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Analysis of the effect of access to potable water on household well-being among small holder farmers in kakamega county, Kenya

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Abstract
In the Second Medium Term Plan of the Kenya Vision 2030, poverty was considered a threat to human life in spite of the policy initiatives used. Despite the effort and interventions by the Kenyan government, poverty rates have continuously remained high keeping the levels of wellbeing relatively low. Given this scenario, an explanation of this requires studying the effect of access to potable water on household well-being among small holder farmers in Kakamega County. The study adopted descriptive research design, which ensured ease in understanding the insight about the problem under study. Smallholder farmers registered with Cereals Board of Kenya in 2017 within Kakamega County making a total of 31,780 formed the target population. A sample size of 385 respondents was used to represent the target population. A self-administered questionnaire was used for data collection since this could be send to a large number of people. Collected data was analysed using inferential as well as descriptive statistics. The study findings showed a significant relationship between access to potable water and household well-being of smallholder farmers in Kakamega County. The study recommended that the County Government of Kakamega should enhance efforts to promote universal access to potable water in rural areas to a higher level, supporting these commitments with institutional frameworks, strategic plans, clear policies and dedicated establishments.

Keywords: potable water, smallholder farmers, universal access, well-being

1. Introduction

1.1. Background to the Study

Rural economic development is dependent upon the development of water infrastructure to enhance accessibility since it has many positive outcomes such as household well-being, productivity enhancement, and improvement in quality of life (Siddaram, 2014) [19]. Within the confines of water, Kaushik (2011) [8] identifies the meaning of accessibility to distance and time involved in obtaining water infrastructure. The concept of economic accessibility to water infrastructure relates to the ease at which water facilities are affordable to all persons including the poor in a way which does not limit their ability to afford other essential basic services such as food, housing and health care (Frone & Frone, 2013) [7]. In view of this, water is considered economically accessible if a household's monthly income spent on it does not exceed 5% (Water Aid, 2011) [27].

According to World Health Organization, drinking water means water used for drinking, cooking, food preparation and personal hygiene whereas accessibility implies that water is sufficient and meets domestic needs and is reliably available to homes (WHO, 2016) [30]. With accessibility, it is also suggested that water is collected within a distance of not more than 1 km of the dwelling, corresponding to a maximum water hauling round trip of 30 minutes. Potable water implies that drinking water (water used for drinking, cooking, food preparation and personal hygiene) is free from pathogens and any levels of toxicants at all times and poses no significant threat to health (WHO, 2016) [30]. The spill-over effects generated by water infrastructure development could serve as a true engine of growth and by extension poverty reduction (Nilotpal, 2013) [14]. As an essential part of a conducive environment for investment and livelihood, access to adequate and clean water promotes economic growth, reduces poverty, and improves delivery of health and other services (World Bank, 2014; Wantchekon, 2014) [28, 25].

Currently approximately 768 million people are estimated to still be without access to an improved drinking water source (United Nations International Children's Fund, 2014) [21]. In Africa, millions of people still have to rely on unsafe water while domestic consumption competes with water for commercial, agricultural and industrial activities (Abdullar & Rakhmatullaev, 2015) [1]. In Kenya, access to water from an improved source increased substantially between 2009 and 2015/16 at the national level, but rural areas were still left behind. The proportion of households with access to water from an improved source increased from 56.1% in 2009 to 72.6% in 2015/16. The progress in enhancing access to water from an improved source was more pronounced in a few counties; Kisii (50.9% to 89.4%), Nyamira (48.9% to 83.6%), Migori (28.8% to 60.9%) and Kakamega (60.5% to 85.5%) from 2009 to 2015/16 respectively. The proportion of households with access reduced in Wajir, Garissa, Mandera and Uasin Gishu. This reduction is attributed in part to inadequacy of existing water resources, landscape/catchment modifications, limited investment in water services due to funding constraints and effects of climate change (Development Initiatives, 2018) [6].

