HOUSEHOLD BEHAVIOUR TOWARDS WATER CONSERVATION ACTIVITIES IN MVOMERO DISTRICT COUNCIL, TANZANIA

HOUSEHOLD BEHAVIOUR TOWARDS WATER CONSERVATION ACTIVITIES IN MVOMERO DISTRICT COUNCIL, TANZANIA

By

Emanuel Lameck

A Dissertation Submitted in Partial Fulfilment of the Requirements for Award of the Degree of Master of Science in Project Planning and Management (MSc. PPM) of Mzumbe University

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CERTIFICATION

We, the undersigned, certify that we have read and hereby recommend for acceptance by the Mzumbe University, a dissertation entitled **"Household behaviour towards Water Conservation Activities in Mvomero District Council, Tanzania"** in partial fulfilment of the requirements for award of the degree of Master of Science in Project Planning and Management of the Mzumbe University.

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Major Supervisor

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I, LAMECK, Emanuel declare that this dissertation is my own original work and that it has not been presented and will not be presented to any other university for a similar or any other degree award.

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lameckimah@gmail.com

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DEDICATION

I dedicated this work to my beloved family and The Catholic Scholarship Programme for Tanzania (CSPT) for their love, prayers, advices, encouragements and financial support. God Bless you abundantly.

ABBREVIATIONS AND ACRONYMS

ANOVA	- Analysis of Variance
MDGs	- Millennium Development Goals
NBS	- National Bureau of Statistics
ODA	- Official Development Assistance
SGDs	- Sustainable Development Goals
SPSS	- Statistical Packages for Social Science
TPB	- Theory of Planned Behaviour
TRA	- Theory of Reasoned Action
TZS	- Tanzania Shillings
UN	- United Nations
UNDESA	- United Nations Development of Economics and Social Affairs
UNESCO	- United Nations Educational, Scientific, and Cultural Organization
UN-WWDR	- United Nations World Water Development Report
URT	- United Republic of Tanzania
USD	- United States Dollar
VICOBA	- Village Community Banking
VIF	- Variance Inflation Factor
WCAs	- Water Conservation Activities
WCB	- Water Conservation Behaviour
WHO	- World Health Organization

ABSTRACT

Water pollution in both improved and unimproved sources have become a major environmental evil in the 21st century. Human related causes such as lack of pro-environmental behaviour and participation have further limited the access to clean water. Therefore, this study examined the households' behaviour towards water conservation activities in Mvomero district council by further examining the extent of households' participation in; costs and benefits from water conservation activities; and factors influencing households' water conservation behaviour. To achieve this study objective, a convergent parallel mixed method was employed to collect both qualitative and quantitative primary data from 210 households regarding their socio-economic characteristics, their extent of participation in; as well as their perceived costs and benefits from water conservation activities. Again, aided with data transformation approach, the study employed a quantitative method of data analysis prior to presentation of findings. Our findings reveal that, majority of the households are neither aware nor participating in the few practiced water conservation activities in the study area. The Probit model shows that education level, income, participation in water conservation activities, attitude, and environmental knowledge are statistically significant; while gender, household size, subjective norm, perceived behavioural control, and land ownership are statistically insignificant but altogether influence water conservation behaviour positively except for income. However, age, marital status, benefits, and costs from water conservation activities negatively influence water conservation behaviour, yet statistically insignificant. The results of this study reflects the lifestyle of the households in Mvomero district council, their behavioural groupings and complexity which are crucial for future policy options; and to policy makers who successfully desire to enhance water conservation behaviour to a broader community.

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CHAPTER ONE
INTRODUCTION

1.1 Overview

This chapter covers the introduction part which includes the background of the study, problem statement, study objectives both general and specific, research questions, the rationale of the study and lastly the whole study organization.

1.2 Background of the study

Water is the most essential natural resource that supports human life, ecological integrity and socio-economic development. However, its contamination and depletion have become a global evil in the 21st century. It is estimated that 5 million people in developing countries (Owa, 2014); and around 1 million people in Africa (Dakkak, 2016; United Nations Development of Economic and Social Affairs [UNDESA], 2015) dies annually from contaminated water and poor sanitation. It is further estimated that about 3,394 under-five children dies annually in Tanzania (Water Aid Tanzania, 2017). Nevertheless, the projection shows that 40% of the global population is to dominate water stress region by 2030 (United Nations, 2015). Therefore, pressure from population growth, climate change and competing for water use on water resource will further worsen the problem in absence of water conservation activities (Adams, 2014).

Water conservation is vital for socio-economic importance. For instance, it has reduced the global burden of waterborne diseases, improving welfare, climate change adaptation, and productivity of the population (UNDESA, 2015). Henceforth, initiatives have been considered by stakeholders to further relish water conservation benefits. For example, International organizations such as World Bank, International Monetary Fund, and United Nations have provided USD 8.6 billion as Official Development Assistance (ODA) to the water sector in 2015 with Sub-Saharan Africa securing 31% of the disbursement (United Nations, 2017). In Tanzania, the government has boosted its water sector budget by 56.2%, thus, from Tanzania shilling (TZS) 573.5 billion in 2015/16 financial year to TZS 1.02 trillion in 2016/17 (United Republic of Tanzania [URT], 2016). Also, Millennium Development Goals (MDG) implementation has been considered among initiatives, allowing 91%, 89%,

68% and 50% of the global, developing countries, Sub-Saharan African and Tanzanian population respectively to have access to clean water (United Nations, 2015; Water aid Tanzania, 2017).

Despite the initiatives and the importance of water conservation, challenges still prevail. Such challenges have constrained people to respond to water conservation activities, and they exist due to number of reasons. Among them includes lack of pro-environmental behaviour (Dolnicar, Hurlimann, & Grun, 2012); limited households' participation and low tendency to conserve water (Arbues, Bolsa, & Villanua, 2015; Kelly & Fong, 2015). Furthermore, climate change (Cosgrove & Loucks, 2015); limited financial assistance (United Nations Educational, Scientific, and Cultural Organization [UNESCO], 2015); improper waste disposal (Sudiajeng, Parwita, Wiraga, & Mudhina, 2018); lack of water-related knowledge and limited households' effort to seek for water information (Febriani, 2017) are also among the reasons. Consequently, 663 million people worldwide continue to access unclean water, the majority in rural areas, mostly in Sub-Saharan Africa (United Nations, 2015) and 26 million people in Tanzania (Water Aid Tanzania, 2017).

