



Determinants of Water-funded Projects in Mitigating Water Risks in Vihiga County, Kenya

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Authors' contributions

This work was carried out in collaboration among all authors. Author JO designed the study, performed the statistical analysis, wrote the protocol and the first draft of the manuscript, managed the analyses of the study, managed the literature searches. Authors EMM and NON were my university supervisors who guided me in all the work. All authors read and approved the final manuscript.

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ABSTRACT

Currently, 85 per cent of the world's human population lives in the drier half of the Earth, which exacerbates the water risks including lack of access to safe water, poor basic sanitation and water-related disasters and diseases. Vihiga County is located in the western region of Kenya (former western province). The county covers a total area of 531.0 Km². This paper examines the impact of water related risks on the livelihood of residents in Vihiga County. The study used evaluation research design. A sample size of 384 households was used to obtain data from the households. Sampling technique comprised of multistage sampling for the households, Quota sampling for the Focus Group Discussions and purposive sampling for the Key Informants. Primary data was gathered by use of questionnaires, Key Informant Interview guides, observation checklists and Focus Group Discussions. Secondary data was collected by use of publications, journals, and internet access. Quantitative data was analysed using Microsoft excel, and Statistical Package for Social Scientists (SPSS) version 20.0. Results reveal that majority of the household respondents had experienced different forms of water related risks including, water pollution at 42%, inadequate water infrastructure 32%, poor water governance 10%, water scarcity 7% and environmental flows at 4% respectively. The study established that the existing Water Funded Projects (WFPs) initiatives include protected water springs at 31%, water kiosks 21%, boreholes at 18%, open wells

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14 %, rain water harvesting at 12% while 4% of household respondents had piped water. The results ($X^2_{5, 0.05}=69.76$; p-value=0.000) indicating that Water Funded Projects (WFPs) initiatives have positively influenced reduction in water related risks.

Keywords: *Determinants; water-funded projects; waterborne bacterial infections; water risks.*

1. INTRODUCTION

The world has shown steady growth in population by attaining the seven billion mark out of which approximately one billion people are in dire need and access to sufficient, safe water and sanitation. Studies show that approximately 3.4 million individuals die annually from water related diseases with highest percentage being the most vulnerable in the society, such as children, women and the elderly [1]. There is therefore need for sufficient, clean, accessible and safe drinking water that will match the increasing global population. The imbalance from demand and the available sources have continuously exerted pressure and burden on the natural resources hence there is risk for increased degradation [2]. Based on the increasing consumptive uses, water security will continue to be an unrelenting issue in the world.

The World Health Organization (WHO) and the International Water Association (IWA) promote the use of a comprehensive drinking water risks management approach, commonly referred to as water safety plans (WSPs). Water utilities have traditionally focused on 'end of pipe' testing for ensuring compliance with water safety standards (Helmer et al., 1999). Inadequacies in this approach, exposed through the outbreak of water borne diseases in affluent nations, led to the development of WSPs. Instead of concentrating on 'end of pipe', the WSP approach encompasses all stages of water supply from the catchment to the consumer.

The primary objectives of a WSP are to: prevent or minimize contamination of source waters; reduce or remove contamination through treatment processes; and prevent contamination during storage, distribution, and handling of drinking water (Davison et al, 2005).

Socioeconomic development is clearly linked to access to safe drinking water. Recognition of this link is not new. Yet, majority of the world's population, lack access to safe drinking water which continues to be a concern in their daily existence. Water related risk such as water shortage and poor sanitation in Africa among

other parts of the world has been closely linked to climate variations and change [3]. Efforts to ameliorate the situation have been put in place to reduce the risk of water insecurity by making water provision policies and allocation of funds in the region. However, there are very little efforts to safeguard and improved management of the water sources as water quality and quantity issues persist in and around the African regions [4]. Feeding and fueling the regions as well as keeping pace with increasing consumptive demands of growing world economies will place the burden squarely upon fresh, clean water never before seen in human history. Consider that the Great Lakes region accounts for over 20% of all fresh surface water in the world. The pressure from political, economic and social forces to divert water from the Great Lakes will be immense [5]. Maintaining the quality and water levels of the Great Lakes Basin and protecting the water rights of its citizens through all of this in the 21st century will be a challenge.