In Kakamega County, H.E. Hon. Wycliffe Ambetsa Oparanya who is also the first Governor of Kakamega

County has undertaken programs geared towards increasing the number of households with access to a reliable water source. An all-inclusive access to potable water is a key devolution scorecard in Kakamega County's priority agenda. Some of the initiatives undertaken by the County in collaboration with development partners and other stakeholders in the water sub-sector include: funding the construction and distribution lines for containerized water treatment plants in each of the twelve sub-counties with each having a capacity to serve more than 40,000 people, investing in massive storage facilities and strategic pipeline distribution network to predictable high demand zones, embracing appropriate technologies in harnessing and pumping potable water, fast-tracking connectivity linkages with inbuilt real-time infrastructure to reduce non-revenue water spillage among others. Consequently, the possibility of water supply coverage is anticipated to increase to 85 percent of the total population by 2022 compared to 61 percent in 2013. To demonstrate commitment to his slogan '*Amatsi Khumukuru'* (Water up to the doorstep of households), Hon. Oparanya has consistently increased budget allocation to the water sector from approximately sh. 200 million in 2016/17 to about sh. 500 million in 2019/20 which translates to about 150 percent increment (County Government of Kakamega, 2019) [13].

1.2 Statement of the Problem

In recognition of the right to life and dignity, the international community recognized that humans have a right to safe drinking water (United Nations, 2014) [21]. According to Young (2015) [31], the disbursement of development finance from development finance institutions, private banks and government, the number of household backlogs with access to water supply and sanitation continues to decline at a very alarming rate in developing countries like Kenya. Despite the effort and interventions by the Kenyan government, poverty rates have continuously remained high (SID, 2013). According to a global monitoring report by World Bank, Kenya was likely to attain some of her Sustainable Development Goals including one and six, only in 2050 (World Bank, 2013) [28]. In the Second Medium Term Plan of the Kenya Vision 2030, poverty was considered a threat to human life in spite of the policy initiatives used (Republic of Kenya, 2013) [16]. Some of the studies that have been conducted have mainly been on effect of access to water on health (WHO, 2016; UNDP, 2017; Puroxi, 2011; Tezera, 2011) [30, 22, 20]. Other studies have explored education opportunities, political representation, and access to credit on well-being among others (Waswa & Mukanzi 2018; Mudi & Waswa 2018; Waswa & Mudi, 2018) [13, 13, 13, 12]. Despite these studies and their recommendations, poverty in Kakamega County remains relatively high (Republic of Kenya, 2014) [17], indicating that there is still more that needs to be done. Furthermore, there is limited research linking access to potable water on household well-being in Kakamega County. This study seeks to fill this knowledge gap.

1.3 Objectives of the Study

1.3.1 Specific Objective

The specific objective of this study was to investigate the effect of access to potable water on household well-being among small holder farmers in Kakamega County, Kenya.

2. Literature Review

2.1.1 Capabilities Approach

The concept of capabilities is leaning around the idea that a country may experience substantial economic growth and still have its people experience poor quality of life, indicating that economic view of progress is limited in its capacity to provide answers as to whether citizens have the ability to live a life of well-being (Sen, 2003) [18]. According to Sen (2003) [18], the best measurement of quality of life is the use of pointers of change within society in order to comprehend the capability of individuals to flourish in their lives. This approach views our lives in terms of two things, 'doings and beings', otherwise called 'functionings' (Sen, 2000) [18] which can be understood as what an individual is able to achieve within their lives. In understanding functionings and capabilities Sen emphasises the ability of individuals to choose one life over another (Sen, 2000) [18]. This study aims to build upon this by considering access to potable water as a key capability that all people should have in order to realize high level of well-being. In the case of Kakamega County, it ought to be understood that people do not choose to forego access to water services and based on that they are inhibited in their ability to pursue many other elements of their lives.

