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**Classification:** DDC Code: 333.91 LCC Code: TD345

**Language:** English



London  
Journals Press

LJP Copyright ID: 146441

Print ISSN: 2633-2299

Online ISSN: 2633-2302

London Journal of Research in Management and Business

Volume 22 | Issue 3 | Compilation 1.0





# A Social Assessment of Human Behaviour, Practices and Contamination of Rural Water Resources in Eket – Nigeria

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## ABSTRACT

*Contamination of water sources creates a significant economic burden on the rural poor. The impact of water contamination has a link to human behaviour, knowledge and attitude. This research investigates the relationship between Human Behaviour, Practices and Contamination of Rural Water Resources in Eket Local Government Area, Nigeria. The study sampled persons who interact at most on a daily basis with natural water sources in rural communities. Study revealed predominant human practices and behaviour to include open defecation into or beside water bodies, dead animal and human bodies deposits, feeding of cattle with weeds around and water sources, clearing of farmlands, bush burning, waste dump into drainage systems, ravine and erosion sites, use of chemical bait in fish farming and processing of cassava in streams. Conclusively, the findings reveal a significant relationship between human behaviour, practices and its influence on contamination of water sources in rural communities.*

**Keywords:** water contamination, human behaviour, human practices, water sources and environmental education.

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## I. INTRODUCTION

### 1.1 Background

Water has become the most necessary resource of the rural population but is widely threatened by contamination from different sources (Erisman et

al., 2016). Pollution of water affects the availability of water in desired proportion to meet the population. CDC (2016) and UNDP (2015) asserted the challenge of water to the rural population had increased due to cases of contamination, with replicate effect on livestock and human. Water contamination goes further to make rural communities adopt other approaches to getting water through rain-water harvesting, hand pumps, boreholes and wells (Ubong et al., 2016; Lumb and Clare, 1992; Makoni et al., 2004). Most of these approaches although innovative imply additional expenditure for the sparse rural population, basing it on the fact that averagely more than 53.5% of Nigeria's population is on less than 1.90 USD daily (World Bank, 2017b). Contamination of water sources creates a significant economic burden for the rural poor. In these communities, women trek or spent most of their useful hours to obtain 'perceived' clean water for use by the household (Omole and Ndambuki, 2014) and even with this effort, they are exposed to unclean and unsafe water (Yusuff et al., 2014).

The impact of water contamination has a link to human behaviour, knowledge and attitude. Several works of literature have linked human behaviour to the many environmental problems including water contamination (Welsch and Kuhling, 2011; Whitmarsh and O'Neill, 2010). Sidique et al. (2010) and Obafemi et al. (2012) asserted that attitude and behaviour of humans on environmental conservation are affected by critical factors of what they earn, gender and educational level. Other studies have also tried to investigate behaviour behind the use of water by households and further reveal variations on the expressed behaviour of household's access to

water (Dolnicar et al., 2012b). Literatures reviewed provided clear evidence that behaviour has influenced use of water, but there is the need to understand what set of behaviour or attitudes and human practices that cause water contamination. Evidence from this analysis provides the need for a research to explore how behaviour affects human practices to lead to water contamination.

### *1.2 Problem Statement*

Water is synonymous with life, and its consumption should meet critical criteria of being safe, clear, tasteless, odourless and absent of disease pathogens (Fan et al., 2014). Water needed by a majority of the population is fresh water. Freshwater in Nigeria is available in its natural state as streams, rivers, lakes, wetlands, rainwater, surface water and improvised situation as well, boreholes, hand-pump taps (Galadima et al., 2011). Majority of these sources of fresh water are available for the rural poor. Unfortunately, a significant quantity of these sources of clean water is contaminated (Matos et al., 2014). Contamination of fresh water raises serious concerns even as the global community looks forward to averting deaths related to unclean water and poor sanitation.

The challenge with the availability of clean and safe water is a primary concern especially for rural communities (WHO, 2017b). Rural communities rely more on these water sources for their daily domestic and agricultural activities (Willis et al., 2013). Most rural households are farmers who would require fresh water for irrigation, feeding of livestock and supporting plant growth (WHO/UNICEF, 2012). Other domestic activities would include fishing of seafood for both consumption and trading. The implication of water contamination to the rural communities would not only affect health but significantly their sources of income and survival (WHO/UNICEF, 2012).

Willis et al. (2013) asserted that contamination of water bodies is linked to human activities some of which are industrial or domestic activities (agricultural, automobile, household wastes).

WHO (2017b) also noted that most water contaminants are faeces targeted at sources of drinking water with 2 million persons affected by its consumption. The primary concern is how educated are the affected population that their daily unnoticed and practically ignored activities can lead to contamination of their water sources and pose a threat to their health and wellbeing (Akpan and Omoogun, 2016). Environmental education is meant to increase knowledge of environmental issues and incite group or individual actions to addressing emerging gaps militating against the environment (Safari, 2014). Environmental education should significantly lead to change in behaviour with a significant effect on the quality of water available for use in the rural environment (Peter, 2013). This study will also explore what factors encourage such behaviour and how related are these behavioural factors to their social norms, education and gender roles.

### *1.3 Purpose of the Study*

This study aims to explore the relationship between human behaviour, practices and water contamination in Eket Local Government Area, Akwa Ibom State, Nigeria. This investigation will seek to identify those social behaviours that encourage water contamination practices by humans. A qualitative study approach will focus on identifying and describing the relationships between human behaviour, practice and water contamination.

### *1.4 Research Questions*

The following questions will guide this study:

- a. Is there any significant influence on socio-cultural norms and human behaviour in rural water contamination?
- b. Is there any difference in behaviour of persons with environmental education (literacy) and persons without environmental education towards water contamination?