Empirical studies worldwide ascertain the importance of factors influencing households' behaviour towards conservation. They argued that information regarding household behaviour is crucial for policy makers and other stakeholders in improving water conservation activities in a given population (Aprile & Fiorillo, 2017; Dupont & Renzetti, 2013; Fielding, Russell, Spinks, & Mankad, 2012; Zietlow, 2016). Furthermore, they indicated that factors such as age, gender and marital status (Aprile & Fiorillo, 2017; Fan, Wang, Liu, & Yang, 2014), education level (Dupont & Renzetti, 2013; Maas et al., 2017; Moges & Taye, 2017), income and household size (Dupont and Renzetti, 2013), employment or occupation status (Aprile & Fiorillo, 2017), Environmental knowledge (Adams, 2014; Aprile & Fiorillo, 2017), and household culture (Adams, 2014; Fielding et al., 2012; Maas et al., 2017) are crucial for determining water conservation behaviour.

In Tanzania context, there are past studies conducted in the area such as watershed conservation and water governance (Lalika, Meire, & Ngaga, 2015) concluding that

water conservation and water governance challenges indicate clearly the demand for more efforts in the quest for nature conservation. Also, a study on the effectiveness and performance of indigenous soil and water conservation measures (Mwango, 2015) concluded that traditional soil and water conservation measures are the major constraints to soil fertility and its spatial variability. Moreover, a study on the extent of the borehole and tap water quality (Kihupi, Yohana, Saria, & Malebo, 2016) concluded that residents of Dar Es Salaam city access a continuous fecally contaminated water; which summons the need for household-based water treatment and safe storage. They recommended for future studies in rural settings focusing on household behaviour towards water conservation activities.

1.3 Problem statement

Water conservation is crucial for decreasing the worldwide weight of waterborne illnesses, enhancing welfare, environmental change adjustment, and efficiency of the populace (UNDESA, 2015). Being the case, Tanzanian government has made a profound investment in water conservation to guarantee its estimated 53 million people with access to clean. However, by 2015 only 50.9% equivalent to 27 million Tanzanian had access to clean water (Water Aid Tanzania, 2017) while the average potential target as per MDGs was 79% of the overall population (URT, 2009). Hence, 49.1% of its population left without access to clean water mostly in rural areas in which 52% of them spend thirty minutes or longer round trip to fetch water from improved sources (URT, 2016). Human actions and their practised behaviours such as open defecation, littering, sewage and toxic waste disposal in water bodies; and limited household participation in water conservation activities accelerate the problem (Arbues et al., 2015; Dolnicar et al., 2012; Kelly & Fong, 2015). For instance, 86% of rural Tanzanian household defecate openly in water bodies (URT, 2016); and yet, 56.3% claimed not to be involved in water management activities (Mokiwa, 2015). Nevertheless, 90% of pollution in terms of wastewater in developing countries like Tanzania is discharged untreated into water bodies (United Nations, 2015). Therefore, such actions interpose households' decision to conserve water and consequently, 329 cholera deaths have been reported in 23 Tanzania

regions including Morogoro due to polluted and contaminated water (World Health Organization [WHO], 2016).

Various actions have been considered to counteract water pollution and its associated adverse effects so as to improve access to to clean water in the country. For instance, demand responsive approach to water resources management and water conservation measures are among the actions in place (URT, 2016; UNDESA, 2015). Nonetheless, a complete understanding of the problem to expand knowledge base was paramount important; summoning this study to examine the household behaviour towards water conservation in Mvomero district council, Tanzania. A convergent mixed methods design was employed, allowing the collection of both qualitative and quantitative data, which were merged through data transformation approach prior to interpretation. In this study, quantitative data were used to determine the factors influencing households' water conservation behaviour; while the qualitative data explored the extent of household participation in, as well as costs and benefits associated with water conservation activities in the study area.

1.4 Rationale of the study

In developing countries like Tanzania, the achievement narrated in MDGs goal 7c assumes improved water sources are free from contamination (Smiley, 2016). This is necessarily the case as the reported statistics ignores household behaviour that affects the quality and sustainability of such improved sources. For instance, according to the Sustainable Development Goals (SDG) report by United Nation (2016), at least 1.8 billion people drink faecal contaminated water resulting from household open defecation into these improved sources. Therefore, by examining household behaviour towards water conservation, this study will boost the understanding of different stakeholders including households themselves toward their involvement and adaptation of water conservation activities for successful attainment of the current SDGs goal 6. Furthermore, the findings of this study will be vital to policy makers in designing promising policies to meet increasing water demand that exceeds its supply; protect flimsy ecosystems, ensure access to clean water and sustainable management of the improved water sources.

1.5 Objectives of the study

The core objective of this study was to examine the household behaviour towards water conservation activities in Mvomero District Council, Tanzania. It was accompanied with the following specific objectives:-

i. To examine the extent of households' participation in water conservation activities in Mvomero District Council.
ii. To examine the perceived costs and benefits of water conservation activities in Mvomero district.
iii. To determine factors influencing water conservation behaviour in Mvomero District Council.

1.6 Research questions

i. To what extent do households participate in water conservation activities in the study area?
ii. What are the perceived costs and benefits associated with water conservation activities in the study area?
iii. What are the factors influencing water conservation behaviour in the study area?

1.7 Organization of the study

The complete dissertation comprises of six chapters. Chapter one covers the general introduction of the study that comprises of the background of the study, problem statement, rationale of the study, research questions, and objectives. Chapter two covers the theoretical settings guiding the study, empirical reviews and conceptual framework. Chapter three provides study's methodological description, covering research design, methods for data collection, data type, sample selection and respective targeted population; also data analysis, reliability and validity. Chapter four covers the presentation of the study's findings both qualitative and quantitative. Chapter five covers the discussion and arguments regarding the findings presented in Chapter four in relation to the particular study area and other similar studies. Finally, chapter six provides the summary, conclusion and policy implications; as well as limitation of the study and area for future studies.