Water risk provides a possibility of given societies having different water related challenges. It hence integrates the possibility and functions of likelihood of the specific challenges occurring and results to given negative impacts on different populations (Schulte, 2017). It is estimated that by 2050, 40% of the world's population will be subjected to reduced access to improved water provisions. This shortage is attributed to growing water shortage, population growth and competing water use. The projected climate changes will further worsen the state of water security and this will especially affect poor people who rely on the environment for survival (Oluoko-Odingo, 2011)

Water risk is felt differently by every sector of society and the organizations within them and thus is defined and interpreted differently even when they experience the same degree of water-related challenges. That notwithstanding, many water-related challenges create risk for many different sectors and organizations simultaneously. Water Funded Projects have been able to reduce the water risk especially in the ASAL areas but in rain fed areas very little efforts have been considered since most of these

areas rely on piped water schemes forgetting the other water sources. In this case Vihiga county has received numerous support for the Water Funded Projects (WFP) even though the water-related risks are experienced hence the study tends to define the reason as to why the risks are high in most households Kijungu [6]. The study aimed evaluating the determinants of the Water Funded Projects (WFPs) in mitigating water related risks in Vihiga County.

1.1 Statement of the Problem

Vihiga county, has over the years, experienced extreme water scarcity, water stress, drought and infrastructural decay hence diminished quality health of the communities, agricultural and livestock output (AHBFI, 2011; Recha et al., 2012).

In response to the water related risk factors, both NGOs and government resorted to offer assistance in the form of water funded projects with the hope that water availability and safety could enable communities mitigate and recover from effects of water scarcity and risk (Muoko, 2010; Mbii, 2011). However, no effort has been made to evaluate the contribution of water funded projects with regard to reducing water risk as opposed to only focusing on the supply side of humanitarian assistance in the form of Water Funded Projects (WFPs).

The intervention efforts aimed at water risk reduction in the county include the construction of boreholes, shallow wells protection and earth dam's (Muoko, 2010). In terms of water infrastructure, almost 10 boreholes have been constructed in Luanda sub-county (30) water tanks have been constructed in some schools to enhance water security [7]. IFAD has participated in sensitizing people on water security (AHBFI, 2011). This study therefore aims at examining the contribution of water funded projects in reducing water risk in Vihiga County.

1.2 Research Objective

To evaluate the determinants of Water-Funded Projects (WFPs) in mitigating water risks in Vihiga County, Kenya.

1.3 Research Question

What are the determinants of Water Funded Projects on mitigating water risks in Vihiga County, Kenya?

2. MATERIALS AND METHODS

2.1 Study Area

Vihiga County is located in the western region of Kenya (former western province). The county covers a total area of 531.0 Km² and is located between latitude: 0°2'27.6" S & 0°13'8.4" N, and Longitude: 34° 30' 57.6" E 34.516° E & 34° 56' 45.6" E with the Equator cutting across the southern part of the County (Fig. 1). Emuhaya Sub-County is the most expansive sub-county at 173.5 Km², followed by Hamisi 156.4 Km², Sabatia 110.9 Km² and Vihiga at 90.2 Km² [8].

2.2 Research Design and Sampling Procedure

Evaluation of research design was used in evaluating the determinants of water-funded projects in mitigating water risks in Vihiga County, Kenya. Additionally, the study utilized both qualitative and quantitative approaches. A sample size of 384 households was interviewed using questionnaires.

2.3 Data Collection

Data was collected from different stakeholders including NGOs, CBOs, local administration, CGV line ministry and households affected by the donor funds for DRR in Vihiga County. The sources encompassed both primary data and secondary data. Primary data involved first hand data that were obtained from the respondents (CGV line ministries, NGO representatives in Vihiga County and local residents affected by water-funded projects in the area). Primary data was collected using questionnaires, interview schedules, key informants, FGDs and observation checklist. Secondary sources involved document analysis of mainly published books, journals, research reports and newspapers on contribution of water funded projects on reducing water risk [9].

2.3.1 Questionnaire

The researcher meticulously designed a questionnaire capturing essential questions in line with the research objectives (Amin, 2005). The study aimed at collecting views of the respondents on the contribution of water funded projects on reducing water risk in Vihiga County. Use of questionnaires was crucial for collecting this type of descriptive data on views and

perceptions of respondents. The questionnaires had both closed and open questions.

2.3.2 Focused group discussion

Focus group discussions (FGDs) guides for the residents of Vihiga County were composed of different gender and in groups of 10 participants. The study conducted Focus Group Discussions in all the three sampled sub counties that helped understand the dynamics and different opinions of the community members on water-funded projects and water security in the County.

2.4 Analysis Criteria of the Extent of Water Related Risks in Vihiga County

The research used a multistage sampling procedure where 50% sampling units as supported by [10] were selected and three out of five sub counties were purposively selected based on the location of the water-funded projects that informed the use of the water projects. Three sub counties namely Hamisi, Luanda and Sabatia sub counties were selected

for this particular study. Pearson Chi square (χ^2) test was done to measure the association between the variable indicators. According to [7], Sabatia has the highest share of the residents using the improved water sources at 84% followed by Luanda 64 and Hamisi at 46% respectively. The household's sample size was determined using Cochran's (1977) formulae for determining sample size for continuous and categorical variables.