2.2 Conceptual Framework

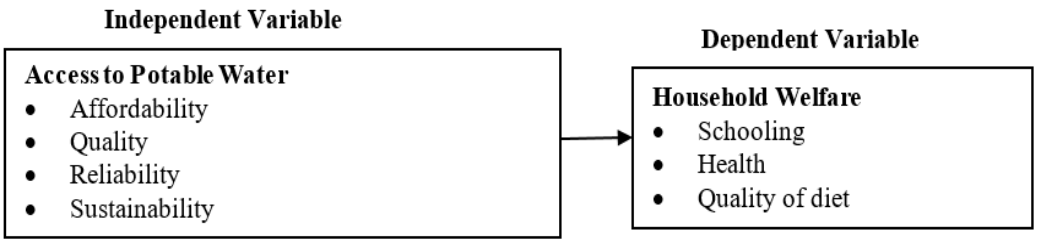

Fig 1: Conceptual Framework

Access to potable water has a great impact on the health of people with limited access to it. Preventable diseases related to water and sanitation, like diarrhoea result in the death of approximately 1,000 children each day (UNDP, 2017) [22]. This has a considerable impact on the ability of individuals to lead a good quality of life and well-being. Access to potable water is a key contributor to poverty and health, and therefore dealing with WaSH will be critical to seeing reductions in poverty, growth in the economy, and the achievement of overall environmental sustainability, as well as quality of life and well-being (UNDP, 2016) [22]. Without access to safe water, people are severely limited in their capacity to lead a life in which they may flourish (UNDP, 2016) [22]. SDG 6 has the core aim of ensuring that all people

are able to access WaSH services with the hope that this will reduce the disparities that exist globally, focusing on vulnerable pockets of society, namely women, children, persons living with disability and the elderly (Chase & Hutton, 2016) [4].

Ali (2012) [3] conducted a study on adequate water supply as a rural poverty reduction strategy in developing countries, the study concluded that water is fundamental to health, survival and livelihoods; it is an economic, social, cultural and environmental good; a basic need and a human right. The study looked at water availability and accessibility in terms of quantity and quality and the relationship with improved health, livelihoods and poverty eradication in the study area. Similarly, Tezera (2011) [20] studied water supply and sanitation development; impacts of poor accessibility of potable water supply and basic sanitation in Soddo District, Gurage Zone, Ethiopia. It found that water accessibility impacts positively on sanitation and health, the economic, social and environmental condition of the area. The study linked water accessibility with health and poverty reduction in the study area.

In their study on the use of skills and knowledge effect of rural electrification on the household well-being of proprietors of micro and small enterprises in Kenya, Mudi, Sakwa and Mukulu (2019) [12] found that a combined multiple regression analysis revealed that there was a significant positive relationship between use of skills and knowledge effects of rural electrification and household well-being of proprietors of micro and small enterprises in Kenya. They thus concluded that use of skills and knowledge effect of rural electrification has an influence on household well-being of proprietors of micro and small enterprises in Kenya.

Addisie (2012) [2] carried out a study on drinking water quality and determinants of household potable water consumption in Simada District, Amhara Regional State, Ethiopia. In the urban areas people were satisfied with the water services provided, because the water quality was good and walking distances were short. In contrast, more people in the rural areas did not use safe water points. This study examined the quality and quantity of water from boreholes and the water supplied in the study area in comparison between central and Sankuri divisions.

Waswa and Mudi (2018) [12] carried out a study on assessment of education opportunity effect of gender equality on subjective well-being among women employees in the County Government of Kakamega, Kenya. Data was analyzed using inferential as well as descriptive statistics. The study applied chi-square technique to assess education opportunities effect on subjective well-being among women employees in the County Government of Kakamega. The study findings showed a significant relationship between education opportunity effects on subjective well-being. It was thus recommended that the County Government of Kakamega should enhance education opportunities for women employees so as to enhance their subjective well-being.

3.1 Research Design

Kothari and Garg (2014) [10] defines research design as the organization of conditions for data collection and analysis in a manner that purposes to combine significance to the research purpose. Cross sectional research design was used in this study. This design is appropriate for this study since Zikmund (2003) [32] note that cross sectional research design is intended to produce statistical information about the aspects of the research issue (in this case household well-being among smallholder farmers) that may interest policy makers.