CHAPTER TWO
LITERATURE REVIEW

2.1 Overview

This chapter covers the theoretical settings and empirical framework that guide the study. The theories guiding this study are covered under theoretical review section; whereas, the contribution of past researcher and their findings are in the empirical review section. Hence, both sections give the study's conceptual framework exhibiting how the variables were operationalized.

2.2 Theoretical review

2.2.1 The Theory of Reasoned Action (TRA)

This theory originated from the social psychology field and developed (Fishbein & Ajzen, 1975). The theory postulates that a person's decision to perform certain behaviour is determined by its behaviour intention. And yet, the intention is influenced by the person's attitudes and subjective norms toward performing a particular behaviour. Therefore, the theory establishes a link between the influencers by considering five factors which include beliefs, attitudes, norms, intention and individuals' behaviour. Generally, the theory argues that behaviour intention which determines the actual behaviour of a person is the sum of attitude and subjective norms. Furthermore, attitude is derived from a person's beliefs on an evaluation of the consequences of such behaviour. On the other side, subjective norm is derived from an individual's normative beliefs and motivation to comply with the norms. The theory does recognize other factors that influence behaviour, yet regarding them as external variables which eventually influence attitude or subjective norm indirectly. However, the theory faced criticism on definitional issues regarding attitude; for instance, the theory is claimed to be un-falsifiable, making risks predictions; henceforth it is falsifiable under reasonable standards of falsification (Trafimow, 2009).

2.2.2 Theory of Planned Behaviour (TPB)

This theory is an extension following the limitation of the theory of reasoned action by adding another factor to their argument, thus perceived behavioural control. It was

developed by Ajzen (1991) purposely to predict and explain human behaviour in a specific context. This theory considers individual's intention as the best predictor of a given behaviour; whereas, such behavioural intention is determined by attitude, the subjective norm, and the perceived behavioural control. According to Ajzen (1991)

> *Attitude towards the behaviour refers to the degree to which a person has a favourable or unfavourable evaluation or appraisal of the behaviour in question… Subjective norm refers to the perceived social pressure to perform or not to perform the behaviour... Perceived behavioural control refers to the perceived ease or difficulty of performing the behaviour…*

Therefore, "the stronger the attitude and subjective norm, with respect to a behaviour, and the greater the perceived behavioural control, the stronger the individual's intention to perform a behaviour in question".

2.2.3 Stern and Dietz theoretical approach

Theoretical approach of Stern and Dietz (1994) stands as an empirical test to a theory linking values, beliefs, attitude and behaviour within a framework that emphasises the activation of personal environmental norms. They postulated that a person's concern to the environment is an outcome of negative consequences that could affect such a valued environmental object. They categorized such environmental concerns into Egoistic environmental concerns which suggest that people tend to conserve the aspect of environment that personally affect them or neglect the conservation of environment if they perceive personal costs to be high. Therefore, people who believe environmental changes affect them personally should be pro-environmental. Secondly, Altruistic environmental concerns which suggest that people tend to have a sense of moral obligation; thus, conserve the aspect of environment if they believe that when affected it may have adverse consequences to others. Finally, Biospheric environmental concerns related to Altruistic environmental concern, this considers the effects on biosphere, human and non-human species. Therefore, people neglect to protect the aspect of environment if it adversely affects the ecosystem or the biosphere; thus, they tend to be free riders.

According to Stern, Dietz, and Kalof (1993) the general model presumption is that households who believe that environmental condition has adverse consequences for

things they value will be predisposed to conserve. Also, for those with strong social altruistic environmental concerns, they will have positive conservation behaviour if they believe that the environmental condition has adverse effects for other people. And finally, those with biospheric environmental concerns are subjected to positive conservation behaviour if they believe that environmental condition will have adverse effects for the biosphere or the nonhuman environment.

2.3 Empirical literature review

2.3.1 Socio-economic factors

Age

From empirical evidences there are mixed findings. For instance, studies by Aprile and Fiorillo (2017) as well as Fan et al. (2014) indicated that older people are more likely to be water conserver. However, studies by Moges and Taye (2017) and Adam (2014) postulate that age does not influence water conservation behaviour, such that the behaviour to invest in water conservation decreases as household's age increases. Similarly, Fielding et al. (2012) supported the earlier argument such that older households may either have many children or may be spending time at home as retired subjecting them to be less water conserver.

Education level

Education is among the important demographic factors towards conservation activities and it can be formal or informal. Some studies state that those with higher formal education level are more likely to be water conserver than less educated households (Dupont & Renzetti, 2013; Maas et al., 2017; Moges & Taye, 2017). However, other studies argued that education level does not influence water conservation behaviour; such that those with high education level are less committed to conserving water (Adams, 2014; Aprile & Fiorillo, 2017; Fan et al., 2014Fielding et al., 2012).

Income level

Income is also among the factors influencing water conservation behaviour. From the previous studies, it is noted that higher income households involve themselves in water conservation activities, marking the positive relationship between income and

water conservation behaviour (Dupont & Renzetti, 2013). However, other studies disagree with such relationship, such that, income does not necessarily influence water conservation behaviour; and household with high income are less likely to be water conserver (Adams, 2014; Aprile & Fiorillo, 2017; Fan et al, 2014; Fielding et al, 2012).

Household size

According to Aprile and Fiorillo (2017), behaviour to engage in water conservation activities decreases with family size and teenagers' presence. Fielding et al. (2012) also postulate that larger household size consumes water and facing challenges in water conservation activities. On the other hand, Dupont and Renzetti (2013) argued otherwise, claiming that a household with larger size tends to consider water conservation practice. However, this variable seems to be less considered by authors leaving a room for more debate over its influence on water conservation behaviour.

