



When the cup is half full: a plan for improving water and sanitation services in the rural area of Kochia Ward, Homabay County in Kenya.

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Access to safe drinking water and sanitation is considered a fundamental human right that acts as a safeguard to health and dignity. When sanitation systems fail, or are inadequate, the impacts on the health of the community, the health of others, and the environment can be extremely serious. Good sanitation and hygiene practices can make major differences in people's health, education and socioeconomic development. The economic benefits of improved sanitation include savings in health costs, higher worker productivity, better school attendance and quality of education, and reduced water treatment costs.

The project plan aims to assess the water supply and sanitation situation in the rural village of Kochia in Homabay county, Kenya, to identify water supply and sanitation related problems and challenges, including water contamination and pollution, to identify possible mitigation measures the residents proposed towards the water and sanitation related problems and finally to create a criteria for monitoring and evaluation for the performance of the project. Participant observation was used as a method for this study. Observation done during the sanitation walk gave the exact extent and condition of how the situation looks like in the study area. It presented an opportunity to correctly mark what the villagers had to say pertaining the water and sanitation status, marking the checklist against the actual on the ground. Economic status was also analyzed during the sanitation walk, the distribution pattern, and the overall viability of the project. Participant observation is accepted almost universally as the central and defining method of research in cultural anthropology.

Water supply in the village is very poor as the residents rely on bucket as away of fetching water from the main water source. Only few households have installed huge capacity tanks to help in preserving rain waters. Sanitation system is very poor in the village. The few available latrines are not properly maintained as open defecation is still practiced by some residents. Water and sanitation is still an important global goal and should be equally provided for to the rural areas just as the concentration has been much in urban centers. It will provide the basic essential health for a sustainable life and economic development, hence improving the overall livelihood.

Keywords: Sustainable project, rural water, rural sanitation

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1 Introduction

The global goals on sustainability rests heavily on the availability of clean water for all, as one of the seventeen goals to realize economic improvement by 2030 (United Nations Development Program 2017). Clean water availability has turned out to be one of the major concerns globally. Owing to the fact that human practices for economic gain have ruined the occurrence of the useful commodity. Developed countries and urban areas can access clean water that are piped, helping improve sanitation in such areas. Industries have directed their untreated effluent products into water bodies, affecting both the down-stream consumers and the aquatic life.

Rain water has been used as a source of clean water in rural areas, while developed countries also channels such waters for treatment and back into the water cycle. Cutting of trees have reduced water catchment in rural areas, because individuals targets short term economic gain. The threats posed by eradication of water catchment are great and have led the world to the current fresh water crisis. There is need to address such crisis in order to help improve the livelihood, more so rural areas in the third World Nations. (UNDP 2017.)

Water as a natural resource is an important aspect of life that is required daily by humans for many purposes. Human beings use clean water for sanitation purposes that includes, drinking, cleaning, and farming use through irrigation or chemical application on farm produce. Globally access to water is centre to humanity's economic existence (Agnew & Woodhouse 2011), water being key players in industrialization and economic development in a region. Industries like thermoelectric power plants uses water for cooling purposes, while hydroelectric power plants generate energy for both industrial and domestic use. Transportation purposes are another key area where water is used, helping in transporting bulky products as it inter-connect the globe in trade.

Global access to clean water is still a challenge more so to the third world nations, Africa as one such continent. Statistically, an estimated 946 million people around the world still use outside toilet that pose a danger of contamination of clean drinking water. The practice exposes individuals to high risks of diseases such as: cholera, diarrhoea, typhoid, dysentery, and hepatitis A. Furthermore 2.4 billion people lacks sanitation globally, while 91% of the global population uses an improved water source as 663 million people still has no access to clean water, and eight out of ten individuals who cannot access clean drinking water are in rural areas. It is a massive call to improve water sanitation in rural areas that will aid in minimizing exposure to deadly diseases, which can be catastrophic in that they have life casualties. (Purvis 2015.) Kenya considers cholera as a new emerging threat with the outbreak reported in

twenty 29 out of 47 counties. Homabay County reported cholera from January to April 2015 (Githuku et al. 2017) which claimed a number of lives during the outbreak.

Kochia ward is one of the wards in Homabay County that are susceptible to cholera and other waterborne diseases attacks due to poor sanitation and clean water availability. It forms the target of this water and sanitation project because it sets a milestone in improving clean water access, supply and availability to the delight and convenience of Kochia residents. Need for clean water for food security in the rural area of Kochia will help in fighting the normal occurrence of hunger brought by droughts, as Kochia solemnly depends on rain waters for food production that reflects on the poor living standards of the residents. It forms one of the factors that have pioneered this project, and that will be of high economic, health, and social importance to the residents. (Githuku et al. 2017.)

The water shortage means that a large population of women and children spend up to one-third of their day fetching water in the hot sun from the nearest fresh water source. This backbreaking work leaves roughly half of the village's inhabitants vulnerable to serious dangers. In addition to exposure to the elements and risk of attack by predators, the primary water gatherers are also the most susceptible to water-borne diseases. (Njonjo et al. 2013.) Addressing water and sanitation scarcity in the rural areas will address such issues, helping improve the living standard and economic performance of the marginalized group.

2 Background of the project

A geographical, demographic, historical, political and economic background information on Kenya is detailed as they are key factors that would affect the project outcome and success. A good background check on some elements is taken as a ground preparation means (Beyene 2012), before the final commissioning of the project and its full implementation.

2.1 Geography

Geographic location and natural features will determine the primary source of water for this project. The source can either be a natural water source like rivers, lakes, and rain water, or a man made source like boreholes. A river as a source of water can be seasonal or permanent, depending on its behavior during droughts. While on the other hand, its flooding capacity during heavy rains will also affect the project location. Depending on rain water as the primary water source can be unreliable, because it will require large storage facility if a consistent amount of water is to be maintained. (Ondigo et al. 2018.)

Topography of land will affect the infrastructure layout of this project, which includes the pipe laying and need for circulation pressure for distribution. The layout will play a key role in determining the resource use in the project and can also be used to the advantage of water

distribution. Topography will also affect the effective distribution criteria, and the need to mitigate against unfair distribution. The project is going to rely heavily on high to low distribution layout, which is a strategy of minimizing much resource use in supply. It will help cut the cost of the resource to the village dwellers, which makes the project to be in line with helping the poor afford clean water. Affordable supply will determine the number of subscribers, and the overall project acceptance in the village of Kochia. (Price 2011.)

Proximity to natural water sources which include rivers, lakes and natural springs are to be analyzed for this project and decision made on the capacity efficiency. The team which will comprise of the project manager, project coordinators, villagers and other stakeholders, will identify water circle in Kochia before coming up with a proper decision on water source for the project. Rivers and lakes are the standard source of water consumption, considering that they undergo regular replenishing depending on the weather (Hughes et al. 2018).

Kochia is rich in a number of natural water sources that include rivers which are tributaries to Lake Victoria. Proximity to water source is key in minimizing infrastructure expense, even if it means a longer network of pipes laid. Consistency of supply is key to the decision and the project has to explore all the available options. Water harvesting from rain water is a supplementary option and could help from over exploiting the primary natural source. (Ondigo et al. 2018.)

Rain water is a reliable source of water even though the need to observe the geographical flow is important, being that it will determine the harvesting points. It is also necessary to estimate the area's rainfall potential. It is the surface area available for water collection, and also the need to come up with a proper storage plan. In this case, it should be a well-structured dam that can act as an alternative back up plan for the dry seasons, when the water levels of rivers are falling down. Harvesting rain waters can also improve on the dangers Kochia village faces due to floods that washes away food crops in the farms or contaminating the water bodies through uncontrolled erosion. (Mugo & Odera 2018.)

Geographical study of the project area will also help in determining the best water pumping means for the distribution purposes. It gives a great number of options in coming up with efficiency in supply and can as well determine budget allocated in the process. Mounting tanks on higher grounds as shown in figure one is also an alternative. It will enable water distribution due to the depth and the level of the ground, to supply water to lowland residents which will minimize the use of electronic devices. These devices are prone to maintenance and consumes billed electricity, which can be costly or unavailable hence limiting water access. Being that the village of Kochia can have limited access to electricity, the project does not rely primarily on electricity. It will enable the project to deliver affordable clean water and sanitation in the village. (Ondigo et al. 2018.)