### *1.5 Theoretical and Conceptual Framework for the study*

This research seeks to draw the link between human behaviour and intended practices leading

to water contamination. Behavioural science evidence has shown that all demonstrated or intended actions are influenced by a particular behaviour (Fuhrer et al., 1995; Glanz et al., 1997). The implication is that behaviour or attitude has an influential role to play on people preventing rural water from being contaminated. Glanz and Rimer (1995) posited that several factors influence human behaviour which include beliefs, knowledge, interrelationship with social identity and roles, institutional factors related to local norms. Other factors also involve social networks constituting community factors as laws and regulations established as part of public policy measures (Glanz and Rimer, 1995). This research will, therefore, attempt to investigate how these levels of influence affect human behaviour which is evident in their practices and actions towards the water resources.

This research will be tailored towards the theory of planned behaviour as Ajzen in 1985. The theory postulates that every intention to carry out any action is a function of a known behaviour or previously conceived behaviour (Ajzen, 1985). Ajzen (1985) further asserted factual knowledge develops an attitude towards behaviour which will later show as a behavioural intention and actual execution of the behaviour as a human practice. Invariably, if the knowledge about the effect of an action is low or absent, the action demonstrated will still be based on what is known perhaps linked to learned customs, culture or peer influence. The influence behaviour has on humans further explains why humans will defecate into water sources without recounting the effect it has on their health when ingested or used to process food.

### 1.6 Scope and Delimitations

This research will focus on only human behaviour as a factor encouraging specific human practices that causes water contamination. The proposed study area is a rural community and persons participating should have had interactions with water sources at natural and make-shift states. The study will adopt a qualitative approach to ensure that respondents can provide responses that are related to belief, social norms, knowledge

and attributes exhibited as individuals or as a community towards water contamination.

Since the study looks more into knowledge, attitudes and practice of individual, it would be necessary to narrow the scope of the research to individuals who reside and use water from the different sources daily in the LGA. Data collated for this study will be limited to the respondent's opinions and triangulated with other sources (research, primary data) for concurrent. The study will be limited to rural communities in Eket Local Government Area and its environs.

## II. LITERATURE REVIEW

### 2.1 Literature Search Strategy

Literatures used for this study were obtained through thorough, systematic and in-depth evaluations of relevant and existing evidence that support the study ideology and concepts. The literature search was conducted through review of relevant and related scholarly published and accredited articles in journals, books, conferences and dissertation. The systematic search process followed a protocol establish to first identify key words in the research that requires relevant literature support, and aligns with the research ideology and questions. The search for the key words was done using search engines, library catalogues, bibliographic databases and consulting scholars with related expertise.

Materials obtained were further assessed to establish relatedness, provenance, value, objectivity and demonstration of strong argument to support research ideas. The next stage was to evaluate, analyse and interpret content for use and establishing its appropriateness depending on the sections of this work. The final stage was to critic literature evidence for gaps and correlate it with the focus and rationale for conducting this research.

### 2.2 Theoretical and/or Conceptual Foundation

This research aligns with Ajzen's theory of planned behaviour (1985) which posited that social and moral values are critical factors that lead to subjective norms that produce behaviour

intention (practices) with a negative effect. This draws correlates with Glanz and Rimer (1995) that certain behaviour exhibited is a function of norms, beliefs, values, culture learned or inherited. This goes a long way to shape people's behaviour and action towards the environment – water resources. Similarly, it goes to show that if the social and moral values are challenged with new knowledge (environmental education), it may also lead to positive change in behaviour (Blumstein and Saylan, 2007). This is also an area this research would want to investigate. The findings will make an attempt to critic the theory postulated by Ajzen (1985) and Glanz and Rimer (1995) to draw inference and conclusion around how behaviour can influence human practices towards positive or negative change.

### *2.3 Literature Review Related to Key Variables and/or Concepts*

This section provides evidence from related literature as it aligns with key research variables and concepts of how human behaviour influences practices towards water contamination.

#### *2.3.1 Human Behaviour, Agricultural Practices and its Influence on Rural Water Sources*

One of human's activities that have so far posed detrimental effect on water sources is agricultural practice. Agricultural production has been carried out over the years without considering its effect on biodiversity (FAO, 2010). Agriculture which involves methods of cultivating the soil, harvesting crops, raising livestock produces end product from its processing, which further lead to agricultural wastes (agro-wastes). Agro-produce generates volume of collectable waste during harvesting and processing, example processing products like fruits, seeds, bulbs, nuts, grains (corn, sorghum, millet, rice, beans), tubers, sugarcane etc (FAO, 2010; Kanu Achi, 2011). Certainly, increase in agricultural produce leads to corresponding increase if not double in agro-wastes. Parris (2011) categorized agro-wastes into crop, animal, lignocellulosic and carbohydrate residues.

Nigeria being an agrarian country has abundant resources of agricultural communities with a potential of producing agro waste and biomass waste. Omoogun (2004) enumerated residues (wastes) that emanate from harvesting and processing of some agricultural produce:

*Table 1: Agricultural Wastes from Harvesting and Processing of some Agricultural Activities (Omoogun, 2014)*

Agricultural Produce	Residues Generated
Corn, wheat, rice	Straw, stalks, husks and cobs
Cattle	Animal waste e.g blood, bone, dung
Sugarcane	Bagasse
Fruits and vegetable	Seeds, peels, husks
Potatoes	Starch and wastewater
Oils and oilseeds	Shells, husk, fibres, sludges, press cake
Coconut	Coir dust, fibres, shell

Effective management of these residues (agro-wastes) can serve other purposes, strengthen energy supply and address deforestation (Parris, 2011; OECD, 2011). FAO (2010) affirmed that agro-wastes in modern agriculture should move beyond production of food for humans to generating biofuels (methane from biomass, ethanol, and biodiesel) and bio-pharmaceuticals. This cannot be achieved without the needed education and level of literacy of the population that agriculture can also contribute to another sector of life and in turn save the water sources from receiving their end-products as wastes.

