protest responses | 11 | 7 |
| Total sample size | 155 | 100 |

*Table 4: Willingness to Pay Responses*
*Source: Field Data 2016*

Following Strazzera *et. al.,* (2003), the first (a) and the third (c) responses were classified as true zero values, while the other two as protest responses since they did not address the value of the public good in question, but some objection as to who should really pay for improved water management projects. Based on the above given classification, 15 respondents (10%) gave a true zero WTP value, while 11 (7%) gave a protest response. In line with the standard

practice in valuation studies (Brouwer, 2009; Wang & Whittington, 2000; Whitehead *et. al.,* 1998), the protest responses were excluded from the analysis. Therefore, only 144, 93% responses, of the initial sample size, were subjected to further analysis.

**5. Conclusions**

This study was conducted with the aim to analyze household WTP for improved management of water projects through WTP decisions among households in Baringo County. Based on the responses from the contingent valuation PC format, the research was inspired by the need to estimate the policy value of improving water management projects through an improvement program for the county of Baringo since inaccessibility to water services were on the rise due to poor management of water project in the county. Earlier findings have shown that people in Baringo are well aware of the water problems in the county upon which they identify poor management of water projects as the primary cause of inaccessibility to water services owing to the consumption of water with high fluoride.

Baringo residents have also been found to be familiar with adverse health and environment effects of poor quality water and, as a result, most of them are WTP positive amounts towards improved management of water project in the county. While a few people are WTP true zero amounts towards the same course citing overwhelming financial commitments within the household, others give protest responses against the water management improvement plan, saying that the government should bear the responsibility of providing clean water plans. In monetary terms, individuals in the study are, on average, willing to pay Kshs. 233.30 ($2.75) for improved management of water projects and the median WTP is Kshs. 200.00, which is equivalent to $2.35. Moreover, education, household income, source of income, type of water source, perceived quality of water, distance to water source, confidence with payment vehicle and fluorosis in household have significant effects on peoples' WTP decision for water management improvements.

Since water accessibility issues continue to worsen in Baringo due to increased population, the county authorities can now use the estimated mean and median WTP to benchmark their budget and policy proposals for improved management of water projects in the county. Based on the study findings, these budget and policy proposals can also be adjusted to the socio-demographic characteristics of individuals, as they have been found to be important determinants of the peoples' WTP decision.

The mean and median estimates can also be used to determine the economic efficiency of other water management improvement programmes in the ASAL regions in the country since peoples' WTP are evident and determinate. All in all, more studies are required to further our understanding of the policy values of tackling specific issues (*e.g.* cholera, fluorosis, dysentery, typhoid, damage pipes and high cost of electricity) that arise due to poor management of water projects. Such studies may provide varied information to decision makers on how to deal with different water accessibility problems in a developing country.

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