The wards under the sub counties were purposively sampled given that they have relatively high number of the completed and functional water projects as compared to the rest of the selected sub Counties with incomplete or decaying infrastructure that are not functional. The proportion of wards.

where the study was conducted was computed from the three sub counties based on 30 % sampling units as supported by Mugenda and Mugenda [10].

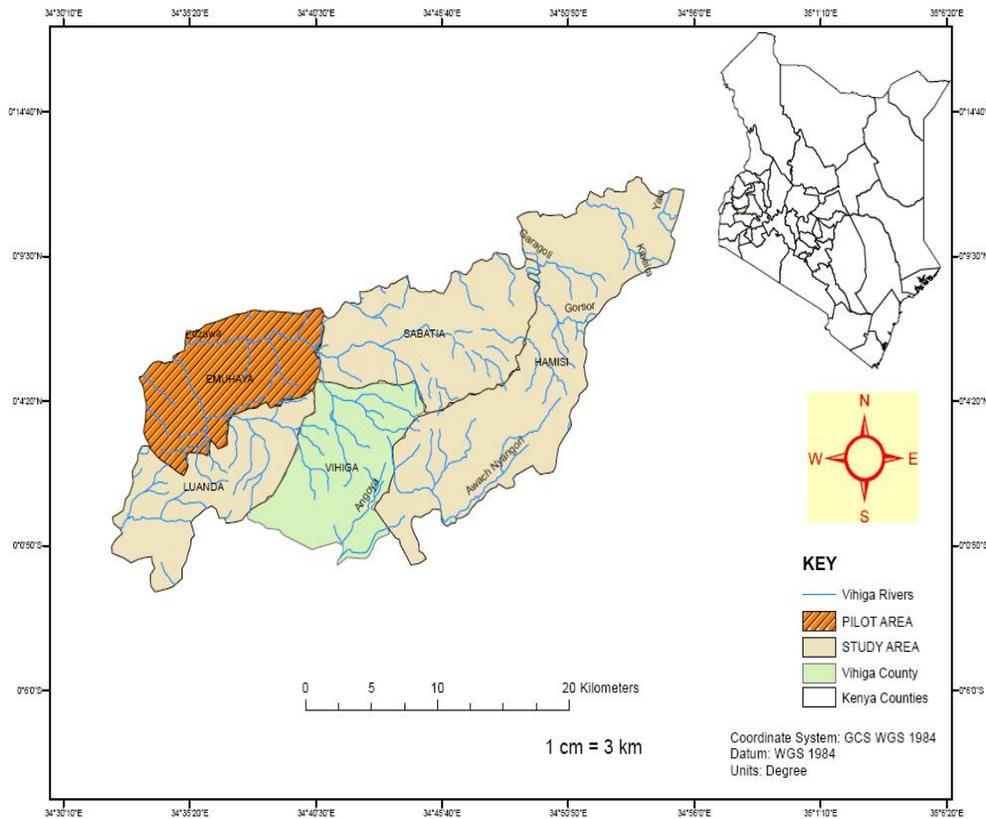


Fig. 1. The map of Vihiga County, Kenya showing location of study area
 Source: Field data (2019)

In-depth interviews were conducted in person with 1 representative from the County of Vihiga Ministry of Water, 3 Sub counties water officers, 2 Non Government Organizations (NGOs) and 2 County Community Based Organization (CBOs) representatives totaling to Eight (8). These key informants were identified through a combination of simple random, purposive and sampling techniques. Appointments were scheduled by telephone with those respondents who were available and willing to speak to the interviewers about water funded projects and water security in Vihiga County.

2.5 Data Analysis and Presentation

The use of the (χ^2) necessitates preparation of cross tabulation of the variables which then generate significance test results (Nachmias, 2001). Pearson Chi square (χ^2) test was done to measure the association between the Water Funded Projects and water related risk in Vihiga County. A test of 0.05% significance level was used to measure the variable in the water related risk and the Water Funded Projects. All the quantitative data were analyzed using the Statistical Package for Social Scientists (SPSS) version 20.0. In addition, qualitative data was sourced through key informant interviews, Focus group discussions and observations were processed and analyzed following three steps.

In the first step, data were organized and summarized in line with the thematic areas. The second step involved description of the summary sheets to produce preliminary report.

The third step involved systematic analysis and interpretation of the preliminary report which then integrated with the quantitative data in the final report.