Agricultural wastes are only detrimental to the environment if not properly managed, recycled and re-used (WHO, 2010; 2014). Discharge of agricultural wastes into available water sources poses a threat to the quality of water available for use. Agro wastes are either bio-degradable or non-biodegradable. The direct effect of agro waste accumulation is referred to as 'eutrophication.' Eutrophication is a phenomenon which involves gradual enrichment of nutrients and development

of plant and animal life in a lifeless water body (Chislock et al, 2013). Eutrophication is a very slow process. This process is accelerated by the addition of wastes which certain proportion of nitrates, phosphates and organic matter (Chislock et al, 2013).

Phosphates and nitrates are essential to plant nutrient and emerge from decay and decomposition of organic matter yielding numerous plant nutrients (Turner and Chislock, 2010). Gradual discharge of agro wastes causes the water body to become exceedingly rich in plant nutrients (Chislock et al, 2013; Turner and Chislock, 2010). Blooms of algae and other organisms appear and make the water unsafe for use as well having the entire biomass may suddenly die and starts decomposing which create a different in the taste of the water. Organically, eutrophicated water also supports a population of many pathogenic organisms and vectors, which aid in the transfer of water-borne diseases from one individual to another (Turner and Chislock, 2010).

Several other researches affirmed that the resultant effect of agricultural residues (agro-wastes) to water sources is the issue of eutrophication. This has significantly led to impoverishment of aquatic life and contamination of groundwater during leaching (Hauck and Youhana, 2010; Pruss-Ustun, 2014). Ekiye et al

(2010) asserted that agro waste impact on water comes in the form of suspended solids, dissolved solvent and sediments. Turner and Chislock (2010) noted that the major problem with agro waste impact on water is illicit disposal. Wastes from agricultural activities serve as organic matter and its disposal and discharge into water multiply the problem of agro wastes and contamination of water bodies. Invariably, there is no doubt that agro-waste not minding its transformative benefit could be that devastating if not properly managed.

### 2.3.2 Human Behaviour, Domestic Waste Management and its Influence on Rural Water Sources

Domestic wastes are waste generated from activities either in residential or non-residential environments (Yoda et al, 2014). This nature of wastes is either in solid or liquid state and can also be regarded as combustible or non-combustible (FAO, 2010). Domestic wastes are largely produced from daily activities and increases in volume and range (FAO, 2010). It is common to see streets in Nigeria overtaken by garbage and drainage blocked by domestic wastes. Ikuponisi (2004) asserted that 2.4 million tons of wastes are generated annually in Nigeria. Igborurike (2010) estimated and projected the volume of domestic wastes generated in some locations in Nigeria.

*Table 2:* Estimated and Project volume of Solid Domestic Wastes in Some location in Nigeria (Igborurike, 2010).

Location	1982	1985	1990	2000
Lagos	625,399	681,394	786,079	98,081
Ibadan	350,829	382,224	440,956	559,882
Kano	319,935	348,580	402,133	535,186
Aba	131,903	143,712	169,719	236,703
Warri	67,477	75,607	91,396	133,531
Uyo	12,503	13,638	15,721	20,923

Domestic wastes production increases geometrically with the population, in a situation where there is no proper waste management system (Anijah-Obi, 2001). The volume of wastes

produced can be described to be alarming and its impact on water quality can be guaranteed. The impact wastes will have on water sources is totally a factor of human behaviour (DeJesus et al, 2015;

WHO, 2015; Stock, 2010). The ineffective management of water is seen as the major cause of pollutants influencing the quality of water sources (Hauck and Youkhana, 2010). Effective management of wastes are the responsibility of humans and can be influenced by a change in behaviour or level of environmental awareness (Farmer et al, 2013). This correlates with the focus of this research to investigate how human behaviour and environmental literacy is related to water contamination.

Domestic solid wastes are regarded as by-products of activities of man which include wrapping papers, vegetables, empty cans, bottles, or container (FAO, 2010). These wastes are toxic, flammable and biodegradable (Pruiss-Ustun, 2014). Solid wastes like leaves, bones, rags and various food items are quite biodegradable, they decompose and find its way to the groundwater (WHO, 2015a). Similarly, there are also non-biodegradable wastes that are not decomposed by nature. These categories of waste are known to be a major problem as indiscriminate disposal into a water body or through erosion will lead to accumulation and fill-up of natural water-sources - streams, rivers, lakes etc (WHO, 2010; UNWomen, 2012; Omole et al, 2015). Omole (2014) posited that domestic wastes are water pollutants contributing significantly to the contamination of underground and surface water. Water sources contaminated with domestic wastes are major causes of cholera, diarrhoea, skin diseases, enteric diseases and other water-based diseases (Govender et al, 2011). Apart from the implication domestic waste has on water, indiscriminate disposal creates an aesthetic nuisance (WHO, 2015a). This beckons for an investigation into how human behaviour and practices have contributed to contamination of water sources which is primarily the focus of this research.

### *2.3.3 Environmental Literacy (Education) and its Influence on Human Behaviour*

Environmental literacy or education has been seen to be integrated into our socio-cultural practices although not adhered (Aisbett and Steinhauser, 2014; Allen et al, 2011). This

unwritten guidance provides a relevant guiding principle of education to children and peers. Children learnt from their adult personal cleanliness and how to take care of their surroundings. Water bodies were attached to cultural beliefs, were respected and seen as 'sacred.' Communities were educated on environmental protection rules and those violating these rules were punished while those who complied were encouraged and most times rewarded (Anijah-Obi, 2001). This was related to the pre-colonial era in Nigeria where environmental education was an integral part of the society and culture. It presented an effective way of how environmental literacy influence human behaviour about the environment.