Figure 1: Distribution tank is on a raised ground to save on supply and distribution costs

2.2 Demography

Based on the projections from the 2009 Kenya Population and Housing Census, Homa Bay County had an estimated population 1,038,858 persons consisting of 498,472 males and 540,386 females by the end of the year 2012. The population was projected to rise to 1,177,181 persons in 2017. Of this total. (County Government of Homabay 2013.)

Demography study proves to be of high importance as it will determine the size of the project, the capacity of the infrastructure and the overall capital injection in the project. It is estimated that an ordinary man can consume 150 liters of water on average per day which includes all the sanitation requirements like cleaning. The rate of consumption gives value to demography study in evaluating the annual clean water production target, and also population distribution pattern is important in coming up with infrastructure layout. Being that the project targets every homestead with its infrastructure, demography study will help in budgeting, resource allocation, and priorities during decision making as per the size of the project. (Fatharta 2013.)

Kochia ward in the sub-county of Rangwe constituency, has a population of 26,554 distributed in a square kilometer of 68.90. The project therefore should be in a position to produce water capacity of about 4,500,000 liters on daily basis to sustain the local demands. The need to explore the relationship between water consumption and conservation behavior is also of high importance in the population study. It will aid in scheduling for maintenance service programs, water leakage report and response efficiency to avoid wastage and contamination of the treated water. (CGH 2013.)

The way in which a population is distributed across different age groups at any given point in time is deemed important because peoples social and economic behavior and needs vary at different stages of life. A country's age structure therefore has a significant impact on its socio-economic development. (Njonjo et al. 2013.)

2.3 Economy

An economic study conducted for Kenya has shown that impacts resulting from poor sanitation and hygiene cost the economy of Kenya 24.7 billion shillings (KSh) (USD 324 million) per year, or the equivalent of 0.9% of annual Gross Domestic Product (GDP). This translates to an average KSh 630 (USD 8.3) per capita annually, or KSh 910 (USD 12) per unserved inhabitant. These figures reflect the; adverse health effects associated with poor sanitation and water supply, costs of treating these health problems, loss of productivity that results when individuals fall sick and other people have to care for them and last but not least the time spent to access services. (World Bank 2011.)

A number of studies have sought to estimate how much it costs to improve access to sanitation and water supply. An initiative led by the African Ministers Council on Water (AMCOW) in 2009 to 2010 also estimated sector financing needs. Annual costs for meeting the water supply Millennium Development Goal (MDG) target were estimated at USD 303 million per year (USD 56 for urban and USD 247 for rural). Annual costs for meeting the sanitation MDG target were estimated at USD 386 million per year (USD 115 for urban and USD 272 for rural). (World Bank 2011.)

Compared to these required investments, the government spending projected by AMCOW of USD 193 million for water and USD 26 million for sanitation falls significantly short. Allowing for expected donor and household funds, the gap for water supply is USD 124 million for water supply and USD 17 million for sanitation. However, the gap could be significantly greater if donor funds of USD 300 million, as projected by AMCOW, are not targeted to the sector. Hence, the government policy should be not only to increase its own funding, but to catalyze investments from other sources. The AMCOW report estimates annual operation and maintenance costs of USD 124 million for water supply and USD 17 million for sanitation. (World Bank 2011.)

The improved health and socio-economic situation will influence the livelihoods of the beneficiaries through reduced health cost and improved ability to work. It contributes to the reduction in the number of persons living below the poverty line. (Project appraisal report 2009.)

3 The project goals and aims

The goal of the project is to improve water and sanitation in the village of Kochia, where supply system has proved to be very poor. The aims of the project are:

1. To assess the water supply and sanitation situation in the rural village of Kochia in Homabay County, Kenya.
2. To identify the supply of water and sanitation problems and challenges in Kochia village.
3. To identify possible mitigation measures the residents proposed towards the water and sanitation related problems in Kochia village, Homabay County, Kenya
4. To create criteria for monitoring and evaluation for the performance of the water and sanitation project and infrastructure in Kochia village Project Performance

4 Project setting

Providing clean water for domestic use has been practiced long in the history, where wells were dug and concreted to ensure clean water availability. Rural areas have had a number of water supply projects initiated by organizations like World Bank, UNDP, and UNICEF among others. The efforts have all been centralized in providing the essential commodity, which is essential in almost all parts of human existence. Clean water for drinking describes an overall overview of human being, both in health, dignity, economic status and social health. (Shrestha et al. 2015.)

Globally, water supply status has been alarming in recent years, and when coupled with other challenges like poverty and inequality, they brought about global unity towards a sustainable coexistence and access of the important commodity. About 1.9 billion people were reported to have access to proper sanitation by the year 2011, while an alarming 2.5 billion global population were not able to access these essential resources. (Shrestha et al. 2015.)

894 million people are still not able to access clean drinking water, which accounts to 9.1% of global diseases and an overall 6.3% deaths related to water diseases. 3.4 million People die annually due to water in global statistics, a child will die every 20 seconds due to water and related diseases, and 50% of hospital beds are occupied globally by people suffering from water related illness. Global statistics projects water issues to catch-up with the world in 2030 if

little is done. It shows that the demand and supply gap will widen, with an estimated 50% deficit in developing countries, and the same countries will record about 47% of the population living in a water stressful area. (Falcone 2013.)

Kochia ward like any other global rural area, is threatened by the statistics and thus its heavy reliance on this project. Water supply and sanitation project is an altogether project, drawing associates from the locals. The success of the project will rely heavily on the collaboration and contribution of the stakeholders, ones who understand the history of the region and the extent of the damage. Global water supply and sanitation projects are made successful by social project investors allowing for close work relationship in implementing adequate technology (Falcone 2013).

In Ecuador, some of the water sanitation projects that help restore the lives of the locals had to work with the community in analyzing the epidemic. The efforts had an objective in trying to eradicate frequent hospital visit by children, who had a persistent and likelihood of feeling ill that was becoming challenging. Even though these are always associated with areas that are less frequented by precipitation, the need to eradicate them have come to Kochia ward. (Ashoka 2017.)

Global statistics on sanitation facilities like toilets are also worrying. It is reported that 1 in 3 global population cannot access clean toilet, with both water and sanitation crisis affecting mostly women. Women have the responsibility of availing the essential resource to the family, confining them to long distance walking and other developments in search of clean water. It has impacted negatively on their economic productivity making them to be marginalized by the society. (Adeigbo 2018.) The project will ease the historic pressure that have been building on women, by involving them in solution development and the implementation process.

The government could as well be an interested party to form government-private partnership for the better of Kochia water project. Partnership between the government and private developers on infrastructure projects, can help facilitate the implementation process. It helps in availing the needed resources at a reduced cost, especially in the case of Kochia where the project will rely on machines for excavation purposes. It also helps in formulating journey for sustainable development, being that the government has budget allocated for such changes. (Hueskes et al. 2017.)

Kochia project can rely on the county government for partnership, being that they work closer to the people of Kochia, and they are for their welfare. It will ease access of public property like land, being that natural resources are owned by the regional government by default. It will help cut the budget expenditure heaped on the complex nature of the project and can as well determines the quality implementation layout due to the availability of funds. The involvement of the county government will also help in the mapping purposes, especially

with the demographic knowledge and information that county government are able to access. (CGH 2013.)

4.1 Water and sanitation

Among the most basic services and infrastructure are those related to water. Inequalities in access to improved sources of water are indicative of severe deprivation. The quality of water is related to the source, improved or unimproved. Improved water sources are less prone to contamination and hence are safer. Access to safe drinking water is critical for the health outcomes of individuals and households in general. Improved water sources include piped water, rain harvested water, bore hole water (that this project will mostly rely on) and water from protected wells. Unimproved water sources include water consumed directly from rivers or streams, dams, ponds, lakes, unprotected wells, unprotected springs, water vendors and other sources. Profiling households' access to water facilities will inform the researcher about the magnitude of the problem and highlight geographical areas for priority interventions. (Njonjo et al. 2013.)