3.2 Target Population

Population refers to all the items under consideration in any field of inquiry (Kothari & Garg, 2014) [10]. The target population for this study included 31,780 smallholder farmers in Kakamega County registered with the National Cereals and Produce Board of Kenya in March 2017. The choice of Kakamega County was motivated by two factors. First, Kakamega County was ranked top on the Contribution to National Poverty and County Ranking (Republic of Kenya, 2014) [17]. Secondly, the researchers' familiarity and proximity with the County was expected to minimize communication challenges and facilitate smooth and efficient data collection. This target population is most likely to be well informed about accessibility to potable water effect on household well-being in Kakamega County.

3.3 Sample and Sampling Technique

Sampling technique is the process of selecting respondents that constitute a sample (Kothari & Garg, 2014) [10]. According to Kothari (2010) [10], a sample is a section of a population that is selected for examination and analyses and used to make inferences to the population from which it is obtained. Since the target population (31,780) is more than 10,000, Mason, Lind and Marchal (1999) [11] explains that the sample size may be computed by the following formula;

$$n = \frac{z^2 pq}{d^2}$$

Where;

n is the desired sample size when population is greater than 10,000.

z is the standard normal deviate at 95% confidence level (z = 1.96).

p is the proportion in target population estimated to have characteristic being measured (p = 0.5).

d is the level of statistical significance set (d = 0.05).

Substituting the values into the equation, the estimated sample size for infinite population was obtained as follows:

$$n = (1.96)^2 (0.5)^2 \div (0.05)^2 = 3.8416 \times 0.25 \div 0.0025 = 384.16$$

A sample of 385 respondents was therefore used for data collection in this study.

4.1 Reliability Test Results

The reliability for multi-item opinion items were computed separately for all the two subscales in the smallholder farmers' questionnaires, as shown in Table 1.

Table 1: Internal Consistency: Cronbach's Alpha Results for the Questionnaire

Scale	No. Items	Cronbach's alpha	Conclusion (Reliable/Unreliable)
Access to Potable Water	9	.821	Reliable
Household Well-Being	8	.863	Reliable

4.1.1 Validity Test Results

Internal validity of the constructs was tested by subjecting the data to suitability tests using the Kaiser-Meyer-Oklin measure of sampling adequacy (KMO Index) and the Bartlett's Test of Sphericity. This is a prerequisite condition for a factor analysis. Before the extraction of factors, the suitability of the questionnaire data set for factor analysis was assessed and the results were summarized as in Table 2.

Table 2: *KMO and Bartlett's Test*

Subscale	Kaiser-Meyer-Olkin (KMO index)	Bartlett's Test for Sphericity		
		Approx. Chi-Square	df	Sig.
Access to Potable Water	.923	25462.633	66	.000
Household Wellbeing	.849	912.693	28	.000

***Source*:** Survey data (2019), SPSS Analysis

Kaiser (1974) asserts that the Kaiser-Meyer-Oklin measure of sampling adequacy index ranging > 0.6 is of adequate internal validity and is considered suitable for factor analysis. The Bartlett's Test for Sphericity on the other hand relates to the significance of the study and indicates the validity of responses obtained in relation to the problem that the study seeks to address. Creswell (2014) [5] observes that Bartlett's Test of Sphericity test statistic should be less than 0.05. Creswell (2014) [5] asserts that if the Bartlett's test for Sphericity is significant, and if the Kaiser-Meyer-Olkin measure is greater than 0.6, then factorability is assumed and hence use of factor analysis is attainable. Thus, based on the results, it was appropriate to proceed with factor analysis on assumption of adequate internal validity, which is an indication that all the subscales had suitable data.

4.1.2 Normality Test Results

Normality of the data were tested through the use of formal test using Kolmogorov-Smirnov and Shapiro-Wilk tests, as shown in Table 3.