The colonial and post-colonial eras witnessed a drastic shift in human interactions to the environment. Instead of living with nature, the environment was seen to be conquered, over-powered, subdued and transformed to suit human welfare and needs (Spencer and Altman, 2010). Amsden et al (2013) will regard this period as a critical turning point that led to the destruction of the environment and gave the man the rights to exhibit illicit behaviour towards the environment. Natural resources like water were not respected, as human found water for use as means of transportation, adventure, exploration for mineral resources and manufacturing (Ashton-Graham and Newman, 2013). This is the period where man chooses to readjust the environment to serve its own personal desires.

In the course of achieving their desire, the environment and water resources have been contaminated and rendered unsafe for man consumption (Burgin et al, 2013; Carr et al, 2012). Invariably, the human is suffering from the consequences of their own actions emanating from practices against the environment – water resources. Rising incidents of environmental pollution have generated a lot of anxiety, concerns and emphasis about the prevailing state of the environment and the need to protect, conserve and sustain it for the present and future generations. This has led to the call for environmental education to raise awareness and build literacy towards shaping behaviour of

humans and secure actions that reduces environmental cases (Cockerill, 2010; Dolnicar et al, 2010).

Environmental education helps individuals and social groups acquire a basic understanding of their environment, its associated problems and critical responsibility (Doron et al, 2011; Fielding and Roiko, 2014). Knowledge of the natural and man-made environmental problems, their causes and consequences will no doubt enlighten the individual on how human activities contribute to contamination of water sources (Honkalaskar, 2014). Hubert and Gupta (2015) asserted that environmental education will also enable rural dwellers to realize the irreversible damage of some of these problems to health, wellbeing, social and economic growth as well as a threat to survival. Environmental education help individuals and social groups acquire social values and ethics, strong feelings of concern for the environment and the motivation for actively participating in its protection and improvement (Borisova et al, 2012; Udayakumara et al, 2010). The impact of environmental education and literacy in terms of building the right knowledge, skills and attitude towards solving water contamination issues in Eket Local Government Area, Akwa Ibom State, Nigeria will be investigated to ascertain its contributions to resolving water contamination issues.

### III. RESEARCH METHODOLOGY

#### 3.1 Study Area and Population

The proposed study area for this research is Eket Local Government Area of Akwa Ibom State, South-South Nigeria (Fig. 1). Eket is a semi-urban and rural setting with an estimated population of 233,544 (120,255 males and 113,289 females), located on this coordinate 4°39'N 7°56'E (Ministry of Economic Development, 2014). Interestingly, Eket contributes to over 4 million rural population of Akwa Ibom State and shares boundary with three other local government areas – Ibeno, Onna, Esit Ekid and Nsit Ubium Local Government Areas. This indigene populace is predominantly farmers, traders and fishermen and women. One of the key and known occupation

of the population is fishing perhaps related to its large mass of water surrounding the Local Government and its environs (Ubong et al., 2015). The background, therefore, connotes that Eket plays a suitable location for this study as persons in the study area will experience related issues to contribute to the what behaviour or practices increase contamination of this large water bodies.

*Fig.1:* Map of Study Area - Eket (Ekid) Local Government Area

#### 3.2 Study Design

A qualitative research design is most suitable for this study as it relates to examining knowledge, moral, values and ideology. Elliot et al. (1999) posited that a qualitative research provides an opportunity for an in-depth interaction with the respondents, creating room to ask open-ended questions and collects additional details that will strengthen the study findings. The selection of a qualitative study is apt because it will allow the research an opportunity to observe and interpret every non-verbal clue as well as enquire more on issues that required qualitative count. The qualitative approach could have its challenge with time and bias; it might look very suitable for this research as it provides the needed depth of findings compared to a quantitative research approach. For example, knowing the number of human activities that cause water contamination does not answer the questions of why – why do people continue with such activities even when they are aware of the effect, are there moral justifications for their actions, could it be a factor of education or awareness and any other whys? Addressing the challenge with qualitative research approach will require a valid sampling, data collection and analysis technique that are time effective and free of the researcher's opinion.

The research although qualitative is structured to align with a phenomenological qualitative study. The phenomenological study addresses issues that socially and psychological related, targets people's experiences, interpretations and expressions towards a known issue. Although the study design aligns with phenomenology, it would also consider applying concepts in a field study and ethnography. The essence is to ensure that all

factors related to behaviour arising from culture, social interactions, norms and values expressed in the community are identified, classified, analysed and described.

### 3.3 Sample and Sampling Technique

The study sample for this research is selected from among persons who interact at most on a daily basis with natural water sources. There are rural populations who utilise water for their daily activities ranging from domestic, farming, fishing, and livestock rearing to recreation or washing practices. The choice of this sample helps to focus more on the ideal target for this study. Therefore, persons who are not in the described inclusion criteria will be in the exclusion list.

Although not every person within the selected sample location will participate, there is a need to adopt a useful sample technique to fairly and representative select sample that will provide sufficient data to draw research inference. The study chooses to implement a non-probability method in selecting the sample for this research. This study will use a non-probability sampling technique as it will allow the research choose sample within a short possible time (Krueger, 1994).

Neuman (2007) posited that non-probability sampling technique is most useful in a qualitative study as the probability of persons to be chosen for the study is indefinite. In applying the sampling techniques, quota and purposive sampling method are selected as the most suitable type of non-probability sampling techniques. The quota sampling technique will help in the selecting samples from the sub-group categorisation and location while the purposive sampling technique will help with selecting participants with known capacity to express perspectives and opinions on the issue of water contamination.

### 3.4 Data Collection Techniques and Instruments

The chosen data collection techniques for this study were the in-depth interview and focus group discussion. These methods align with the research methodology of a qualitative research which will

afford the investigation an opportunity to interact deeply on the issue. Further details on how the techniques was structured and rolled out are provided below.