2.6 Validity of the Instrument

In determining statistical proof, content validity index CVI was used to determine the validity of all the instruments used especially the FGD. This was to test whether the instruments had appropriate sample for the construct subjected to measurement.

3. RESULTS AND DISCUSSIONS

3.1 Water Scarcity

Food and Agriculture Organization (FAO) estimates two thirds of the world's population is

likely to experience water scarcity by the year 2025 owing to the increasing droughts, overuse of water, misuse of water and pollution. Africa faces serious freshwater challenges albeit in different contexts. Water plays an important role in the continents development goals as widely recognized. However, water resources in Africa are under increasingly severe pressures from climate change and other global changes such as urbanization increased agricultural and industrial production, and population growth.

Kenya like any other East African countries in the Sub Saharan Africa, face a fare share of the water risks. These are based on water supply and sanitation that are characterized by low levels of access to water and sanitation in both the rural and the urban poor.

Owing to the effect of salinity on ground water, water desalination can be done in dry regions with saline ground water, but its economic viability depends on the range of pollutants and the amount of purification required (Ward, 2007). The study sought to evaluate the determinants of the Water Funded Projects (WFPs) in mitigating water related risks in Vihiga County. The determinants that informed the study and formed the basis of evaluation were based on the types of stakeholders involved in Water Funded Projects Water Funded Projects (WFPs) and guided by water supply, accessibility, level of sanitation, quality & quantity of water. According to Kanda et al. [11] water supply infrastructure in Kenya requires substantial investments to realize the 100% accessibility of water as outlined in Vision 2030. More than half of financial investments in the water sector come from foreign donors (WASREB, 2015).

3.2 Stakeholders Involved in Funding Water Projects in Vihiga County

As per the the results in Fig. 2, it reveals the types of stakeholders that are mostly involved in the funding of the water projects and the respondents in the study area rated Non-Governmental Organizations (NGOs) as the highest at 39% (150). This was followed by National Government 36% (138), County Government of Vihiga 18% (69), Community Based Organizations (CBOs) 6% (23) and individual members of the communities at 1% (4) respectively.

From the study a Chi-Square value $X^2_{4,0.05}=26.76$ on the variation of the funding stakeholders of the water projects was significant at $P<0.005$. It

resonates well with the FGD conducted in Luanda in Vihiga sub County, it emerged that majority of the household respondents perceive water development as a partnership and a concern of the national government and NGOs. This explains the reason why majority of the households score the two stakeholders higher than the rest. From the KII, it was revealed that the Belgium government is involved in implementing rehabilitation and expansion of water sources in Maseno, Mbale and in Kaimosi. The 1.7 billion dollars Belgium water project also known as the Vihiga Cluster is a Belgium government funded water project which is expected to expand water provision to the three locations, Kaimosi 25,000 cubic meter, Mbale and Maseno 5,000 cubic meters per day respectively. On completion of the new pipeline water funded project, approximately 270,000 people are expected to benefit from it in Vihiga County [12-15].

Evidently from the observation of the various projects in Vihiga County, various funding NGOs have funded different water projects but the most consistent partner has remained the national government. Chinwe [16] carried out a study in Laikipia County and found out that local communities/groups initiated about 70% of water projects in the county through conceptualization of water project ideas and self-organization while the Government of Kenya initiated about 19% of the water projects.

This is in tandem with an establishment from key informant that Lake Victoria North Water Board Services (LVNWBS) has been the lead agency in funding of the the water projects. However, the funding has been in partnership with other agencies from other parts of the world like Belgium Agency and even World bank in mitigating drought in the larger Western region of Kenya. This is in agreement with a study done by Quinn (2010) that found out that majority of the Sub-Saharan African nations are supported by donors which has led to an increase in water supply programmes in the last decades mainly in the rural areas. According to Kanda et al. [11] water supply infrastructure in Kenya requires substantial investments to realize the 100% accessibility of water as outlined in Vision 2030. More than half of financial investments in the water sector come from foreign donors (WASREB, 2015).

However, the study further indicates that the Kenyan government is the major funder and

implementer of the projects contributing in 77% of the cases. On the other hand, the local communities and actors from development cooperation contributed 33% and 26% of the funds, respectively [16].

The County government of Vihiga was rated third 18% by the household respondents as a key player in the funding of the water projects in Vihiga County. From FGDs, the different mandates of the County government different from the national government has been a challenge to the locals and has been subject to discussion within the locals. This is due to the fact that the county governments get funding from the national government therefore making it difficult for the household respondents to differentiate national governments contributions from the national government in reducing water related risks.

FGD Participant B3 reported that;

The main funding partner of the water projects is the national government and it may not be the county government because the county governments also acquire its resources for development from the national government.