Gender and Marital status

Gender ascertains the sex of respondent whether male or female; while marital status explains his condition of being married or not. Findings of Aprile and Fiorillo (2017) and Fan et al. (2014 shows that women conserve water than men while on the other side, single individuals save more water than the married, divorced and widowed. However, the findings of Adams (2014) disagree with such a conclusion, indicating that men engage in water conservation than women who engage mostly in domestic activities. He further generalized using multiple regression models that gender difference did not significantly matter in predicting attitude towards water conservation and reuse.

Employment or Occupation status

Occupation status takes into account whether the respondent is employed, unemployed, trader, retired, or entrepreneur. From the past studies, it was concluded that entrepreneur households are less likely to engage in water conservation compared to those who are employed and retired (Aprile & Fiorillo, 2017). Furthermore, Chang (2013) found that water conservation behaviour of the

household is influenced by his occupational status; whereas, Adams (2014) concluded otherwise, leaving this variable debatable.

Environmental knowledge and concern

Environmental knowledge and concern were also found to have an effect on water conservation behaviour. Studies by Adams (2014) considered the relationship between pro-environmental concerns and water conservation behaviour using bivariate regression; concluding that household with a greater level of environmental concerns will positively engage in water conservation. Also, Aprile and Fiorillo, (2017) suggest that household with greater knowledge of environmental problems and its consequences are more likely to conserve water and have a greater commitment to doing so. However, this variable is under-researched in developing countries' context in which the conclusion may not be similar.

2.3.2 Psychological factors

Attitude

Abraham, Martin, Cofie, and Raschid-Sally (2016) consider attitude in terms of open or observed behaviour and a hidden one. In their study the majority of the respondents agreed that open defecation into the river affects the quality of water. Therefore, people with open behaviour or attitude are not water conserver. On the other hand, Fan et al. (2014) found that households who underestimate their level of water consumption observe fewer conservation practices compared to those who overestimate their consumption. However, Chang (2013) and Fielding et al. (2012) concluded that positive attitude influences water conservation behaviour of the household.

Subjective norms

Studies have considered the subjective norm as the psychological factors in determining water conservation behaviour of the household. The argument related to subjective norm is derived from the theoretical basis of TRA (Fishbein & Ajzen, 1975) and TPB by Ajzen (1991). Therefore, Chang (2013) and Fielding et al. (2012) indicated that subjective norms have an influence on water conservation behaviour;

such that subjective norm is positively significant in explaining water conservation behaviour.

Perceived behaviour control

Perceived behavioural control can be referred from the theory of planned behaviour, following modification of the theory of reasoned action by Fishbein and Ajzen (1975). According to Ajzen (1991), "perceived behavioural control refers to the individual's perception of the ease or difficulty of performing behaviour of interest". Therefore, Fielding et al. (2012) in their study guided by the theory of planned behaviour concluded that perceived behavioural control have a positive influence on household water conservation behaviour.

2.4 Summary of the literature reviewed

From the reviewed empirical studies, Appendix II gives a table summary of the key factors influencing water conservation behaviour. The table was generated to give a snapshot of how the variables were operationalized for appropriate quantitative analysis. Hitherto, the positive sign indicates that the set of variables moves in the same direction; whereas, the negative sign, indicates that the set of variables moves in the opposite direction. In advance of the current study, past empirical studies spot the importance of information regarding the factors influencing households' water conservation behaviour. However, these studies are centred in urban context and neglect the importance of issues such as participation, assets, cost and benefits that influence water conservation behaviour. Unlike previous studies which employed a quantitative design only (See, Adams, 2014; Aprile & Fiorillo, 2017; Fielding, et al, 2012), this study centred in a rural context, and employed a convergent parallel mixed method in which both qualitative and quantitative data were collected. Qualitative data aided in identifying the costs and benefits from, and the extent of household participation towards water conservation activities. Whereas, quantitative data were used to determine factors influencing households' water conservation behaviour, and to test the theory of planned behaviour and theory of reasoned action in the case of psychological factors.

Comment [k1]: Here you need to show how the studies are inform your studies . what are t issues which the previous studies did not take into account? How your study will capture tho issues?

- There is something new which you need to include?
- Is the methodology for analysis different o the same?
- New theories to be included ?

2.5 Conceptual framework

Conceptual framework "is a visual or written product that explains either geographically or in narrative form the key factors, concepts or variables and the presumed relationships among them" (Miles & Huberman, 1994). In line with the reviewed literature, a framework was constructed to lead the formulation of research design in examining the household behaviours towards water conservation activities in Mvomero District. The conceptual framework narrates the variables from both theoretical and empirical review for this study. The major variables include psychological and socio-economic factors; and costs and benefits that influence water conservation behaviour.

Figure 2.1 narrate the relationship among factors shaping the behaviour of household toward water conservation; while Table 2.1 describes how the variables in the conceptual framework are operationalized. Therefore, *Water Conservation Behaviour (WCB)* is the dependent variable in this study, which is measured with a question "How often are you careful in avoiding water pollution activities in your area?". Four Likert scale questions were used to obtain a response to such a question, and the likely responses 'Always', 'Sometimes', 'Seldom' and 'Never'. For analysis purpose, WCB is considered as a binary-coded variable; taking a value of 1 if it is 'Yes, always' and 0 if otherwise. However, water pollution, in this case, is defined as the contamination of water resulting from human activities.

In order for households to have strong WCB so as to eventually access clean water, extra efforts are very crucial in term of increasing households' participation, benefits, and offsetting challenges associated with Water Conservation Activities (WCAs). For instance, Biratu and Asmamaw (2016) suggested that people who participate in WCAs in term of meetings, labour contribution, training and programmes are more of water conserver compared to non-participants. Similar to their result, it is expected that household *participating in WCAs* will always avoid water pollution activities in their area compared to those who do not participate. However, the extent of household participation is measured using a Likert scale such that highly

participating, participating, moderately, not participating, and completely not participating.