#### *In-depth Interviews – (n=150)*

The in-depth interviews are proposed to facilitate in-depth understanding and discussions of behaviour factors that influence certain behavioural practices affecting the quality of water. Strauss & Corbin (2007) asserted that in-depth interviews are usually required to assist with probing further causal and enabling factors, generated during desk review as it relates to human practices and social norms. In-depth interviews will provide an opportunity to ask flexible, semi-structured questions leading to a deeper understanding of what behaviour influences detrimental practices of contaminating available rural water sources.

The research conducted a total of a hundred and fifty (150) interviews over the period of the study. In facilitating the IDI sessions, the research gave considerations in ensuring that the process is relatively engaging, creating an opportunity for discussants to interact freely and openly with the researcher. The researcher lead all interview sessions and solicit the support of a note taker. The note taker helped in capturing adequate data and manage turn-around time of concluding each interview session. An alternative option was use for voice recorder to support data capturing for analysis. All participants for the in-depth interview, agreed and sign-off on consent form before commencement of the interview. Participating in the interview was strictly voluntary. The researcher conducted debriefing for all participants on their opinion and responses to the discussion points before closing the interview session.

#### *Focus Group Discussion (n = 25)*

Focus Group Discussion was also selected as data collection technique for this study. The selected technique assisted with a deeper investigation of human behaviour and influence on water contamination. Focus Group Discussions was used to validate and obtain further details on issues raised using a quantitative process (Babbie,

2011). The technique assisted the researcher to investigate intensely into human behaviour, thoroughly assessing perceptions, opinions, ideologies and experiences in relations to its effect on water contamination.

The researcher conducted a total of twenty-five (25) focus group discussion, lastly for about 40-60 minutes. The size of persons for each focus group discussion session was within the range of 6-10 persons. The researcher lead all Focus Group Discussion sessions and solicited the assistance of a notetaker. The note taker helped the research capture mainly responses and will not be part of the discussions. Participation in the FGD sessions was voluntary and based on the inclusion criteria. Location of the FGD session was in a convenient environment to allow for productive and less distractive discussions.

Participants had the opportunity to opt out at any time if they feel pressured to answer any questions or uncomfortable with discussion points. However, the researcher will create an open, fair and less tense environment to allow for participants to express their views happily. All participants for the FGD , agree and sign-off consent form before commencement of the interview. The researcher also conducted debriefing for all participants of their opinion and responses to the discussion points before closing the interview session.

#### *Data Collection Instrument*

A semi-structured discussion questionnaire will be used to direct discussions for the in-depth interview and focus group discussion sessions. The instrument is developed and tailored in line with the research questions, conceptual framework and goal. The instrument although concise will help to elicit information that will allow for deep analysis and inference. The tool will be administered as paper-based and most suitable for a qualitative study. The total number of the instrument is produced based on the number of proposed participants for the study. Participants will be allowed access to the instrument to reflect on the questions to determine their participation.

#### *3.5 Validity and Reliability of Data Collection Instrument*

The quality of research instrument depends mostly on the ability to measure what it intends to be measured and generate findings that are consistent with research purpose and questions. Research instruments that are developed for use in the research are subjected to measuring its reliability and validity (Lincoln et al., 2011; Porter, 2007). The purpose of measuring the reliability and validity of research instrument is to mainly reduce error at the point of use, analysis and interpretation.

The researcher the tool for review, vetting and approval through the internal supervisor from the University of Reohampton, London to ensure that the proposed research instrument meets reliability and validity. The reviewed tool pre-testing and re-testing with the selected population to ensure it will deliver the same results as expected when reapplied. The essence is to ensure that there is consistency with the content, the process of administering the tool and expected responses (Grossoehme, 2014). The validity of the tool ensured that it's suitable for the study and can measure what it intends to measure. The validity focused on content, construct and criteria established to guide the research.

Conducting reliability and validity measure of the research instrument presented a reliable and valid reason to ensure that the inference drawn from the study will be socially desirable. The reliability and validity measurement strengthened the tool primarily to reduce biases, and promote accuracy in data collected, analysed and reported (Patton, 1999; Rolfe, 2006). The measure of validity also ensures that the proposed sampling techniques align with the conceptual research framework for assessing behaviour related to water contamination. The research also measured validity in data collection and analysis by ensuring that all collected and analysed data goes through two levels of triangulations, audit trails and process as well as verification by the respondents.

### 3.6 Method of Analysis

The process of analysis will commence concurrently with the data collection, with analysis of thematic content using an inductive approach. Data collected will first be indexed and transcribed to enable text coding. Key and related information from the transcripts will be sorted and summed as themes with the label as it is linked to the appropriate research question. The coding strategy will both be substantive and theoretical saturation. Substantive will assist with identifying key themes related to the research while theoretical saturation will aid to establish the relationship between identified themes with other factors. The correlations will further be linked to the research questions and ascertain its level of relatedness to the stated research questions.

## IV. FINDINGS, ANALYSIS AND EVALUATION

### 4.1 Introduction

Quality of water for the rural poor have received several global attention. Concerns are how human activities have significantly influenced the quality of water available for the rural communities. Several studies have been able to identify few causal actions contributing to the quality of water identifying oil spills as a significant contributor especially in southern Nigeria. This study was proposed to identify more socially related activities and behaviours that are culturally or customary linked to producing contaminants depleting the water quality. The study area – Eket Local Government Area, Akwa Ibom State, Nigeria selected with the mix of a known issue of the oil spill and other unclassified causal activities. The research findings will be able to unveil diverse human-led activities, attributed behaviours and its effects on the well-being of the populace. The results will also demonstrate what relationship human activities, behaviour have with water contamination.