Access to safe human waste disposal methods is crucial for the health and wellbeing of people. Lack of access to safe human waste disposal facilities leads to higher costs to the community through pollution of rivers, ground water and higher incidence of air and water borne diseases. Other costs include reduced incomes as a result disease and lower educational outcomes. Improved waste disposal modes include connection to main sewer, septic tank, cess-pit, Ventilated improved pit (VIP) latrine, and covered pit latrine. Unimproved methods include uncovered pit latrine, bucket latrine, bush and other sources. Pit latrines in Kenya are the most common method of waste disposal with 74 percent of Kenyans using them (VIP latrines are used by 5 percent; covered latrines are used by 48 percent; and uncovered latrines are used by 21 percent). A sizeable population (17.5 percent) still uses the bush to dispose human waste. (Njonjo et al. 2013.)

4.2 Cultural integration

Cultural integration makes an important part of the project implementation process. Society depends much on the culture to make personal, social, and economic development. It provides an improved understanding of ones surrounding, facilitates learning and the overall satisfaction in the society (Ontario 2016). History of a place is passed down through culture, allowing individuals to understand the rich historic happenings that helps support the position of the community. Cultural integration is the act of assuming one's cultural belief and practices, while retaining the original cultural belief that is different from the culture in question.

The team that will carry out the project (project manager, coordinators and members of the community) will need to integrate with cultural practices of Kochia ward, and assume the

overall functionality and practices. They will be able to learn from the practices, learning on both the past and present trend down the history. To learn on water consumption trend of Kochia ward, the team will draw comparison on what have been the cultural practice around water and the historic position water holds in the community. Some community value water as a significant to their belief, and it defines their overall use and consumption capacity.

Women spend between 3 to 5 hours daily fetching water. This amounts to about 40% of their working day. The reduced time and energy spent in fetching and queuing for water, of say, a half hour by 2015 will enable women to engage in alternative activities. The reduction in time spent fetching water could be utilised for income generating activities that will increase the contribution of women family labour by 10%. (Project Appraisal report 2009.)

4.3 Ethical and legal consideration

Researchers must be aware of the ethical considerations of research from the point at which they choose the question to be asked, through the choice of a population in which to study it, the methods to be used to collect data, the recruitment of informants, and publication. The American Anthropological Association (AAA) code use as their starting point the principle that the researcher must respect the rights, lives, attitudes, and opinions of the people they are studying. The AAA code makes it clear that the safety of people with whom the researcher is working has the highest priority, superseding any scientific goals. Codes of professional ethics not only point to the need to protect the rights of subjects, but also the reputation of the profession as a whole (DeWalt 2010, 184.)

The ethical conduct of research requires that the researcher be sufficiently trained to carry out research not only ethically, but also competently. For the use of participant observation as a method of research, this also means knowing how to enter a new setting and develop effective field relationships. It also means being attentive to the situation, knowing when to step back a bit, and how to listen, and finally how to leave the setting in such a way that subsequent researchers would find a receptive community. There is no substitute for feeling and showing respect for the people with whom the researcher is working. Participant observation works best when there is true rapport between the researcher and members of the community. (DeWalt 2010, 185.)

Participant observation that was used in this study raises the greatest number of ethical questions with respect to informed consent and the right of the people to choose to participate in a research. While it may be clear to most individuals who are being interviewed using structured interview schedules, the activities carried out during participant observation are less clearly so. The researcher had to travel alongside community members during the sanitation walk, participating in events, work, leisure activities, hanging out. Community companions will probably not be fully aware that the researcher will faithfully record an account of these

events as soon as possible and that this will form a set of data for analysis. (DeWalt 2010, 187.)

The principal of informed consent not only includes disclosure of the goals of the research, but also the honest assessment of the researcher as to the risks and benefits of the research, informing participants about their rights, the purpose of the research, procedures to be undertaken, potential risks and benefits of participating, the expected time frame of the study, the confidentiality of personal identification to the people participating in it (DeWalt 2010, 189). The researcher took into account the privacy of the participants as well as the confidentiality of the data that was collected during the sanitation walk. The researcher explained clearly the objectives of the research to the participants.

Respect for persons requires that subjects, to the degree that they are capable, be given the opportunity to choose what shall or shall not happen to them. This opportunity is provided when adequate standards for informed consent are satisfied. The basic concept is that people have the right to freely choose whether to participate in a research project or not. In order to make that decision, they need to have a reasonable understanding of both the risks and benefits of participating in the research project. (DeWalt 2010, 246.) The participants have a right to privacy as well that is why the names that the researcher used during the interviews are not the actual or real names of the persons who took part in the interview. This was done to conceal the real identity of the interviewees.

According to DeWalt (2010), the most fundamental principle is that people have a right to know that they are the subjects of a research project. In participant observation we actually hope that at some moments the research nature of the relationship can be made less explicit. Again, people have the right to know that they are being studied, and they must have a right to refuse to participate.

The research was not funded by Laurea University of Applied Sciences since this research did not need large budgeting. The researcher funded the travel expenses and the materials used during the sanitation walk. During the sanitation walk, water and snacks were provided to the villagers (participants).

The code of ethics of the AAA recognizes that anonymity can always potentially be compromised. Confidentiality is important at several levels. At the community level, the researcher often has information about people that the participants do not want shared with their neighbours. It is critical that researchers do not share information or gossip with community members, even if their informants are sharing gossip, or asking for some. We spoke of the need to maintain confidentiality for the sake of rapport. There is also an ethical imperative to do so. (DeWalt 2010, 246.)

4.4 Risk analysis

In dealing with a project, government and its legislations plays an important role in achieving the success of a project. World Health Organization (WHO) have set standards for the governments to adhere to when implementing water sanitation projects, including standards in drinking water that has to be followed. The water and sanitation project team in Kochia has to work closely with the government, both the national, regional, county, and sub-county level of government, in order to implement a lawful project. Projects have often been stopped when in the process due to failures to follow the right procedures and regulation adherence, which have resulted to losses hence the failures of the project. (WHO 2014.)

Kochia water and sanitation project should be a solution to water crisis issues rather than a source of danger to the community, hence the strict adherence to government's rules and regulations governing water projects. Even though water health and safety issues can take time to be noticed like in the case of DC water crisis (Augenstein 2016), the aftermath in the long run can prove to be dangerous in a span ranging from 5 years upfront. The project is committed to safety and health more than any other thing, which will give it a pole position to improve the standard of living of Kochia village.

The government also has regulations in place governing the use of natural water sources, the level of exploitation, and the down-stream flow in efforts to save other people managing on the same resource. According to Nordblom et al. (2013), upstream water usage for projects may affect the downstream aquatic life, the wet lands, and the overall industrial and domestic use of water. The authors call for proper management of water especially when running big projects, with consideration and adherence to government regulations on the amount of water that should flow at one given time (Nordblom et al. 2013). Kochia water sanitation project has to adhere to these regulations, more so, some of the natural water sources in Kochia are tributaries of Lake Victoria. Overexploitation could harm the economic practice of people in the lake regions, especially in the fishing, transport, tourism, and recreation industry. Compliance to taxation and the government charge rate should be considered and evaluated to avoid criminal proceedings against the project organizers. Clear economical project target should be outlined, either as a commercial project or a donation to the Kochia ward, as in this case the project is targeting the commercial purpose hence profit making to sustain its operation and should comply to government taxation adherence policy from the Kenya Revenue Authority (KRA). Another permit from government agency, National Environmental Management authority (NEMA) should be taken care of before project commissioning, NEMA regulates the environmental use of the natural resources like water bodies, as they regulate pollution, contamination and over exploit of the available resources that can cause danger to the

existence of the resource, making it important in acquiring their full authorization of use certificate before operation could start. (National Environment Management Authority (NEMA) 2000.)