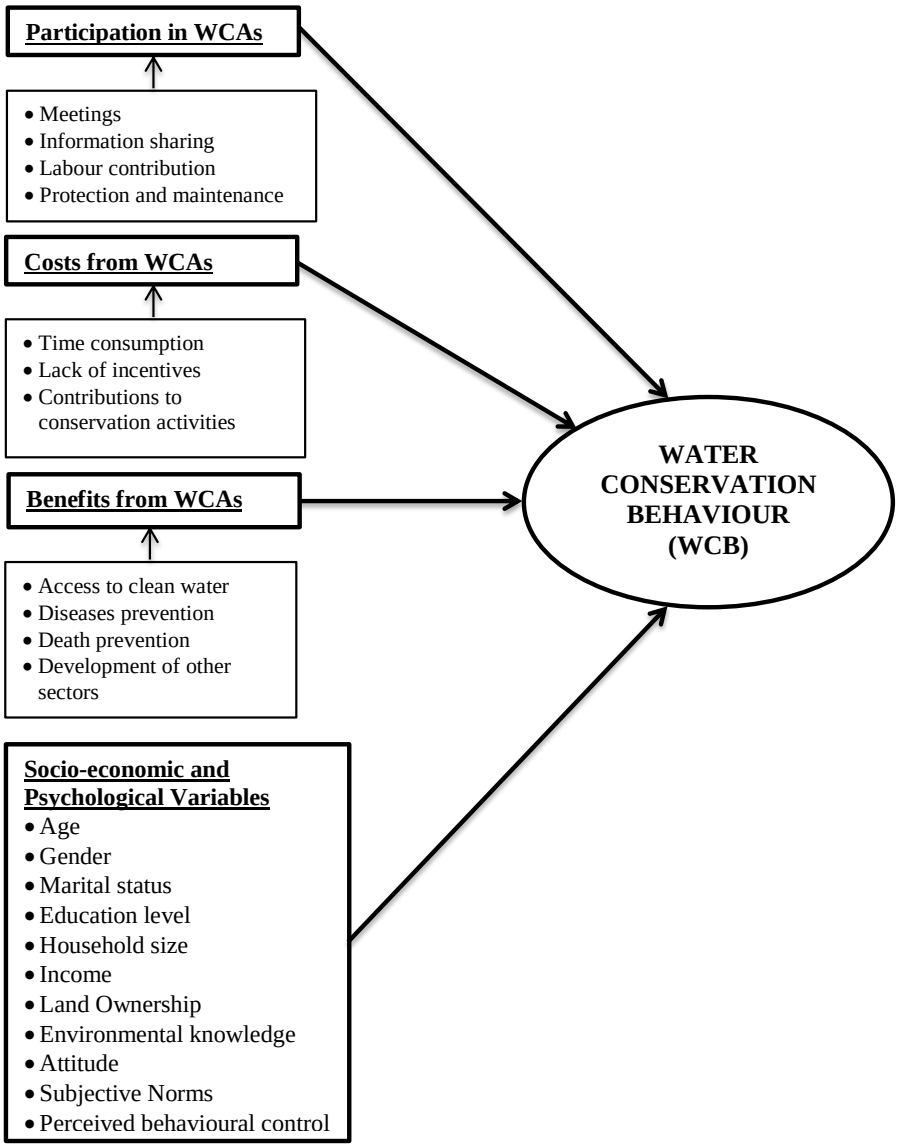

Figure 2.1: Conceptual framework

Adopted and modified from (Sesabo, Lang, & Tol, 2006).

Notwithstanding, WCAs are attached to a number of *benefits* both health and non-health benefits. The health-related benefits include diseases and deaths control, while

access to clean water and other sectors development evidence the non-health benefits. Therefore, it is expected that households who perceived that WCAs creates benefits are more likely to conserve water by avoiding water pollution activities compared to those who perceive otherwise. However, *costs from WCAs* also shape the behaviour of the household to conserve water. It is suggested that household who perceived that WCAs create cost are less likely to avoid water pollution activities (Cosgrove & Loucks, 2015; Febriani, 2017).

Age is measured in a number of years and it is crucial in determining household's WCB. As in line with previous studies (See, Aprile & Fiorillo, 2017; Fan et al., 2014), it is expected of younger people to often avoid water pollution activities at their household compared to elders. This is because younger people are considered to be proactive regarding conservation initiatives, which is less likely for older people who are slothful in term of labour contribution. On the other hand, *income* is the household's average monthly income measured in Tanzanian shilling (TZS). A household with higher income often believed to have surplus income enabling them to afford creation of a friendly environment (for example, good sewage system, basic sanitation facilities and so forth) to avoid water pollution activities (Dupont & Renzetti, 2013); unlikely to low-income earner who only have enough income for their daily consumption (Fielding et al., 2012). For instance, most of the low-income earners do not have basic sanitation facilities, consequently defecating openly into water bodies. Therefore, it is expected of households with higher income to often avoid water pollution activities compared to those with lower income.

Gender is another demographic factor accounting for the sex of a household and it is considered as a dummy variable for measurement; coded as 1 if male and 0 otherwise. According to Aprile and Fiorillo (2017) and Fan et al. (2014) women culturally spend more time at home doing domestic activities compared to men which subject them to water pollution activities. Therefore, it is expected of men to avoid water pollution activities compared to their opposite sex. *Marital status* is the marriage status of the household measured as a dummy variable; such that 1 if married and 0 otherwise. Similar to this study's expectation, unmarried households do often avoid water pollution activities (See, Abraham et al., 2016; Fan et al., 2014)

as they are assumed to have limited number of domestic activities that put water into jeopardy. *Educational level* marks the number of years spent in formal school. Households who have attained a higher level of education will often conserve water as they are believed to possess more knowledge pertaining conservation activities (See, Maas et al., 2017; Moges & Taye, 2017), which is less likely to people with lower level of education (Adams, 2014).

Household size is measured as a number of all members of the household. In line with previous studies (Fielding et al., 2012) it is expected that the higher the size of the household, the less likely the possibility of conserving water and vice versa. *Environmental knowledge* unlike formal educational level, it covers the environmental education obtained from seminars, TV, Radio, magazine, journals, newspapers, leaflets to mention the few. Household who have gained environmental knowledge from either source are more likely to be water conserver (Adams, 2014; Aprile & Fiorillo, 2017) unlike the household with a lack of environmental knowledge. Nevertheless, *Attitude* as derived from the TRA and TPB, is the degree to which a household has positive or negative feelings towards WCAs. In this study, attitude is measured with one item, such that 'How do you perceive WCAs?' and the response categories are either negatively perceived (extremely bad, bad) or positively perceived (extremely good, good, and neutral). These responses are binary coded as 1 if the household perceives WCAs to be positive and 0 otherwise. Therefore, households with a positive perception towards WCAs are expected to be more of water conserver in their area.