This section focuses on presenting the analysis of data collected from the interviews and focus group discussion conducted in the study area. The analysis presentation will be made using a

qualitative approach. Findings will be discussed and triangulated with other relevant literature and secondary information as a way of validating or critiquing the research results.

### 4.2 Presentation of Findings

The results of the findings are arranged based on the themes generated from the analysis. The results are supported with credited pictures to demonstrate the intensity of the findings, as described by the study participants.

#### 4.2.1 Sample Characteristics

A total of four hundred (400) persons participated in the study a hundred and fifty scheduled (150) in-depth interview sessions and twenty-five (25) focus group discussions. Participants of the study were mainly community leaders, youth, women, elderly, student and policymakers (including Eket Local Government Environmental Officer) who are significantly affected by the issue of water contamination. A total of five (5) communities participated in the study, namely: Afaha Odoro Enen, Afia Nsit, Ede Urua, Ikot Eboh and Esuk Ntied.

#### 4.2.2 The Value of Water to Rural Communities

Study participants narrated that the importance of water and several activities that water can help them achieve namely bathing, cooking, farming, irrigation, drinking and washing. Some study participants also mentioned that 'good water' required for activities as mentioned above were obtained mainly from the streams and spring water sources. Participants explained that streams served as habitat for fuelwood, fishing activities, a pure water source for drinking, 'clean bathing' and washing of huge volume of clothes (laundry). Streams were preferred water sources because of its flowing and can purify itself from dirt and impurities. Interesting, some study participants described streams and springs water sources as contributing to their good health. A study participant in Esuk Ntied summarised, '*People who drink from the stream look fresh*'; and another in Afaha Odoro Enen noted, '*It's a natural source of water, and people prefer to drink because of a belief for healing.*'

#### 4.2.3 Human Activities and Behaviour Affecting Water Sources

As part of the research questions, participants were asked to describe and narrate several activities within the communities that have direct and indirect link to contaminating their water sources. Most study participants agreed on open defecation into or beside water bodies were regularly practised particularly when people have to spend nearly 8 hours in farms. Other participants mentioned that dead human bodies were discovered in water bodies floating and sometimes spend days before being evacuated. The source of the dead human bodies was attributed to persons who have been drowning in water and opening deposited. Further narrating the ordeal, a study participant exclaimed, *'You can see open defecation in Atabong River. For example, you can see abandoned dead bodies of people that water brings to the stream thereby contaminating the water.'*

Cattle rearing – feeding of cattle with weeds around and water from the streams, clearing of farmlands, bush burning, a deposit of dead animals, poor drainage systems were mentioned by the study participants as contributors to contamination of their water sources. Other study participants also mentioned that open dumping into drainage systems, ravine and erosion sites could have an effect on their water sources, especially during raining season when particles from the waste will be flush to the nearby streams, and other chemical deposits find its way to groundwater. Uses of chemical bait in fish farming and processing of cassava in streams were also additional causes of water contamination identified by the study participants. Two study participants in Ede Urua Community and Afaha Odoro Enen respectively described the situation:

*'We have cattle rearers take their cattle to the stream, clearing of farmlands, burning the bush around the stream, dead animals and things and poor drainage system especially during rainy season (Gutters not clean) washing into our streams'* – Participant in Afaha Odoro Enen Community

*'Our women place cassava from their farms in bags and tie it up and leave to ferment and keep their farm produce fresh because they don't have containers. Fish farmers use chemicals/explosives for fishing. They do this as far as Edo River, and we even see dead fishes flow to our own stream'* – Participant in Ede Urua Community

Some industrial activities like oil drilling at the top of the creeks, oil spills from the seismic explosion, gas flaring with fumes particles deposited on their roofs were also mentioned as causes of water contamination in study communities. A study participant in Ede Urua further described the situation,

*'Our community is sitting directly on oil, and there has been drilling activities ongoing by the oil servicing company. There were seismic explosion and oil spilt into our water sources.'*

Study participants also complained of some make-shift ranches and abattoirs sited close to streams that are not far away from homes. Participants described that these ranches and abattoirs produce wastes (wastewater, animal dungs, blood and blood products) and deposits which are channelled to the streams. The most affected communities were Ikot Eboh and Odoro Enen.

#### 4.2.4 Impact of Environment Education on Human Behaviour towards Water Contamination

The study also attempted to find out if there has been any form of education on environmental management and what impact this education has created on the behaviour of persons in the community. Study participants described that as a result of education provided, communities resolved to take actions by setting up a waste management process where vendors are paid to pick up waste from communities and have them disposed of in dump site, kilometres away from the community. Participants took actions because it was eminent that human activities contributed to drying up and blocking the natural sources of water – streams. The efforts led to communities

resorting to using of boreholes. Several study participants described the situation:

*'The streams are blocked because it has been abandoned... Almost every compound has a borehole' – participants in Afaha Esit Community*

*'People don't visit the stream again... so boreholes are predominant and very few people sell the water now. For example "Ekpo Owong" a stream there dried up because it was abandoned because of construction works, blockage from waste and people don't visit it again' – Key Informants in Esuk Ntied and Local Government Environmental Management Office*

Study participants also mentioned some of the medium environmental education was provided. These includes churches, markets, seminars and town hall meetings. Participants agreed that the education received have improved the way we manage especially our waste from homes. A participant in Afia Nsit described:

*"In our community, each household packages domestic waste in bags or make use of dustbin and at the end of the month, there are waste vendors that pick up these waste to dispose of. We usually make payments based on households; there is really no fixed amount."*

Another participant posited:

*'We see these changes in the community because we notice that on sanitation days, we see people actually working and making an effort to clean their environment' – Key Informant in Local Government Environmental Management Office*

### 4.3 Analysis and Evaluation

The study results presented has provided significant contributions to the research questions. This section will interpret the results and draw necessary conclusions on each research questions.