Table 3: Tests of Normality

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	df	Sig.
Access to Potable Water	.283	307	.230*	.775	307	.252
Household Wellbeing	.264	307	.134	.841	307	.116

*. This is a lower bound of the true significance. a. Lilliefors Significance Correction

Although Normality test by SPSS concurrently indicate both Kolmogorov-Smirnov (K-S) and Shapiro-Wilk test results, this study used the S-W to interpret the normality of the variables. Garson (2012) recommends that Shapiro-Wilk's test should be used for small and medium samples up to n = 2000. Shapiro-Wilk is comparable to the correlation between a given data and its corresponding normal scores, with S-W = 1 when their correlation is perfectly normal. This means that a significantly ($p<.05$) smaller S-W than 1 imply that the normality is not met. Hence, the data is normal when Shapiro-Wilk (S-W) >.05. It is evident from Table 4.5 that all the variables follow normal distribution given that there were no statistical significant differences noted in any of the variables with their corresponding normal scores.

4.2 Findings and Discussions

The study sought to determine access to potable water effect on household well-being among smallholder farmers in Kakamega County, Kenya. The dependent variable in this study was household well-being. To attain this objective, access to potable water was assessed through three main measures namely affordability, quality, and reliability. Nine constructs that underlie the three measures were subjected to factor analysis. Largely, access to potable water on household well-being was analyzed through descriptive statistics, factor analysis, correlation analysis and regression analysis.

Factor analysis was used to investigate items with greater significance to access to potable water, and to establish their dimensionality on the variable. This was done by use of Principal Components Method (PCM) as a technique of factor analysis which enabled the researchers to identify and retain the factors with high statistical significance influence, as held by Oso and Onen (2009). Kennedy (2010) points out that analysis of principle components describes interdependencies among the items of a variable with an aim of identifying few factors which explains most of the information on the variable construct. The extraction of the factors follows the Kaiser Criterion where an Eigenvalue of 1 or more indicates a unique factor. All the nine items describing access to potable water were put on factor analysis, whose results were presented on Table 4.4.

Table 4: Total Variance Explained for Access to Potable Water

Component.	Initial Eigenvalues.			Extraction Sums of Squared Loadings.		
	Total.	Variance. (%)	Cumulative. (%)	Total	Variance. (%)	Cumulative(%)
Item 1	7.303	58.860	58.860	7.303	58.860	58.860
Item 2	.921	7.575	66.435			
Item 3	.682	5.432	71.867			
Item 4	.549	4.832	76.699			
Item 5	.440	3.469	80.168			
Item 6	.376	3.354	83.522			
Item 7	.373	3.215	86.737			
Item 8	.324	2.957	89.694			
Item 9	.311	2.791	92.485			
Item 10	.274	2.685	95.170			
Item 11	.259	2.560	97.730			
Item 12	.188	2.270	100.000			

Extraction Method: Principal Component Analysis.

Table 4 indicates the eigenvalues associated with each linear component (factor) before extraction, after extraction and after rotation. Before extraction, SPSS identified nine linear components within the data set. The eigenvalues associated with each factor represents the variance explained by that particular linear component and it is presented in terms of percentage of variance explained. The nine measures of access to potable water were subjected to factor analysis and five (5) factors attracted coefficients of more than 0.4. Therefore, the five (5) statements were retained for analysis. According to Rahn (2010) a factor loading equal to or greater than 0.4 is considered adequate. Using factor analysis, only one factor was identified to have the significant influence on explaining characteristics of access to potable water with cumulative variance of 58.86%. Only this item had an eigenvalue greater than one (1) and had the significant influence on access to potable water characteristics, explaining 58.86% of variance on the variable as shown in Table 4.4. Hence, the component was identified to have the highest influence on access to potable water construct.

To investigate whether there was any statistical significant relationship between access to potable water and household well-being of smallholder farmers in Kakamega County, the null hypothesis that *"there is no significant relationship between access to potable water and the household well-being of smallholder farmers in Kakamega County"* was tested. A Pearson Product Moment Correlation Coefficient was used, with scores on access to potable water as independent variable and household well-being as dependent variable. The correlation analysis result was shown in SPSS output, as indicated in Table 5.