However, there are household respondents who believe that the county government has been in the fore front in the water project funding to increase water security. This may be due to dominance and presence of county government officers at the grassroot level that make the locals believe that they are the main funding partner of the projects. It is argued that the County government has gained in the last few years due to the fact they have reduced national governments bureaucracies, weakened inefficiencies and ineffectiveness associated with central government and majorly development projects from the locals (Kimenyi, 2005).

Community Based Organisations (CBOs) and individual members contributions were not so much felt by the household respondents in Vihiga County. From a key informant involved in the management of Water Funded Projects (WFPs), the community members have formed groups that help in management of the Water Funded Projects (WFPs) and these are individual members volunteering.

The fact that they volunteer may be the reason for conclusion by many household not to rate their efforts higher as other agencies. Low

participation of the community organisations and individual members in community projects is one of the challenges in community projects sustainability in Kenya (Ahmad et al., 2011).

In Vihiga County, the community members have organised themselves in groups to help manage the water projects. The community organisations are formed for each and every water project in the community like the water kiosk, protected water springs and boreholes. According to the FGD in Mbale;

The community groups main role and contribution is to provide land, labour and materials for the construction of the water projects. The groups are meant to enhance community participation and promote a sense of ownership of the projects for sustainability.

Active community participation in project planning, implementation, monitoring and evaluation improves project acceptability, produce a more equitable distribution of the benefits, promote local resources mobilization and ensure project sustainability (GoK, 2016).

According to Peter et al. [17] water projects become sustainable due to various reasons. First, it is due to the intergration of strategies into the project before its completed like collaboration with various stakeholders, sensitization and training of community members, considerations of gender by empowering women to manage community projects and application of appropriate technologies. The other factors include environmental impact considerations into a project; sensitivity to socio-cultural factors in the communities; capacity building for communities and effective monitoring and evaluation as well as effective networking with all stakeholders [17].

3.3 Determinants of the Water Funded Projects (WFPs) in Mitigating Water Related Risks

The study sought to evaluate the determinants of Water Funded Projects (WFPs) in Vihiga County and the results are as presented in Fig. 3 which indicates, majority of the household respondents 38% (146) believe sanitation is the most improved water security factor by the Water Funded Projects (WFPs). This is followed by water quality 28% (108), water access 16% (61), water supply 11% (42) and water quantity at 7% (27) respectively.

From the Chi-Square value obtain ($\chi^2_{4,0.05} = 193.51$) reveals that there was highly significant variation with $P < 0.01$ in the determinants of various Water Funded Projects (WFPs) in mitigating water related risk in Vihiga County. The FGD conducted in Luanda Township on the contribution of the Water Funded Projects (WFPs) to the household wellbeing confirmed that sanitation improvement in terms of waste management and hygiene of the household had increased and that was attributed to the existence of the Water Funded Projects (WFPs) which was attributed to the fact that there was an increase of water sources protection and increased management of waste from the household.

3.3.1 Water supply

Household respondents pin pointed water supply as one of the factors that inform water security and was rated fourth at 11%-(42)- Fig. 3 as a contribution of the Water Funded Projects (WFPs) in achievement of water security in Vihiga County. Though not significant, the households recognized the increase in availability of water from the water sources in the better part of the year. It was confirmed from women leaders that the established water schemes have inconsistent flow of water as a challenge in supply of water leading to reduced quantity of water. This was attributed to frequent technical failure due to high rate of system vandalism by most of the residence in that they want easy and free supply.

According to FGD Participant C5;

Unlike before, there has been consistent flow of water in many natural water sources like protected water springs and water kiosks. This has not just been important for safe drinking water but many households currently have engaged themselves in other livelihoods as Vihiga is an agriculturally active County. Many households today are practicing small-scale farming of vegetables that in the long run empowers them economically

In the entire world, Africa is the tenth region that suffers most from inadequate access to the water supply with only 62% of its population having access to potable water supply (Were et al, 2008). Generally, in Vihiga County there are 8 existing piped water schemes that are undergoing rehabilitation namely Maseno,

Kaimosi, Mbale, Sosiani, Vihiga, Vokoli, Hamisi and Chango.

From the research findings an increase in supply through Water Funded Projects (WFPs) justifies the importance of improving on the proper management of the water sources as they contribute to the economy of a place hence a positive relationship between increased income of a given population with access and increased supply of water (EPA, 2012).