Government in conjunction with WHO have regulated on the water sanitation project manuals, guiding on the criteria to establish clean water, best water security model, and how to distribute the essential commodity to the targeted group of people. The guidelines on health basis covers on quality, wholesomeness, drinking water that is safe, and it has to be enough to sustain the people targeted. It aims at the global sustainable goal agreed upon by Nations, which is set to provide water and sanitation a basic to all globally. (WHO 2014.)

Moreover, Water projects are regulated by government laws and policies as they serve as key aspect of citizens' safety. The law on water and natural resource use differ by government legislation hence need to seek and follow the appropriate procedures and work permits in accordance to the law of the Republic of Kenya, County government of Homabay and the local leadership of Kochia ward, to gain full support and authorization including being provided by the security in undertaking the project. (NEMA 2000.)

Political ground and temperature is also key in every operations as unstable politics will put the project team members in danger hindering the success of the project. Corruption level has married most of the global projects, especially in the developing countries that are still dealing with the menace. The project needs to evaluate the local leaders as interested parties, determine their level of involvement in order to mitigate on what could cause some of the massive obstacles in achieving the project.

The legislation on chemical used in water treatment should also be inquired before a decision is to be made in adherence to government policy. There is need to avoid sanctions on health ground while wasting the project capital resource, like in the DC water crisis of 2003 where a change of policy known as "disinfectant byproduct rule" warranted for a change of treatment chemical from chlorine to chloramine. The changes on chemical use endangered lives on the long run, raising alarm on health ground and evaluation on the supply system. Legislations are regulatory for effective and healthy water service delivery that should be observed, according to Augenstein (2016), cost saving and ignorance led to the flint water crisis of 2015 that exposed thousands to harmful lead component Raising the motive of such projects and the general vision and goal. (Augenstein 2016.)

According to the Environmental Management and Coordination Act (2000), no person shall, without prior written approval of the Director-General given after an environmental impact assessment, in relation to a river, lake or wetland in Kenya, carry out any of the following activities

- Erect, reconstruct, place, alter, extend, remove or demolish any structure or part of any structure in, under the river, lake or wetland
- Excavate, drill, tunnel, or disturb the river, lake or wetland
- Deposit any substance in a lake, river or wetland or in, on or under its bed, if that substance would or is likely to have adverse environmental effects on the river, lake or wetland.
- Drain any river, lake or wetland

5 Participant Observation method

Being that the research aims at analyzing and implementing a working procedure in order to supply clean water and proper sanitation in Kochia, Participant observation was used in gathering the accurate data that would aid in implementing the project, prioritizing areas of potentiality.

Participant observation is a method in which a researcher takes part in the daily activities, rituals, interactions, and events of a group of people as one of the means of learning the explicit and tacit aspects of their life routines and their culture. Participant observation is accepted almost universally as the central and defining method of research in cultural anthropology. (DeWalt 2010, 13.)

As a participant observer, the author set up household, made friends, participated in group activities, and engaged in informal and formal interviewing as shown in appendix 1 and 2. The author took part in usual and unusual activities like hanging out and conversing, sanitation walk while consciously observing and recording what was observed. As a participant observer, one should create opportunities to spend time with and carry out activities with members of the community involved. (DeWalt 2010, 13.)

According to DeWalt (2010,15), the key elements of the method of participant observation as used by anthropologists usually involves; living in the context for an extended period of time, learning and using local language and dialect, actively participating in a wide range of daily routine and extraordinary activities with people who are full participants in the context, using everyday conversation as an interview technique, informally observing during leisure activities or while hanging out, recording observations in field notes (usually organized chronologically) and using both tacit and explicit information in analysis and writing.

The most important form of observation that is critical to water supply and sanitation project, is to take a sanitation walk within the community that was done by the author to get

face to face with the issues on the ground. The author visited water collection points, analyzing the street conditions, visiting homes and public buildings, using the local latrines, etc. During these sanitation walks, there was also the opportunity to ask questions about water supply and sanitation issues. (Simpson-Hubert 1983.)

The sanitation walks and observation process did not only explore the situation of water and sanitation system but also on the potential layout of the project's infrastructure. It will help in handling two most critical steps and saving on resources and time. Through the observation, the author accompanied by some residents were able to map areas of high demand that will require much concentration when project is finally commissioned to start. It will also help in distinguishing road maps for the water supply infrastructure, and that of sanitation including sewer line. The two lines need to run on a separate road map if the projects might have a chance in minimizing contamination in case of any technical development in the supply system.

Observation done during the sanitation walk gave the exact extent and condition of how the situation looks like in the study area. It presented an opportunity to correctly mark what the Kochia villagers had to say pertaining to the water and sanitation status, marking the checklist against the actual on the ground. Economic status was also analyzed during the sanitation walk, the distribution pattern, and the overall viability if the project is finally implemented.

Being that natural sources like rivers were the primary source of water for this project, the evaluation of water source capacity can be evaluated at the observational phase. The researcher and the participants (the residents) were able to ascertain the capacity, the behavior in relation to flooding or drought period, and whether it can be permanently reliable or seasonal depending on the weather. Some other water sources like the nearby lake or precipitation in form of rain will be evaluated by observing. Rain water will be dictated by the amount of annual precipitation and other statistics to help in planning. The researcher will further lake water as a water source, but being much cost oriented in its implementation.

6 Results

This section presents the results obtained during the sanitation walk and the observations made by the researcher. The researcher will discuss the assessment of water and sanitation situation in the rural village of Kochia in Homabay County, Kenya, the identified water supply and sanitation related problems and challenges in the village, the possible mitigation measures the residents proposed towards the water and sanitation related problems in the village, and the criteria for monitoring and evaluation of the performance of water and sanitation project and infrastructure in the village.

6.1 Assessment of water supply and sanitation situation in Kochia

Kochia village rely on three major types of water sources, working both as their domestic use and agriculture uses. The first source is from the rain water that is experienced in three months of the twelve months of the year. They are usually distributed quarterly to match the season pattern of the area. Rain water has not been a reliable source of water supply because most villagers through the survey noted that they lack some useful equipment like storage tanks, making the rain water only to be useful within that spring season.

The rain water has also been the reliable source of water for economic development through agriculture. Kochia village depend much on pineapple as an economic crop in the region, but other useful cereal crops and vegetables are usually planted during the spring seasons. In as much as their productivity depend on the availability of water as a useful resource over a period of time, short spring seasons can have a negative yield hence affecting the rate of production.

The second major water source is the Kochia stream which cuts across the village from the nearby hills. The stream can withstand sunny weather but it could unfortunately run dry under persistent droughts. It can only sustain domestic water and livestock watering, but other economic activities like irrigation cannot depend heavily on the stream. Villagers however cite long distance walk and the high rate of exhaustion that is usually associated with drawing water from the stream. They would rather cut down their demand for the commodity, rather than strain to acquire the exact gallons to satisfy their demands.

Water is mainly used for domestic purpose and livestock watering. The villagers rely heavily on stream water for drinking and cooking, but few are able to use the resource for economic benefits. Irrigation is only possible to those who are within a shorter distance from the stream, and again are able to invest in the irrigation technology. Water usage in Kochia has been limited when compared to other parts of Kenya that are producing massively due to availability of water.

Domestic water use is the major activity that consumes water in Kochia village, even though recreations like swimming and religious practices are performed during rainy seasons. It implies that water serves as an important element to the community, and the scarcity is more of a disaster and an inconvenience. A number of youth groups have tried some innovation by making fruit juice from pineapples, but poor water quality has halted their development. Industrial use of water could be another sector that the community are yet to exploit, to which a number of residents cited water scarcity and lack of clean water as the stumbling block.

The water supply in the village is very poor as the villagers rely on bucket as a way of drawing water from the river. Only few households have installed huge capacity tanks to help in preserving rain waters. Homesteads have as well constructed some wells to help in boosting the water system, more so during dry season when water level in the river reduces below the normal circulation point. Rainfall is also considered a natural water supply system, both helping to constitute for the overall water supply.