Table 5: Access to Potable Water and Household Well-Being

		Household Well-being
Access to Potable Water	Pearson Correlation	.515**
	Sig. (2-tailed)	.000
	N	307

**. Correlation is significant at the 0.01 level (2-tailed).

It is evident that there was positive (r=.515, n=307, p<.05) but moderate correlation between access to potable water effect and household well-being of smallholder farmers in Kakamega County. The relationship was statistically significant; therefore, the hypothesis that, "*There is no significant relationship between aaccess to potable water and household well-being of smallholder farmers*" was rejected. It was therefore concluded that there is a statistical significant relationship between access to potable water and household well-being of smallholder farmers within Kakamega County. An increase in access to potable water therefore causes an improvement in household well-being of smallholder farmers and vice-versa.

To estimate the level of influence of access to potable water on household well-being of smallholder farmers, a coefficient of determination (R Square) was computed. This was done using regression analysis and the results were as shown in Table 6.

Table 6: Model Summary on Regression Analysis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.265[a]	.270	.267	.54362

a. Predictors: (Constant), Access to Potable Water

The model shows that access to potable water only accounted for 27.0 % (R^2 =. 270) of the variation in overall household well-being of smallholder farmers. However, to determine whether access to potable water was a significant predictor of household well-being of smallholder farmers, Analysis of Variance (ANOVA) was computed as shown in Table 7.

Table 7: ANOVA - Access to Potable Water Effect on Household Well-Being

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	6.910	1	6.910	23.111	.000[b]
	Residual	90.134	305	.296		
	Total	97.044	306			

a. Dependent Variable: Household Well-being b. Predictors: (Constant), Access to potable water

From Table 7, it can be seen that although access to potable water has a small effect on household well-being of smallholder farmers, it is a significant predictor of [F (1, 305) = 23.111, p <. 05)]. Analysis of the regression model coefficients is shown in Table 4.8. From the table there is a positive beta co-efficient of 0.304 as indicated by the co-efficient matrix with a P-value = 0.000 < 0.05 and a constant of 1.342 with a p-value = 0.000 < 0.05. Therefore, both the constant and access to potable water contribute significantly to the model. Consequently, the model can provide the information needed to predict household well-being from access to potable water. The regression equation is presented as follows: $Y = 1.342 + 0.304X_1 + \varepsilon$; Where Y = household well-being, X_1 is access to potable water and ε is the error term.

Table 8: Regression Coefficients of Access to Potable Water and Well-Being

Coefficients					t	Sig.
Model		Unstandardized Coefficients		Standardized Coefficients		
1		B	Std. Error	Beta		
	(Constant)	1.342	.098		14.811	.000
	Access to potable water	.325	.042	.304	5.577	.000

a. Dependent Variable: household well-being Model: Y = 1.453 + 0.304X1

4.2 Discussion of Key Findings

The study sought to evaluate the influence of access to potable water on the household well-being of smallholder farmers in Kakamega County. The effect of access to potable water on household well-being was tested using regression analysis. The results showed that access to

potable water had a significant positive relationship with household well-being of smallholder farmers. This is consistent with the observation by Ali (2012) [3] that water is fundamental to health, survival and livelihoods. The finding is also in agreement with that by Tezera (2011) 20] that water accessibility impacts positively on sanitation and health, the economic, social and environmental condition of an area.

5. Conclusion

Pearson correlation analysis showed that there was positive but moderate correlation between access to potable water and household well-being of smallholder farmers. It was therefore concluded that there is statistical significant relationship between access to potable water and household well-being of smallholder farmers, with increase in access to potable water causing an improvement in household well-being of smallholder farmers. Regression analysis revealed that access to potable water is a significant predictor of household well-being of smallholder farmers in Kakamega County.

5.1.1 Recommendations

In view of the findings of this study, it was concluded that there was a statistical significant relationship between access to potable water and household well-being among smallholder farmers. It is therefore recommended that the County government of Kakamega should promote universal access to potable water in rural areas to a higher level, supporting these commitments with institutional frameworks, strategic plans, clear policies and dedicated establishments. To this end, investments in water works infrastructure, improving connectivity to access points and sustaining water flows will go a long way in improving the County's population well-being.

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