Subjective norm refers to perceived social pressure to either engage or not to engage in conserving water. Three items are used to measure this psychological variable. Firstly, it is expected of me to conserve water in my area; secondly, I feel that there is a social pressure to conserve water in my area; and lastly, people who are important want me to conserve water in my area. The responses categories arstrongly agree, agree, neutral, disagree, and strongly disagree. Therefore, the household facing social pressure often avoid water pollution activities compared to those who are not under social pressure (Chang, 2013; Fielding et al., 2012). *Perceived behavioural control* literally is the household's perception of the easiness or

difficultness in avoiding water pollution activities. It is expected of a household with greater perceived behavioural control too often avoids water pollution activities (Fielding et al., 2012). This psychological variable is measured by three items such that, I am confident that I could conserve water in my area if I want to; the decision to conserve water around my area is within my control; and lastly, the decision to conserve water around my area is beyond my control. The responses categories are strongly agree, agree, neutral, disagree, and strongly disagree.

This study also examines the influence of *land ownership* on WCB. This is a unique factor in the developing countries like Tanzania whose household decision to participate in conservation activities (behaviour) especially in rural areas is likely to be influenced land ownership. Households possessing land are believed to be wealthy, being able to engage in the decision regarding WCAs unlike household lacking land possession. However, the possession of land is subjected to a number of activities carried on it (for example, livestock keeping-grazing, farming activities) which might in one way or another result to pollution activities. Therefore, land ownership is important for households' decision to participate in WCAs, for the same reason it is taken into consideration in this study. Previous studies, for example, Kwayu, Sallu, and Paavola (2014) found that land ownership despite being statistically insignificant, it was positively related to watershed conservation; while Behrman (2017) found that land ownership whether sole or jointly owned increases participation in decision-making. Hence, land ownership is measured as a binary variable taking a value of 1 if the household owns a land and 0 otherwise.

Table 2.1: Summary of the study variables

SN	Variable	Description	Code/ Measurement	Expected sign
1	Aged	Age of the respondent	Dummy: 1 if Age>=35 years; 0 otherwise	-
2	Gender	Sex of a household	Dummy: 1 if male, 0 otherwise	+
3	Marital status	Marriage status of the household.	Dummy: 1 if married, 0 otherwise	-
4	Income	Average monthly income per head	Tanzanian Shillings (TZS)	+
5	Education level	Number of years spent in formal school	Years	+
6	Household size	The number of all members of the household	Numbers	-
7	Environmental knowledge	Received environmental knowledge obtained from informal education	Dummy variable: 1 if household have environmental knowledge; 0 otherwise	+
8	Costs	Disadvantages derived from WCAs	Dummy variable: 1 if WCAs creates cost; 0 otherwise	-
9	Benefits	Merits derived from water conservation activities	Dummy variable: 1 if WCAs creates benefits; 0 otherwise	+
10	Land ownership	Land ownership/ access by the household	Dummy Variable: 1 if own a land; 0 otherwise	+
11	Participation	Household involvement in WCAs	Dummy Variable: 1 if the household participate in WCAs; 0 otherwise	+
12	Attitude	Household feelings towards water conservation activities	Dummy variable: 1 if positive; 0 otherwise	+
13	Subjective norm	- it is expected of me to conserve water in my area - I feel that there is a social pressure to conserve water in my area - People who are important want me to conserve water in my area	Strongly agree, agree, neutral, disagree, and strongly disagree	+
14	Perceived behavioural control	-I am confident that I could conserve water in my area if I want to; -The decision to conserve water around my area is within my control; -The decision to conserve water around my area is beyond my control	Strongly agree, agree, neutral, disagree, and strongly disagree	+

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Overview

This chapter covers the methodological approaches used in the study. It narrates the study area, research design, data type and data collection methods, targeted population and sampling, and winding up with data analysis, reliability and validity.

3.2 Study area

Mvomero District is among the six districts of Morogoro region in Tanzania. It is lying between 300 to 400 meters above the sea level; yet located between longitudes $37^{o}20'$ and $38^{o}05'$ East and between latitudes $05^{o}80'$ and $07^{o}40'$South (Mkonda, 2014). Tanga region, Morogoro rural district, Kilosa district, Morogoro urban district and Pwani region mark its north, east, west, southwest, and northeast borders respectively. The district covers an area of about 140,042 km^2, with 17 wards totalling 312,109 people of which 154,843 are males and 157,266 are females (National Bureau of Statistics [NBS], 2013). The main socio-economic activity carried out is crop production with livestock keeping dominating the southern part (Mkonda, 2014). See Appendix IV for a map showing the study area. The district is however featured with high rainfall range of about 600 mm and 200mm annually.

The area of study was selected following some key important features it possesses. Initially, it is a newly formed and registered local government in 2004. Being the case, it villages has implemented several projects to improve water services, World Bank being the core funder. For instance, in 2009 World Bank restored government's water projects in Mzumbe ward from Tangeni River; of which was later decentralized to water user association in Mvomero district in 2010. Therefore, with inadequate access to clean water in Mzumbe ward, the researcher was interested in studying the behaviour of households in the study area, towards conservation of such essential resource.

3.3 Research design

A research design is a general strategy or plan for conducting a research study. Apart from indicating the goal of the study, research design further gives the necessary

details for gathering information required to structure and address the research problem (Gay, Mills, & Airasian, 2012). There are different designs for different studies, however, the main question guiding the study, nature of the variables involved, constraints of the environment and researcher's convictions (positivist or interpretivist (Khan, 2014)) are crucial for choosing a particular research design. According to Creswell (2014), research design is grouped into three approaches being qualitative research design, quantitative research design and mixed method research design.