3.3.2 Water access

Access to water as one of the factors of water security was rated third as an important contribution of the Water Funded Projects (WFPs) to water security and was rate at 16% of all the water security factors in Vihiga County. The findings are in tandem with a research carried out by Development initiative report which was enhancing access to safe water and sanitation. It clarified that access to water from improved sources has been on the increase from 2009 in many counties in Kenya where by the proportion of households with access to water from improved sources have improved from 56% to over 70%. However, this improvement is of significance and evident in urban areas than in rural areas.

From the FGD in Sabatia, the participants confirmed that;

Due to the pattern of distribution of water sources in Vihiga County, there has been parity in access of water mainly for the rural household. This therefore explains the lower percentage of 16% compared to the other water security factors contributed by the Water Funded Projects (WFPs) in Vihiga County.

Accessibility to water is defined in terms of physical distance from dwellings (in Kilometres or metres), availability and affordability. According to CUIDS [18], there are five (5) water schemes in Hamisi sub-county with 27.7% coverage (Hamisi, Kaimosi, Bumbo-Shamakhokho, Mawe and Sosian) and three ongoing water project with an estimated coverage of 17% (Tiriki West, Gaga and Givole water schemes). Hamisi Sub-county has 840 protected springs, 320 hand-dug wells, 15boreholes and 1,175 water points.

Sabatia Sub-County has an estimated 543 water points comprising 497 protected springs, 26 hand-dug wells and 20 boreholes. It is estimated that about 88% of the population is covered by

potable water supplies. Out of this, 543 potable water points serve 75% while piped schemes cater for 13%. The piped schemes are Mbale (coverage 55 Km², 65,000 people in Sabatia and parts of Vihiga Sub-counties), Vokoli (coverage 3Km², 3,000 people within Sabatia Sub-county) and Kaimosi (covering three lines; Mago-Mululu, Lusengeli-Sabatia and Kwa Shem-Budira serving Sabatia Sub-county) (GoK, 2016).

3.3.3 Sanitation facilities in Vihiga County

From the research findings Fig. 4, majority of the household respondents use pit latrines 73% (280) followed by flushable toilets 24% (92) and the rest use other ways of disposing waste like open defecation and in the bushes in Vihiga County.

Water is essential to life, but many people do not have access to clean and safe drinking water and many die of waterborne bacterial infections. Some of the pathogens that are known to be transmitted through contaminated drinking-water lead to severe and sometimes life-threatening disease. Examples include typhoid, cholera, infectious hepatitis (caused by hepatitis A virus [HAV] or HEV) and disease caused by Shigella spp. and E. coli O157. Water is essential to life, but many people do not have access to clean and safe drinking water and many die of waterborne bacterial infections. Safe drinking water for all is one of the major challenges of the 21st century and that microbiological control of drinking water should be the norm everywhere. Routine basic microbiological analysis of drinking water should be carried out by assaying the presence of Escherichia coli by culture methods. Whenever financial resources are available, fecal coliform determinations should be complemented with the quantification of enterococci.

This resonates with WSP, (2014) which provides state of sanitation in Vihiga County meaning that improved, unimproved, shared and open defecation are rated as 46%, 13.5%, 39% and 0.8% respectively. Water sources free from pollution are important in reducing health risks in communities. According to the FGD in Hamisi, Participants confirmed increase in clean and safe water in their community unlike some times before the Water Funded Projects (WFPs) increased.

Therefore, this can be attributed majorly to the existence of better sanitary facilities through bench marking programme made by the Ministry

of Health with regard to different indicators resulting to ranking of the county in position 37 out of 47 (Water and Sanitation Benchmarking Programme, 2013). According to GoK, [7] the County lacks waste adequate disposal, sewerage, and effluent management system, this makes most public, and private premises to rely on septic tanks that are served by the lagoons established in the urban areas.

According to FGD Participant D6 in Chavakali town;

We dwellers do not have access to the sewerage system and thus dispose the wastewater inappropriately causing many problems to the environment and specifically to the water sources. Some of us who also have residential houses in the urban setting that are designed with flushable toilets are now much more disadvantaged because the extensive system is not accessible and this only make the owners to be tempted to dispose into the open environment.

In regard to Vihiga County, sanitation concerns all those facilities and amenities that help in making residential areas free from unhygienic conditions that could pose a health hazard. Such amenities include sewerage systems, and solid waste management systems. Overall, 97% of the households are not connected to conventional sewerage system and therefore rely on on-site sanitation facilities (91% ordinary pit latrines) [18].

On the average about 85% county residents use improved sanitation. The County Government is in the process of improving sanitation in public facilities, urban and market centres by constructing public sanitary facilities. The county does not have a sewerage system (CIDP, 2018-2022)

Pit latrines are not allowed in urban areas and cities since they are environmental and health hazards. Even the key public purpose facilities such as County Hospital, County Headquarters, Administration Police line, former Municipal Council rely on septic tanks which are rarely exhausted. While there has been some improvement in development of water infrastructure (piped schemes and protected springs) the same is certainly not true for sanitation infrastructure (IUCN, 2000).