#### 4.3.1 Social and Cultural Norms Influence on Water Contamination in rural communities

Social and cultural norms are described as practices that are customary or accustomed and are carried out comfortable without a rethink of its implication on oneself or its immediate environment. In this study, several social and cultural norms were identified to have connection with water contamination in rural communities. This included open dumping practices, open defecation, rearing of livestock close to water sources, agricultural activities (bush burning, use of nitrogen fertilizers in farms close to water sources), use of chemicals as fishing bait, processing of food (e.g. cassava flour) and disposal of waste into erosion sites or ravines. The impact of these activities was linked to not only contamination of natural water sources, but the extinction of these naturally purified water sources. WHO (2010) posited that these practices (including by-products from agricultural activities) do not only affect the state of water, it significantly contributes to increase in standard of living by increasing cost for obtaining water to meet up with daily needs. UNWomen (2012), Ocheri et al. (2012) and Omole et al. (2015) also agree that indiscriminate disposal (as wastes or defecation) into a water body or through erosion will lead to accumulation and fill-up of natural water-sources - streams, rivers, and lakes. The study goes further to agree with Glanz and Rimer (1995) that certain behaviour exhibited by humans is a function of norms, beliefs, values, culture learned or inherited.

The study results identified that there was a significant and drastic shift of communities reliant on natural water sources (streams, springs) to having boreholes. This is also another area of concern, as people would naturally think that borehole water could be safer but not investigating effect of not meeting the requirements of continuous treatment of borehole water. WHO (2015) asserted that reliant on boreholes can be a time bomb for serious outbreaks of water-borne diseases, as regular treatment might not be practised by low-income countries. Relatively, Sidique et al. (2010) and Obafemi et al. (2012) expressed concerns that

rural communities will have to spend more to procure water from average income earners or when not able to afford setting up boreholes. This further aligns with Omole and Ndambuki (2014) assertions that its effect will mean rural communities are experiencing more poverty and vulnerability to diseases. The result presented demonstrates a significant influence on social and cultural norms and water contamination in rural and semi-urban communities.

#### *4.3.2 Environmental Education Influence on Human Behaviour towards Water Contamination*

Environmental education or awareness has been posited to be a catalyst for positive change in human behaviour towards the environment (Cockerill, 2010; Dolnicar et al., 2010). Aisbett and Steinhauser (2014) and Allen et al. (2011) agrees with the study findings that environmental education might not necessarily be in a formal setting but may be integrated into our socio-cultural structures and customs, mainly practised by rural communities. The study findings reveal that human attitudes towards their environment are determined by how informed they are about the consequences of their actions. This was demonstrated in communities taking action as a result of information and education received on the cause of water contamination and its detrimental effects on their lives and wellbeing. This, therefore, aligns with Honkalaskar (2014) and Hubert & Gupta (2015) assertions that environmental education will enable rural dwellers to realize the irreversible danger of contaminated water to their health, wellbeing, social and economic growth as well as a threat to survival.

The resultant effect of environmental education is the ability of the informed groups or persons to act on the information (Doron et al., 2011; Fielding and Roiko, 2014; Doren et al., 2011; Roiko, 2014). Communities in the study area reported setting up environmental watchdogs to monitor indiscriminate disposal of waste, especially around waterways. Study communities also were committed to harnessing their households waste into a designated waste bin for onward pickup by the contracted waste

management vendors. These actions were also attributed to the education and awareness received through interaction sessions, seminars and dialogue with government, community leaders and the rural inhabitants. This is what Borisova et al (2012) and Udayakumara et al. (2010) refers to as motivation and actively participating in the protection and improvement of water resources. Invariably, among sections of communities where environmental awareness has not been carried out (e.g. Ikot Eboh), dwellers reported ignorance of the impact their actions and activities on the environment. Fielding et al. (2013) and Boellstorff et al., (2013) linked this situation to gaining knowledge about the environment and refusing to act on the knowledge. The result presented therefore clearly demonstrates that there is a significant difference in behaviour of persons with environmental education and persons without environmental education in preventing water contamination.

## V. SUMMARY AND RECOMMENDATION

The focus of this research aligns with achieving Target 6.1 of the Sustainable Development Goal which solicits that every community has access to harmless and inexpensive water for drinking. Achieving this goal require an investigation into what exposes available sources of drinking water to avoidable contaminants. Consequently, the rationale for this research is to understudy what human behaviour and activities are connected to water contamination in rural communities in Eket Local Government Area, South-south Nigeria. This chapter then focuses on summarizing the different sections of the research work and provide recommendations.

### *5.1 Summary*

The environment is being polluted, and humans have been identified as critical agents who adjust and readjust the environment to suit their immediate needs, without thinking of the consequences of their actions and ignorance. Relatively, the primary reason for this study was to find how human activities and its related behaviour contribute to the contamination of rural water sources. The research was structured

and documented in chapters providing insights into the focus of the various chapters and sections of the research work.

The study illustrated the statement of problems, rationale and defined questions related to the importance of water to the rural communities and provides some initial background on how some human behaviour and practices affect the quality of water. The implication of human behaviour and practices on water as it affects wellbeing and economic status of people were identified. A theoretical concept that defines the design of the study was captured and related to the theory of planned behaviour as postulated by Ajzen (1985). Major definitions, assumptions and limitations of the study were developed to provide clarity on what the study aims to achieve or not able to achieve.

The next focus of the research work was a review of scientific and empirical evidence that supports the research dimension on human behaviour or practice influence on water sources. The literature search strategy allowed the research to explore different ways of sourcing, validation and utilising related evidence for the study. Literature evidence sourced and used was mostly linked to the study theoretical frameworks, questions and hypotheses. The focus was to find out what is existing (known facts) and the gaps in research that will be addressed by this research. Some of the known facts were on human activities contributing to water contamination but what was not clear was the reasons why these activities were continuously carried out by humans. Were their reasons related to the level of ignorance, education, cultural norms or practices or perceptions? These were areas the study intends to investigate.