3.3.1 Qualitative research design

A qualitative design is an approach that stresses on an interpretive view (Khan, 2014). It involves gathering information from a smaller sample group to explore and understand the meaning individuals or groups assigned to a social or human problem (Creswell, 2014). Historically, the origin of qualitative design can be traced back from education and social science discipline with the aim to study social and cultural phenomena. Unlike quantitative design which is confined to closed-ended questions, a qualitative one allows acquiring in-depth information regarding the phenomena through open-ended questions for the problem-solving (Leavy, 2017). The commonly used qualitative research design includes narrative, phenomenological, grounded theory, ethnography and case study designs (Creswell, 2014). In such designs, data are collected from respondent's settings, analysed and the researcher interprets the meanings of the respective phenomenon.

Qualitative design in term of case study design (See, Hornberger, Hess, & Gilligan, 2015) and phenomenological approach (See, Koutiva, Gerakopoulou, Makropoulo, & Vernardakis, 2016) has been used in previous water conservation studies. Similarly, this study adopted a case study approach as it convenient in exploring respondent's perception, behaviour toward water conservation in an in-depth manner. This approach was used to examine the extent of households' participation in and the costs and benefits of WCAs. However, the shortfall of this approach is that researcher induced bias tends to influence studies (Edmonds & Kennedy, 2017).

3.3.2 Quantitative research design

A quantitative research design is more of positivist view in which reality is independent of the researcher's perception and involves the collection of data from a large sample (Khan, 2014). Unlike the qualitative design, a quantitative one is flexible in treating the data collected; yet examine the relationship among variables in order to test objective theories. However, failure to provide in-depth meanings and explanations of the phenomena under study is considered to be the major weakness of quantitative design (Creswell, 2014). This design is mainly divided into experimental design and non-experimental design such as survey which also includes cross-sectional and longitudinal designs (Edmonds & Kennedy, 2017). Previous water conservation studies (See, Abraham et al., 2016; Adams, 2014; Aprile & Fiorillo, 2017; Fielding et al., 2012;), have adopted cross-sectional survey designs for determining the factors influencing WCB. Similarly, this approach was preferred in this study since data are collected at a single point in time allowing the comparison of variables simultaneously with less or no additional cost. However, the cross-sectional design fails to measure phenomena's alterations over time. (Gray, 2009).

3.3.3 Mixed research design

Since neither quantitative design (strength of testability) nor qualitative (strength of context) captures relevant details and trends of the problem under study when employed independently (Classen et al., 2007), researchers have considered employing multiple designs. According to Cresswell (2014) the use of a mixed research design call for the researcher's decision regarding the major research design; which for this study was quantitative design. Therefore, Cresswell disintegrated the mixed method into convergent parallel, explanatory, and exploratory sequential mixed design.

3.3.4 Research design for this Study

Reference made to the arguments in sub-section 3.3.3, this study employed a convergent parallel mixed method. "This is a mixed method design in which the researcher converges or merges quantitative and qualitative data in order to provide a comprehensive analysis of the research problem. Nevertheless, both forms of data are collected at roughly the same time and then integrated the information while

interpreting the overall results" (Creswell, 2014). Some of the previous studies on water conservation (See, Baptista et al., 2015; Thornton & Riedy, 2015) adopted convergent parallel mixed method stressing its suitability in providing a comprehensive analysis and understanding of a research problem. However, how to converge or merge the two set of data is considered a major challenge in mixed method design (Creswell, 2014; Hollohan & Barry, 2014). As a remedy, this study adopted a data transformation approach that allows altering qualitative data or themes into quantitative codes to obtain a single quantitative database prior to interpretation. This design process is summarized in Figure 3.1.

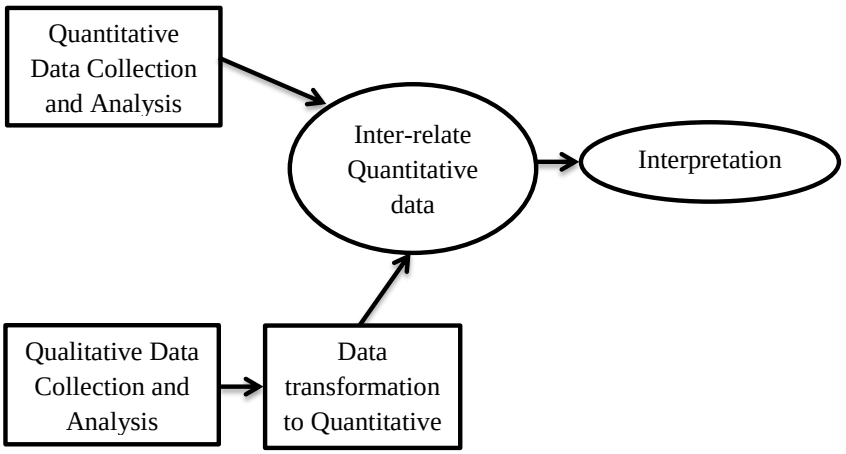

Figure 3.1: Convergent Parallel Mixed Method (data transformation approach)
Source: Edmonds and Kennedy (2017).

3.4 Data type and Data collection methods

With an aid of cross-sectional survey, this study collected data from the respondents, thus the households from the study area. The data collection process provides a systematic approach and techniques for collecting information from the respondents, so as to address the key research objectives.

3.4.1 Data Used

3.4.1.1 Primary data

Primary data are alternatively known as first-hand data which are collected directly from the field. In this case, the researcher has to go field and gather relevant

information from the respondents. Primary data gives accurate data and help to avoid fabricated one; however, they cost time and expensive to obtain as the researcher has to start from the scratch to gather such kind of data (Dawson, 2002). Therefore, this study collected first-hand data in term of both qualitative and quantitative data in order to address the key research objectives. The qualitative data assisted in examining the extent of household participation, and the costs and benefits of WCAs. On the other hand, quantitative data were used to analyse factors influencing households' WCB in the study area.