Acquiring water as a resource in Kochia ward at times can be too challenging. Even though a theoretic claim can be made that the village is around Lake Victoria region, water scarcity is a normal occurrence and dry spells usually sees the diminishing of the useful resource. The area is usually prone to water stress in certain months of the year, in reference to population demand against the availability. It implies on how the village of Kochia is experiencing clean water inequality, because it can clearly be seen that water is distributed across social and economic standards.

Villagers are usually experiencing long walks towards the lake when in the process of watering the livestock during dry seasons. It inconveniences most of their daily activity because a lot of time is dedicated towards locating the resource. Women are also finding it stressful when searching for water, and they are prone to physical tiredness due to the means and mode of water transport. The use of buckets are the common means of transport, where women are socially responsible for the activity.

Sanitation has fallen as the poorest practice within Kochia ward irrespective of government enforcement of pit-latrines in every homestead. Open defecation is still practiced in the region, as it accounts for the majority of the sanitation. Villagers are still challenged in accessing conducive sanitations, mainly because of the social standards. By considering health level, homesteads in Kochia wards lacks on the proper means of sanitation, making it a requirement for the study to improve their overall.

The few available latrines are not properly maintained, making them to be some of the most dangerous sources of health issues. Kochia village have experienced some of the deadly breakout of diseases like Cholera as explained by the villagers, which have worsened to claim lives in the long run. It implies on the real state of sanitation to be at an alarming state that needs immediate remedy if a proper development is to be achieved. The conditions of such facilities in homesteads have to be placed at strategic places to balance on families.

6.2 Water supply and sanitation problems and challenges in Kochia

Kochia village is experiencing scarcity of water due to the unreliability in the water sources. Rain water has proven to be unreliable because it depends much on the seasons, making the resource to be available in certain months of the year. The stream also does not supply much of the water resource, coupled with the fact that residents have to travel long distance for the commodity. Hence Kochia could be a water stress area because of the limitations in getting the commodity from the primary source.

Families in Kochia, especially women, have resorted to long distance walking in quest to draw water from streams. Some families have to carry buckets for as far as one and half kilometres. Distance has been stressful to most of Kochia women, who are traditionally and socially responsible for getting water from the source. Youths also miss schools during dry seasons because water could only be available in the lake region, though the villagers have reported a number of health issues when consuming directly from the lake.

Water supply problem in Kochia, as noted from the sanitation walk results is in two fronts. First, the resource is not readily available because of the distance, and the same stream the villagers depends on can also be classified as seasonal. The reliability of water supply has been challenging issue for years, and several of efforts they have made has not been fruitful as a result of being marginalized by the government. The distance also affects women and children being the only social group left with the responsibility to look for water and this has affected both their physic and the social position within the village.

The second front of water problem is in the quality. Kochia village has been infested by cholera in the past years which have also claimed lives, and the villagers can relate it to poor sanitation and water treatment mechanism. Even though most families have resorted to boiling drinking water, some poor families are acting out of negligence hence risking much of water contamination and related diseases. There is need for treated water for the villagers, who are also finding it hard in accessing healthcare facility due to distance. Kochia ward residents believe that a treated water will positively add value to their lives.



Figure 2: Overview of water quality direct from streams

The economic dependency on water also surfaced but they did not label it as a problem, because they have never relied on such production in their history. However, if there is a chance to improve their standard of living, then economic dependency also should be considered an issue. It will mean food security to Kochia village, and could further open doors for the socio-economic growth within the area. It will also better their education potentiality because of improved income and grows domestic production from the area, with much benefit per capita to the families.

The main problem with the village sanitation in Kochia is the maintenance of the erected pit latrines. Most of these facilities are not fit to be used by humans especially for health benefits, while others can be catastrophic due to the mud thatched walls that are giving in to weather. It implies on the danger when using such facilities hence the growth of open defecation as a practice around Kochia village.

Latrines are available but only in countable number of homesteads, especially those that are considered to be of different social class from the rest. Even though it is a statutory requirement by the Government of Kenya through health ministry that every homestead should install a pit latrine, most are still lacking while others have been destroyed due to poor maintenance. Families have resorted to open defecation in nearby bushes and farm lands, making the environment to be un-hygienically fit as a surrounding.

Poor latrine structures around Kochia ward have done them more harm than good. Even though the community dwellers are used to their state, it is just about time before hazardous health issue can befall them. The status of these few available latrines can best be described by the foul smell from the atmosphere, which ought to be fresh as nature dictates. Children are encouraged to resort to open field defecation because their parents are worried as well about latrine status. Sanitation is turning out to be an essential necessity that should be handled within Kochia ward. The effectiveness will help restore the natural resources from contamination, and also to avail adequate space for proper infrastructure and piping works.

6.3 Mitigation measures

Harvesting of rain water including the surface runoffs. During the rainy season, the water can be harvested and stored in constructed underground tanks that are strategically located across the village. The harvested water can later be pumped into homesteads after treatments, ensuring continuous supply even long after the rains. Homesteads can as well install some medium size water tanks for rain water harvesting purposes. However, limitation on such mode of improving water supply is based on sustainability, because rainfall in Kochia area is seasonal and thus can only function as a short-term solution.

Building on borehole to improve on water supply. Borehole is the main water source that the project will be using in the quest to supply water. Boreholes are adequate and reliable source of water, and they can be available in a long run. Moreover, boreholes will not attract much of strict legislation and control as compared to rivers as the primary source. Boreholes are constructed deeper into the water table to make them more reliable than any other source of water, because the occurrence of underground waters are independent off any atmospheric conditions.

Figure 3 shows a borehole drilling process going on. The machine shown in the picture is the same type that will be used to drill boreholes in Kochia village.



Fig 3: Borehole drilling in process

The project intends to cover the entire Kochia ward as the primary project target area. It will distribute water through piping system to every homestead and social amenities like schools and religious buildings. The sanitation system will have a primary centralized effluent system for treatment and the release to the environment, making sure that every household is covered by the project. Both water supply system will also be installed in social places like markets and playing field, with an intention to deliver proper water supply across the region and minimize stress that have always been there.

The water stand taps will also be distributed to farms upon formal request by the farmers, with an aim to boost their economic performance and raise their standard of living. Though

the piping system will be on the same line as the domestic water line, farms will require additional water pipes hence the need to make formal requests and agree on the additional costs.



Figure 4: Capacity of a water treatment process which can target a wider area

The water supply coverage will be improved to a sustainable level in that the project will be relying on a drilled borehole rather than the surface water. The project team have analysed the viability, reliability, and durability of boreholes in Kochia village. The analysis has given much faith to that source water that will eventually improve on the water supply. The supply will also be based on equality rather than social and economic differences, because every person has a right to access clean water for use. The supply will however be regulated to control the consumptions and avoid wastages, which have been an acquired behaviour when there is a limited access of the commodity.

Sanitation will also cover homestead with the modern toilet system to replace the traditional pit latrines. The modern toilet system is easy to manage and maintain in the long run, and it promotes much hygiene to the surrounding than the pit latrines. Every homestead will have a basic modern toilet constructed by the project, but only limited to one. An additional number of the toilets can be constructed at the expense of the facilitator, who will take all the necessary construction costs and equipment purchasing.



Figure 5: Overview of a water treatment plant

6.4 The criteria for monitoring and evaluation for the performance of the project

According to Green and South (2006, 12), the term evaluation means assessing the effects of an intervention and whether goals have been achieved while monitoring has been defined as the systematic and continuous following, or keeping trace, of activities to ensure they are proceeding according to plan. The emphasis in monitoring is therefore on recording what has happened in terms of programme delivery, whereas evaluation is concerned with assessing what has been achieved and how any changes have come out.

Evaluation planning is the process of clarifying what needs to be researched and identifying how evidence will be collected. Developing a plan can help those involved in an evaluation to steer a path through the mass of information about a programme. Decisions about the scope of the evaluation need to be made. Agreeing the primary purpose of an evaluation will guide choices in terms of design and approach. An evaluation that is commissioned primarily as a demonstration project will require a different approach and level of resources than an evaluation undertaken with the purpose of informing the future direction of a project. (Green & South 2006, 66.)