According to GoK [12-15] a total of 87% of residents in Vihiga County use improved

sanitation while the remaining use the unimproved sanitation such as pit latrines without slabs or with wooden floors, bucket latrines and latrines walls that are made of leaves. It therefore confirms that there is adequate improvement on sanitation that can be attributed to the Water Funded Projects (WFPs). There is need therefore for more efforts and maintenance of the sanitation standards to ensure appropriate awareness and behavior to help improve on the household's health wellbeing.

A study carried out by Chinwe [16] found out that 58% of the household respondents agreed that the water projects in the area were a success mainly because they provided people access to water. In addition to this success factor is that 12% of the projects through water provision, improved health, and sanitation [16].

However, only 17% of the household respondents in Laikipia County agreed that the projects were a complete success in providing access to water. Chinwe [16] outlines the factors for partial success of the water projects by the respondents as that the water provided was inadequate and/or of poor quality (39%). About 7% out of the 11% that rated the projects a complete failure did so because of the inadequate water and poor water quality [16].

3.3.4 Water quality and quantity

Generally the county government has been able to improve water sources through construction and rehabilitation of 136 water springs, 15 shallow wells fitted with hand pumps and construction of 4 new shallow wells equipped with hand pumps; 9 boreholes; expansion one existing water project at Muhanda, in order to enhance clean and safe water for domestic use (CIDP, 2018-2022).

It was established from LVNWBS KII that, it has been their responsibility to provide clean and safe water to different populations in Vihiga County and the entire Western region. The organization has a routine practice of testing water from the sources and advising on the ways of improving on the quality of potable water for communities that they have provided water with. It therefore confirms the assertion by the household respondents on the increased water quality in Vihiga County.

A wide range of natural and human influences affects water quality and, most important of the natural influences are geological, hydrological

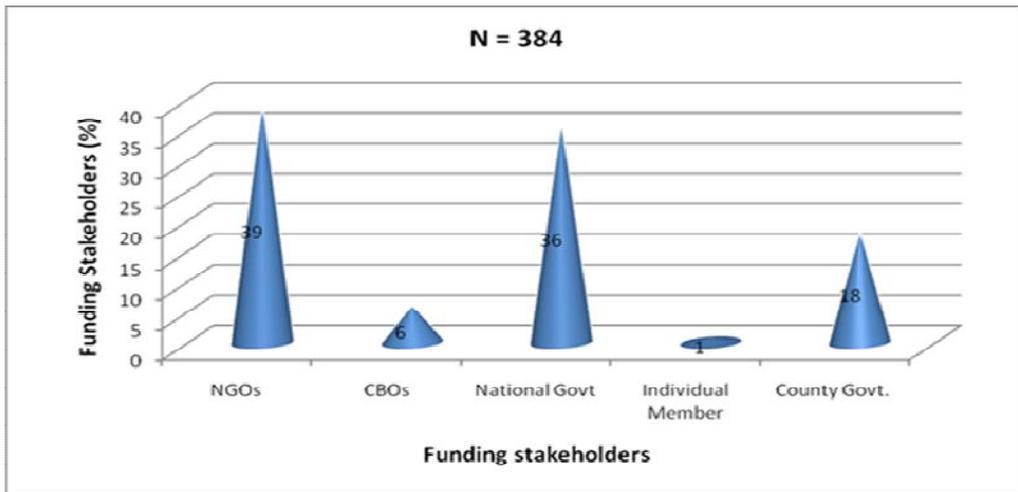


Fig. 2. Stakeholders involved in water projects funding in Vihiga county, Kenya
 Source: Field data (2019)

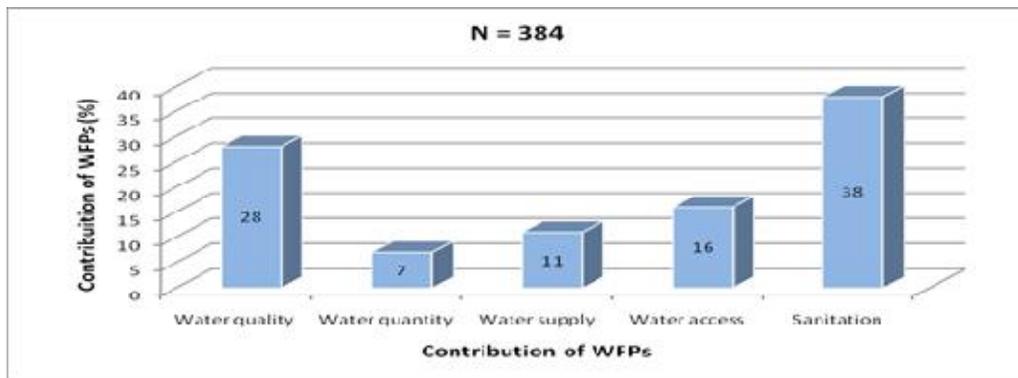


Fig. 3. Determinant of Water Funded Projects (WFPs) in mitigating water related risks in Vihiga County, Kenya
 Source: Field data (2019)