In this study, several social and cultural norms were identified as linking up to water contamination in rural communities. This included open dumping practices, open defecation, rearing of livestock close to water sources, agricultural activities (bush burning, use of nitrogen fertilizers in farms close to water sources), use of chemicals as fishing bait, processing of food (e.g. cassava flour) and

disposal of waste into erosion sites or ravines. The study results also identified that there was a significant and drastic shift of communities reliant on natural water sources (streams, springs) to having boreholes. The study findings further reveal that human attitudes towards their environment are determined by how informed they are about the consequences of their actions. Conclusively, the findings reveal a significant relationship between human behaviour, their related practices and its influence on contamination of water sources in rural communities.

## 5.2 Conclusions

Social norms are critical factors influencing human behaviour towards contamination of rural water sources. The study findings reveal that human attitudes towards their environment are determined by how informed they are about the consequences of their actions. This further reveals the relationship and influence created by human behaviour towards contamination of rural water sources. Furthermore, a change in social norms which constitutes an influence of human behaviour can go a long way to solve issues of rural water contamination.

Education has also been noted to be a contributory factor to changing social behaviour and human attitude. This study further revealed how education was able to provoke local actions to solve water contamination issue. Invariably, environmental education will help in changing social norms, behaviour and attitude towards water contamination; by ensuring that people understand the effect of their actions.

## 5.3 Recommendations

The study results reveal several socio-cultural practices that deplete the natural water sources. Relatively, communities have shown that actions towards resolving the issue based on knowledge and awareness obtained on the consequences of their actions on their natural resources and well-being. The emphasis on the knowledge of environmental problems and consequences of water contamination, depletion of natural

resources can be resolved with an effective awareness and utilisation of environmental education (Odumosu, 1990). Indeed, it would be necessary for rural communities to embrace environmental education as a vehicle for creating change in behaviour towards averting water contamination issues.

Environmental education is further recommended as it will help communities acquire social values and ethics, strong feelings of concern for the natural water resources and the motivation for actively participating in protecting and improving the quality of water available for use. Attitude change is one of the most important aspects of environmental education (Honkalaskar, 2014). Institutionalizing environmental education will help create change in attitudes of individuals in communities towards water resources because they also have right to survive and be respected. Environmental education also encourages individuals to empathise with and care for the natural water sources to engender lasting environmental friendliness.

Individuals and social groups can also acquire skills in solving the problem encountered currently with the contamination and abandonment of natural water sources in Eket Local Government Area. Skills can be obtained through integrating environmental education in existing structures and platforms in the community. Such platforms could include formal and informal education settings – in schools or peer group settings with young or elderly. Learning new skills for addressing the current water contamination issue has to do with the psychomotor domain of learning experience whereby the individuals and social groups acquire conservation and environmental management skills (Anijah-Obi, 2001). Some skills communities can acquire through environmental education would include tree planting, flood and erosion control measures, low-cost waste management strategies, sustainable agricultural practices aimed at protecting water sources for the present and future generations.

It would also be necessary for leaders in the community and the government to view

environmental education as a life-long process, having come to terms the role environmental education plays in changing behaviour and mobilising communities to take action. The government should begin with building the future from today through incorporating environmental education into continuous education, spanning all age levels from pre-school age to tertiary level of education. The current curriculum can be reviewed to incorporate age-friendly sessions on environmental education. The non-formal education sector can also benefit from environmental education through developing the curriculum that addresses the knowledge need of out of school and persons involved in vocational training. The informal environmental education will be rewarding as most of the reported human practices occur outside the school environment, by persons who are involved in a trade, agricultural or industrial activities.

Utilizing the various arms of the mass media, newspapers, magazines, radios and television can be another way of mobilising people concerning educating and sensitising them on the contamination of their natural water sources. Programmes hosted on these platforms should emphasise why the community should take action to secure and protect their natural water sources, noting the importance and benefits derived from the present and future generation. A similar local approach to mass mobilisation could be the use of dramas, folktales, poems and songs to communicate the need to preserve natural water sources and its consequences on the wellbeing of people.

Community structures can also initiate the idea of setting up clubs and volunteer action groups in each ward of the community where members of the clubs and volunteer action groups should be charged with the responsibility of creating awareness, providing grassroots education and ensuring that every member of the community is aware of the consequences of current human practices on the water sources. A house-to-house approach can be adopted as a radical approach to ensuring every member of a household is fully aware of the issue of water contamination and their role in addressing the issue. The clubs and

action groups should also be responsible for monitoring deviant behaviour and practices contributing to contamination of water sources and setup mechanism for disciplinary actions.

Government can also mobilise development partners who are involved in humanitarian services to assist with environmental education, develop and implement environmental conservation strategies that are at no cost to the affected communities. Humanitarian services are provided by non-governmental organisations (NGOs) that will be committed to raising and creating social change on the water contamination issue. Non-governmental organisations (NGOs) can also assist with persecuting cases of a wide range of contamination, especially causes by industrial activities. Finally, the Government of Akwa Ibom State and Nigeria should work with experts in environmental education and science to design sustainable interventions of ensuring that communities in Eket Local Government Area have access to clean, safe and reliable water including launching a clean-up exercise of all natural water sources.

#### 5.4 Implications for Further Study

Future study should consider extending the sample size to cover more communities and Local Government Areas with similar characteristics. This will help to broaden the scope of the study and give the study findings strong inference to inform policy directions and strategic decisions to address water contamination issues. In order to also strengthen the findings, the study should consider a scientific approach of analysing samples of water sources across the study areas to ascertain health effects of contaminations in the water sources. This will assist with additional evidence to influence policy decisions to act on addressing issue of water contamination.

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