The requirements for monitoring and its management need to be considered in the planning stages as there is clearly an overlap in terms of setting up systems for monitoring and routinely collecting data for evaluation. Monitoring data can, of course, be collated and used in evaluations. For example, a project might collect details of the age, sex, and ethnicity of

those registering which could be used to provide evidence about project reach and whether it is accessible to all groups within the community. (Green & South 2006, 76.)

Monitoring gets little attention in research methods literature yet is an important process which can have positive and negative implications for practice. In an ideal situation, monitoring data would be easily collected, not get in the way of project delivery, and illuminate where there are glitches. In reality many projects have to cope with burdensome monitoring requirements in order to be accountable to funding bodies. (Green & South 2006, 77.)

There is a point in the evaluation where the evidence needs to be brought together. Hopefully, by using an evaluation plan, a lot of relevant evidence will have been gathered and analysed. At this stage, there is a risk that the detail of the findings overwhelms the interpretation. For evaluation to be utilised, key findings need to be identified and the overall strength of the evidence assessed. (Green & South 2006, 77.)

In order to determine the success of a project, the findings should be compared with the original framework outcomes and indicators. It can be useful to summarize the findings in tabular form, so they can be matched with the indicators. There also needs to be an overview of the project development, implementation and outcomes. (Green & South 2006, 77.)

The process of interpreting findings can be carried out in conjunction with other stakeholders as it gives people the opportunity to comment on and validate the emerging findings. Key strategies include continuous feedback of findings and seeking a consensus before the final report. Our experience suggest that it is beneficial for researchers to be involved in this final process of interpretation as it allows some additional reflection to be built into the evaluation and can enable points of learning to emerge. (Green & South 2006, 77.)

The final stage of undertaking an evaluation is reporting the findings. Hopefully, by the end of the evaluation, clear and relevant findings will have been identified. Evaluation has a primary purpose to inform practice, and therefore the reporting stage is very significant. Attention to good communication of results will help with utilization of the findings. (Green & South 2006, 77.)

The Socratic Wheel is flexible enough to support step-by-step monitoring and evaluation on a small or large scale. The tool that the author is planning to use can support strategic planning starting with a baseline assessment of the situation and priority setting. It can also be used to examine the similarities and differences that exist between people or between actions. (Chevalier & Buckles 2013, 146.)

Every monitoring and evaluation process must be designed and tools selected to fit the purpose and situation under investigation. This may require that evaluators scale tools up or

down to meet specific user needs and constraints (scarce time, financial and human resource). Methodological pluralism and creativity is also needed to go beyond current tendencies to emphasize upward accounting for resources and results, and to draw on a narrow range of methods (field observations, surveys, descriptive statistics, interviews, focus groups and storytelling). (Chevalier & Buckles 2013, 98.)

The project should also evaluate on different ways to sustain big projects like the water supply and sanitation. It should include the potential source of revenue to run and fund the project, leaving out both non-governmental organization and government funding. If such projects are able to have independent way of generating funds, by not levying heavy recovery fees on poor villagers. Then the success rate can be massively improved, and the project will have to meet its primary target.

6.5 Challenges to improvement of village water supply and sanitation coverage

The author discovered several obstacles during the sanitation walk which includes:

- Distance between the homesteads. Kochia village is in a huge piece of land with homesteads widely located apart. It will increase the project cost of piping works and sewer line connection, which would otherwise have been cheap when homes were closer to each other.
- Political interference is also an obstacle to deal with because the local leaders are trying to influence the project implementation. This includes the primary area where the project will be located, as well as the project list of priorities.
- Dealing with imminent resistance due to negative influence. The project will struggle in getting the primary land for main facility construction because of the negative information going around the village, whereas some land owners have rejected the piping works from accessing their land.
- Being that the project will depend on Kochia people for maintenance purposes, economic standard of the region is still an obstacle for the sustainability of the project, hence the need to implement economic benefits

7 Evaluation

Evaluation is concerned with assessing whether interventions are effective. There is considerable debate about how effectiveness and success are judged. Clearly, different stakeholders will hold different views stemming from their different aspirations for an intervention and indeed, what type of evidence they find convincing. (Green & South 2006, 5.)

Establishing whether interventions have worked or equally have not worked, is integral to evidence-based practise and of potential interest to the wider public health workforce. Such evidence can be used to inform future developments from local projects through to major policy change. (Green & South 2006, 5.)

Evaluation has long been recognized as fundamental to good practise and to be a core component of the health promotion planning cycle that is shown in the figure 6 below. From the perspective of those more directly involved with initiatives being evaluated, the findings can be used to review progress and make any necessary amendments to keep the project on track. Equally, demonstrating achievement and celebrating success can provide further motivation and empower individuals. (green & South 2006, 5.)

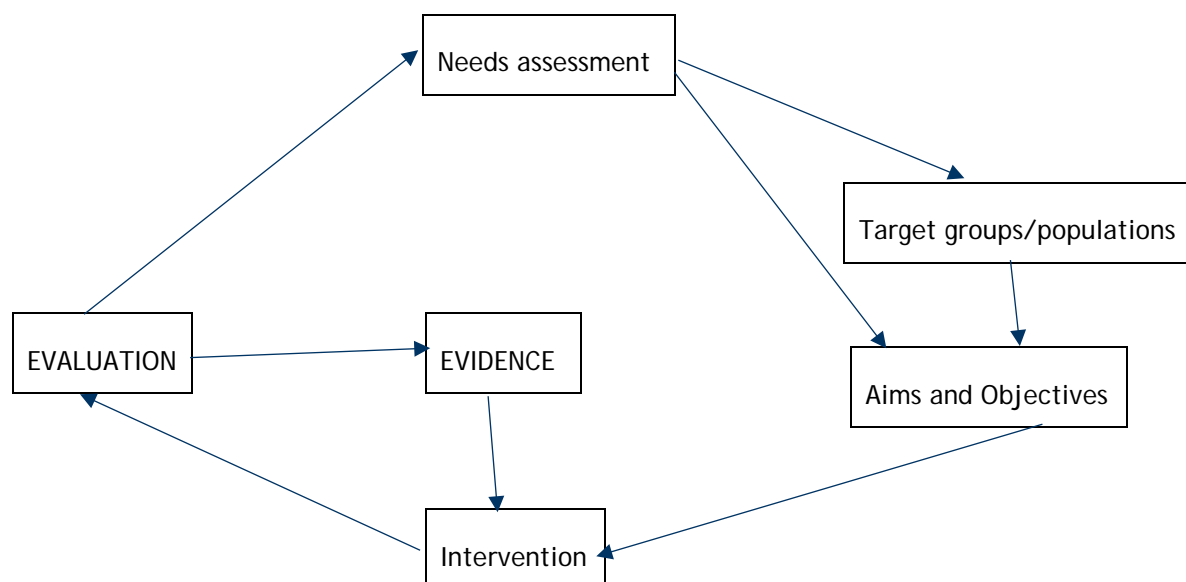


Figure 6: The health promotion planning cycle (Green & South 2006)

Evaluation also has a major role in protecting the public from inappropriate or harmful practises. Clearly there is an ethical obligation to ensure that interventions do not harm, either indirectly by squandering limited resources on ineffective interventions or, indeed, more directly. Ineffective and inappropriate interventions may alienate community groups and make them more resistant to other attempts to bring about change. (Green & South 2006, 6.)

The purpose of this study was to plan how to improve the availability and supply of clean water for drinking and plan also to improve sanitation in Kochia village. It is very important to note that this has been explored to some extent. The researcher has come up with great results that have answered the goals of this project. The researcher came across the obstacles to improvement of water supply and sanitation in Kochia village which should be addressed to

enable smooth enrolment of the project. The researcher has also discussed the findings about the problems with village sanitation and water supply.

Water and sanitation has been a wider scope to cover, though much of the research has been done to create clear coverage of the sector. However, there is need to understand the level of sustainability rain water can have in this community.