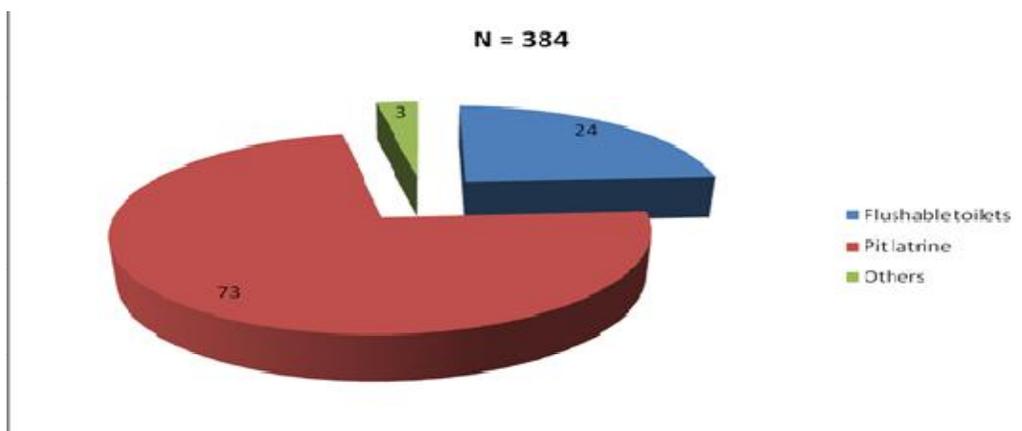


Fig. 4. Sanitation facilities in Vihiga County, Kenya
 Source: Field data (2019)

and climatic, since these affect the quantity and the quality of water available. The quality of water supplied by the company should meet the guidelines provided by the Kenya Bureau of Standards (KEBS) and enforced by Water Service Regulatory Board and Lake Victoria North Water Board Service.

The water utility is required by WASREB to comply with the examination of residual chlorine levels and bacteriological tests [11]. Amatsi Water and Sanitation Company recorded an average of 95.3% compliance in 2014 – 2017, which was above the minimum acceptable benchmark of 90%. Indeed, a study by LVNWSB on the quality of water at AWASCO confirmed that it meets the physical, chemical, and bacteriological standards, and thus safe for consumption (LVNWSB, 2016).

4. CONCLUSION AND RECOMMENDATION

Majority of the household respondents 38% (146) believed that sanitation is the most improved water security factor by the Water Funded Projects (WFPs). This was followed by water quality 28% (108), water access 16% (61), water supply 11% (42) and water quantity at 7% respectively. Different stakeholders' involvement in funding of the water projects was examined and the results revealed that Non-Governmental Organizations (NGOs) were rated the highest 39% (150) by the household respondents in the study area. This was followed by National Government at 36% (138), County Government of Vihiga 18% (69), Community Based Organizations (CBOs) 6% (23) and individual members of the communities at 1% (4) respectively.

Determinants of Water Funded Projects (WFPs) in Vihiga County, Kenya have a direct impact on the availability, Accessibility, Supply, Quality and Sanitation towards Water Related Risk . Water Funded Projects in Vihiga County is the determinants in mitigating the existing water related risks by making evident improvement on sanitation at 38%, water quality 28% and water access at 16% but of less significance to water availability.

The study recommends that there is need for a collective public private participation in establishing and maintenance of the Water Funded Projects (WFPs) to fully contribute in enhancement of all the water security factors like availability, access, quality and effective

utilization. The stakeholders involved in managing water sector in Vihiga County need to invest more on sanitation and routine maintenance of the different sources of water to reduce water pollution and increase the maintenance levels of the water project systems to prevent infrastructural decay that increase water related risks.

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CONSENT

The interviews were recorded with the consent of participants. Note taking from the non verbal expression, the mood and tone of the participants were observed. Quota sampling was used to sample FGD participants. Each interview was summarized in a short document highlighting key findings on the day it was concluded. All the recordings of each discussion and interview were transcribed verbally to English and reviewed for accuracy with the consent of the interviewees.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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