Developmental evaluation supports innovation development to guide adaptation to emergent and dynamic realities in complex environments. Innovations can take the form of new projects, programs, products, organizational changes, policy reforms, and system intervention. Complex environments for social interventions and innovations are those in which what to do to solve problems is uncertain and key stakeholders are in conflict about how to proceed. (Patton 2011,1.)

Developmental evaluation has five main purposes. The first purpose is to assist and support social innovators with ongoing adaptation of their interventions in turbulent environments as they encounter the dynamics of complexity. These innovators and program developers never expect to get to a steady-state or fixed model. They have a mindset open to ongoing development, ever adapting to an ever-changing world. They also are not particularly concerned about taking what they're doing to the wider world, though that can change if their local success attracts broader attention. The second purpose is adapting effective general principles to a new context as ideas and innovations are taken from elsewhere and developed within a new setting, the work of developmental evaluation in the dynamic middle between top-down and bottom-up forces of change. (Patton 2011, 1.)

According to Patton (2011, 1), developing a rapid response in the face of a sudden major change or a crisis, like a natural disaster or financial meltdown, exploring real-time solutions and generating innovative and helpful interventions for those in need is the third purpose of developmental evaluation.

The fourth is pre-formative development of a potentially scalable innovation to the point where it is ready for traditional formative and summative evaluation; pre-formative developmental evaluation works with emerging ideas and visionary hopes in a period of exploration to shape them in to a potential model that is more fully conceptualized, potentially scalable intervention. (Patton 2011, 1.)

The fifth is major systems change and cross-scale developmental evaluation, providing feedback about how major systems change is unfolding, evidence of emergent tipping points, and/or how an innovation is or may need to be changed and adapted as it is taken to scale, that is, as its principles are shared and disseminated in an effort to have broader impact (Patton, 2011, 195).

8 Conclusion

To conclude, water and sanitation is still an important global goal, and should be equally given to the rural areas just as the concentration have been much on urban centres. It is a call to both the local and national governments to take it up to task in implementing such initiatives, because it will help save a life that should not have been lost due to poor sanitation and unclean water. It will provide the basic essential health for a sustainable life and economic development, hence improving on the overall livelihood. The Kenyan government should further eradicate pit latrines because they are the primary source of health-related infections, and the same can further save on the environment. However, due to much cost in realizing such eradication, the remedy will still rely on resource allocation to improve on pit latrine. It will be able to effectively have a healthy rural area, ones with no water scarcity and not prone to waterborne diseases.

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Appendices

Appendix 1: Sampled Survey from Kochia Ward from a low income earner

KOCHIA WATER AND SANITATION QUESTIONNAIRE

Name of Investigator: VICTOR
 Date: 18th December 2018

Starting Time: 9 am
 Ending Time: 10 am

Investigator Introduction:

Hello, my name is MILLICENT, and I work for _____, a water and sanitation project targeting Kochia ward and collecting information on clean water availability in Kochia Ward. May I speak to an adult member of your household?

Section I. Demographic Questions

- 1 What is your name? MOUREAN AKEL
- 2 Gender of respondent
 1- Male
 2- Female ☒
- 3 What is your age? 32 years
- 4 Location/ Address: KOCHIA WARD
- 5 Type of family
 1-Nuclear ☒
 2-Joint/ extended
- 6 a. Number of adult males in the household 6 - SIX
- b. Number of adult females in the household 3 - THREE
- c. Number of male children 4 - FOUR
- d. Number of female children 3 - THREE
- 7 How many members in the household are employed? NONE
- 8 What is the monthly household income?
 1- <1000 Kshs.
 2- 1001-5000 Kshs. ☒
 3- 5001-10000 Kshs.
 4- 10000-30000 Kshs.
 5- > 30001 Kshs.

Section II. Drinking WaterGeneral

- 9 Which of the following sources of drinking water are available in your neighborhood? (Multiple responses are possible)
 1- Bore well/ hand pump
 2- Public tap
 3- Community well ☒
 4- Household water supply (piped)
 5- Other ☒
- 10 Which of the following sources of drinking water does your household use? (Multiple responses are possible)
 1- Bore well/ hand pump
 2- Public tap
 3- Open well ☒
 4- Household water supply (piped)
 5- Other ☒

- 11 What is your main source of water? Single response
- 1- Bore well/ hand pump (skip to q. 12)
 - 2- Public tap (skip to q.18)
 - 3- Open well (skip to q.28)
 - 4- Household water supply/ piped (skip to q. 32)
 - 5- Other specify RIVER (skip to Q36) ✓

Bore well/ hand pump

- 12 How far (in meters) is the bore well/ hand pump that you use? _____
- 13 How long (in minutes) does it take to fetch water and return home? _____
- 14 Who fetches water most often ?
- 1- Adult male
 - 2- Adult female
 - 3- Male child
 - 4- Female child
- 15 Has the bore well / hand pump broken down in the past one year?
- 1- Yes
 - 2- No (skip to q. 36)
- 16 How frequently has the bore well/ hand pump broken down during the past one year?
- 1. Once a week
 - 2. Once a fortnight
 - 3. Once a quarter
 - 4. Once in six months
 - 5. Once a year
- 17 Is the bore well/ hand pump fixed promptly when it breaks down?
- 1- Yes
 - 2- No

GO TO QUESTION 36

Public tap

- 18 How far (in meters) is the public tap that you use? _____
- 19 How long (in minutes) does it take to fetch water and return home? _____
- 20 Who fetches water most often?
- 1- Adult male
 - 2- Adult female
 - 3- Male child
 - 4- Female child
- 21 What is the frequency of water supply?
- 1- More than once a day
 - 2- Once a day
 - 3- Once in two days
 - 4- Once in three days
 - 5- Once a week
 - 6- Other
- 22 Is this frequency sufficient for your needs?
- 1- Yes (skip to q. 24)
 - 2- No
- 23 How often would you like to get water?
- 1- More than once a day
 - 2- Once a day
 - 3- Other
- 24 On the days that you get water, how many hours do you usually get water for? _____

- 25 Has the public tap broken down in the past one year?
1- Yes
2- No (skip to q. 36)
- 26 How frequently has it broken down?
1- Once a week
2- Once a fortnight
3- Once a quarter
4- Once in six months
5- Once a year
- 27 Is the public tap fixed promptly when it breaks down?
1- Yes
2- No

GO TO QUESTION 36Open well

- 28 How far (in meters) is the open well from which you get water? _____
- 29 How long (in minutes) does it take to fetch water and return home? _____
- 30 Who fetches water most often?
1- Adult male
2- Adult female
3- Male child
4- Female child
- 31 What is the frequency of cleaning the well?
1- Once in a quarter
2- Once in six months
3- Once a year
4- Not cleaned in the last year

GO TO QUESTION 36Household water supply (piped)

- 32 What is the frequency of water supply?
1- 24 hour supply (skip to q. 36)
2- More than once a day
3- Once a day
4- Once in two days
5- Once in three days
6- Other
- 33 Is this frequency sufficient for your needs?
1- Yes (skip to q. 36)
2- No
- 34 How often would you like to get water?
1- More than once a day
2- Once a day
3- Other
- 35 On the days that you get water, how many hours do you usually get water for? _____

CONTINUE TO QUESTION 36Common Questions

- 36 Is the quantity of water that you receive (from your main source of water) adequate?
1- Yes
2- No ✓
- 37 Is water available (from your main source) throughout the year?
1- Yes (skip to q. 39)
2- No ✓
- 38 Which months do you face scarcity? Multiple
1- January ✓

- response
- 39 Generally, how does the water smell?
- 40 Generally, does the water have a taste?
- 41 Generally, what does the water look like?
- 42 Do you pay for water?
- 43 How much do you pay a month?
- 44 Are the bills that you receive accurate?
- 45 Have you made a complaint related to your drinking water service in the past one year?
- 46 To whom did you complain?
- 47 What was the result of the complaint?
- 48 Overall, are you satisfied with your drinking water service?
- 49 What is the extent of your satisfaction?
- 50 What are the reasons for your dissatisfaction? (list up to three)
- 51 Have you paid a bribe for any service related to drinking water in the last one-year?
- 52 For what purpose have you most recently paid a bribe?
- 53 How much did you pay?
- 54 Was the bribe demanded (or did you pay on your own)?
- 55 Did the work get done after paying the bribe?
- 2- February ✓
3- March ✓
4- April
5- May
6- June
7- July
8- August ✓
9- September
10- October
11- November ✓
12- December ✓
1- No smell
2- Foul smell ✓
1- Yes
2- No (tasteless) ✓
1- Clear
2- Cloudy/ dirty ✓
1- Yes
2- No (skip to q. 45) ✓
-
- 1- Yes
2- No
1- Yes ✓
2- No (skip to q. 48)
MCA of KOCHIA WARD.
- 1- Prompt action taken
2- Delayed action taken
3- No action taken ✓
1- Satisfied
2- Dissatisfied (skip to q. 50) ✓
1- Complete (skip to q. 51)
2- Partial (skip to q. 5)
* COMPLETELY EXPOSED TO DISEASES.
* LABOUR INTENSIVE TO ACQUIRE.
* NOT AVAILABLE AS NEEDED.
- 1- Yes ✓
2- No (interview complete)
1- To get a connection/ to access water supply
2- To finish repair work
3- Other ✓
KSHS. 500/-
- 1- Demanded ✓
2- Paid on my own
1- Yes
2- No ✓

(Interview Complete)

Appendix 2: Sampled survey from a high income earner from Kochia Ward

KOCHIA WATER AND SANITATION QUESTIONNAIRE

Name of Investigator: VICTOR
 Date: 20TH, DEC. 2018

Starting Time: 10 AM
 Ending Time: 11 AM

Investigator Introduction:

Hello, my name is VICTOR, and I work for _____, a water and sanitation project targeting Kochia ward and collecting information on clean water availability in KOCHIA. May I speak to an adult member of your household?

Section I. Demographic Questions

- 1 What is your name? PETER DIKELD
- 2 Gender of respondent
 1- Male ☒
 2- Female
- 3 What is your age? 42 years
- 4 Location/ Address: KOCHIA
- 5 Type of family
 1-Nuclear
 2-Joint/ extended ☒
- 6 a. Number of adult males in the household TWO
- b. Number of adult females in the household TWO
- c. Number of male children FOUR
- d. Number of female children TWO
- 7 How many members in the household are employed? THREE
- 8 What is the monthly household income?
 1- <1000 Kshs.
 2- 1001-5000 Kshs.
 3- 5001-10000 Kshs.
 4- 10000-30000 Kshs. ☒
 5- > 30001 Kshs.

Section II. Drinking WaterGeneral

- 9 Which of the following sources of drinking water are available in your neighborhood? (Multiple responses are possible)
 1- Bore well/ hand pump ☒
 2- Public tap
 3- Community well
 4- Household water supply (piped)
 5- Other
- 10 Which of the following sources of drinking water does your household use? (Multiple responses are possible)
 1- Bore well/ hand pump ☒
 2- Public tap
 3- Open well
 4- Household water supply (piped)
 5- Other

11 What is your main source of water? Single response

- 1- Bore well/ hand pump (skip to q. 12) ✓
 2- Public tap (skip to q.18)
 3- Open well (skip to q.28)
 4- Household water supply/ piped (skip to q. 32)
 5- Other specify ----- (skip to Q36)

Bore well/ hand pump

12 How far (in meters) is the bore well/ hand pump that you use?

700 METRES

13 How long (in minutes) does it take to fetch water and return home?

45 MINUTES

14 Who fetches water most often ?

- 1- Adult male
 2- Adult female ✓
 3- Male child
 4- Female child ✓

15 Has the bore well / hand pump broken down in the past one year?

- 1- Yes ✓
 2- No (skip to q. 36)

16 How frequently has the bore well/ hand pump broken down during the past one year?

1. Once a week
 2. Once a fortnight
 3. Once a quarter ✓
 4. Once in six months
 5. Once a year

17 Is the bore well/ hand pump fixed promptly when it breaks down?

- 1- Yes
 2- No ✓

GO TO QUESTION 36

Public tap

18 How far (in meters) is the public tap that you use?

19 How long (in minutes) does it take to fetch water and return home?

20 Who fetches water most often?

- 1- Adult male
 2- Adult female
 3- Male child
 4- Female child

21 What is the frequency of water supply?

- 1- More than once a day
 2- Once a day
 3- Once in two days
 4- Once in three days
 5- Once a week
 6- Other

22 Is this frequency sufficient for your needs?

- 1- Yes (skip to q. 24)
 2- No

23 How often would you like to get water?

- 1- More than once a day
 2- Once a day
 3- Other

24 On the days that you get water, how many hours do you usually get water for?

- 25 Has the public tap broken down in the past one year?
1- Yes
2- No (skip to q. 36)
- 26 How frequently has it broken down?
1- Once a week
2- Once a fortnight
3- Once a quarter
4- Once in six months
5- Once a year
- 27 Is the public tap fixed promptly when it breaks down?
1- Yes
2- No

GO TO QUESTION 36Open well

- 28 How far (in meters) is the open well from which you get water? _____
- 29 How long (in minutes) does it take to fetch water and return home? _____
- 30 Who fetches water most often?
1- Adult male
2- Adult female
3- Male child
4- Female child
- 31 What is the frequency of cleaning the well?
1- Once in a quarter
2- Once in six months
3- Once a year
4- Not cleaned in the last year

GO TO QUESTION 36Household water supply (piped)

- 32 What is the frequency of water supply?
1- 24 hour supply (skip to q. 36)
2- More than once a day
3- Once a day
4- Once in two days
5- Once in three days
6- Other
- 33 Is this frequency sufficient for your needs?
1- Yes (skip to q. 36)
2- No
- 34 How often would you like to get water?
1- More than once a day
2- Once a day
3- Other
- 35 On the days that you get water, how many hours do you usually get water for? _____

CONTINUE TO QUESTION 36Common Questions

- 36 Is the quantity of water that you receive (from your main source of water) adequate?
1- Yes ✓
2- No
- 37 Is water available (from your main source) throughout the year?
1- Yes (skip to q. 39) ✓
2- No
- 38 Which months do you face scarcity? Multiple
1- January

response

- 39 Generally, how does the water smell?
- 40 Generally, does the water have a taste?
- 41 Generally, what does the water look like?
- 42 Do you pay for water?
- 43 How much do you pay a month?
- 44 Are the bills that you receive accurate?
- 45 Have you made a complaint related to your drinking water service in the past one year?
- 46 To whom did you complain?
- 47 What was the result of the complaint?
- 48 Overall, are you satisfied with your drinking water service?
- 49 What is the extent of your satisfaction?
- 50 What are the reasons for your dissatisfaction? (list up to three)
- 51 Have you paid a bribe for any service related to drinking water in the last one-year?
- 52 For what purpose have you most recently paid a bribe?
- 53 How much did you pay?
- 54 Was the bribe demanded (or did you pay on your own)?
- 55 Did the work get done after paying the bribe?

- 2- February
3- March
4- April
5- May
6- June
7- July
8- August
9- September
10- October
11- November
12- December

- 1- No smell
2- Foul smell ✓
1- Yes ✓
2- No (tasteless)
1- Clear ✓
2- Cloudy/ dirty
1- Yes ✓
2- No (skip to q. 45)

KSHS. 200/-

- 1- Yes
2- No ✓
1- Yes ✓
2- No (skip to q. 48)

LOCAL LEADERS:

- 1- Prompt action taken
2- Delayed action taken
3- No action taken ✓

- 1- Satisfied
2- Dissatisfied (skip to q. 50) ✓
1- Complete (skip to q. 51)
2- Partial (skip to q. 5)

- WATER NOT TREATED
- UNRELIABLE DUE TO DISTANCE
- EXPENSIVE BUT LOW QUALITY

- 1- Yes ✓
2- No (interview complete)
1- To get a connection/ to access water supply
2- To finish repair work ✓
3- Other

KSHS. 1,500/-

- 1- Demanded ✓
2- Paid on my own
1- Yes ✓
2- No

(Interview Complete)