3.4.1.2 Secondary data

Secondary data are second-hand data collected from different sources, rather than directly from the field. The collection process of secondary data involves reviewing relevant documents fitting the study in question (Dawson, 2002). Unlike primary data that needs field visiting, secondary data are cheaper in accessibility and less time-consuming. However, secondary data are subjected to less accuracy and for some cases irrelevant with the study in hand. Therefore, following limited secondary data associated with WCB in a rural context, and to maintain accuracy and relevance of the data, this study entirely collected first-hand data

3.4.2 Data collection method

Data collection methods include various techniques for gathering relevant information for the study at hand. The decision on the particular method to be employed depends on various influential factors such as data type (whether secondary or primary data); the objective of the study, and experienced response rate (Malhotra, 2005). Since this study entirely collected first-hand data, a survey method was taken into consideration.

3.4.2.1 Survey method

Similarly to previous water conservation studies (See, Maas et al., 2017; Moges & Taye, 2017), a questionnaire survey, both structured and semi-structured was used as the main instrument for data collection in this study. It acquired first-hand data from a selected representative sample obtained from a sampling frame of 19,056. A questionnaire survey accommodated the collection of household's socio-economic

and psychological factors; their extent of participation in WCAs; as well as factors influencing WCB. Hitherto, the questionnaire was interviewer administered giving room for respondents to ask for additional clarification for questionnaire items not understood. See Appendix I for the questionnaire survey used for data collection in the study area.

3.5 Designing and testing the questionnaire

According to Dawson (2002), designing a questionnaire start by deciding which questionnaire to be used in data collection, as well as on how it will be administered. Dawson further noted some key precautions to take into accounts such as avoidance of jargons and technical terms, ambiguous and emotional words; yet avoiding the question that causes annoyance, sadness, offence, frustration or embarrassment. Also, the questions should be kept short, simple and less prestige biased, asking question indirectly for sensitive issues and avoidance of leading questions. Therefore, all such key issues were taken into consideration in this study while designing a sound questionnaire for data collection.

3.5.1 Measurement scale

Measurement scale was used to collect data for this study. In line with past studies (See, Abraham et al., 2016; Aprile & Fiorillo, 2017), this study employed a Likert scale as a measurement scale. The dependent variable (WCB) was measured by a question 'How often are you careful in avoiding water pollution activities at your area?' while the likely responses were 4-Likert scaled as always, sometimes, seldom, and never. Also, a 5-Likert scale was used to gather responses from respondents on variables such as subjective norm and perceived behavioural control similar to previous studies (See, Chang, 2013; Fielding, et al., 2012).

3.5.2 Questionnaire translation

This study was conducted in the rural settings in which majority of respondents possess lower education level which pose difficulties in answering English written questionnaire. Since the household understands their local language (Swahili), the questionnaire was interviewer-administered and the Researcher took the liberty to translate the questionnaire for convenient data collection. Notwithstanding, this

approach allowed the Researcher to provide assistance to the respondent in understanding the questionnaire items that were not understood.

3.5.3 Pilot study

This study carried out a pilot study to test the designed questionnaire prior to the main data collection. The pilot study was conducted to find out if the questionnaire obtains the required results. The questionnaires were presented to third part (those not involved in its construction) to see if there were any anomalies noticed, and then 10 questionnaires were sent out to respondents as a pilot study. The respondents were made aware of the pilot study, and asked to give their comments regarding the length, wording and structure of the questionnaire. The responses were reviewed carefully and the questionnaire was restructured and piloted again.

3.6 Target population and sample selection

3.6.1 Target population

A population is a group of individuals who have the same characteristic, whereas the target population is the group of individuals with some common defining characteristics that the researcher can identify and study (Creswell, 2014). Ishak and Abu-Bakar (2014) identify persons, part of an organization or institution, households, and housing units as fundamental units of population. This study considered the entire population characteristic in Mzumbe ward of Mvomero District. However, to make a meaningful contribution to WCAs in the study area, this study considered households aged 18 years and above to represent its targeted population.

3.6.2 Sampling frame

According to Digaetano (2013) sampling frame is the listing of all units from which sample is to be drawn at any stage of sampling. To study a sample instead of the entire population depends on several factors including measurement destructive nature, low cost of sampling error, size of the available population, limited time and budget, and variation in the element of the population (Malhotra, 2005). The process of determining sampling frame for this study was assisted by 2012 Population and housing census- population Distribution by Administrative Areas' (NBS, 2013). Therefore, 19,056 households from all four villages of Mzumbe ward in Mvomero

District Council formed a sampling frame from which sample size for this study was drawn.

3.6.3 Sample size

The sample size comprises the number of respondents to be studied drawn from the sampling frame. The determination of sample size depends on a number of both quantitative and qualitative factors. Qualitative factors include the nature of the study, data analysis type, time and resource constraints, the sample size in similar studies, and a number of variables involved in the model. The quantitative factors include the desired level of precision, standard deviation, desired level of confidence interval, and data analysis techniques (Malhotra, 2005). For this study sample determination formula as suggested by Yamane, (1967) was used to compute the sample size. The calculation was further guided by some assumptions; such that the degree of precision and confidence interval was 5% and 95% respectively. Based on personal judgement, 90% was considered as an initial estimate of the proposition; while ±7% as the level of precision, following the lack of information regarding households' WCB in the study area. Therefore:

$$\mathbf{n} = \frac{\mathbf{N}}{\mathbf{1+N\,(e^2)}} \tag{3.1}$$

Where;

n = sample size =?

N = total number of population = 19,056

e = is the level of precision = ±7%

Therefore,

$$\mathbf{n} = \frac{19{,}056}{1 + 19{,}056\,((0.07)^2)} = \frac{19{,}056}{94.3744} = 201.9192 \approx \mathbf{202}$$

The computed sample size was 202 households; however, the study further assumed that for a sound econometric analysis every single variable in the model to have at least 15 respondents. Therefore, with 14 variables to be modelled, the sample size

amounted to **210,** marking the number of households studied. Being the case, the distribution of 210 respondents were 55 for Changarawe and Sangasanga villages each, while 50 for Vikenge and Tangeni village.

3.6.4 Sampling techniques

After the establishment of the sampling frame, the Researcher had to decide on whether to use a traditional or probability sampling. Regardless of the technique selected to draw the sample size, each carried distinctive features affecting true representation and bias minimization. However, in this study both probability and non-probability sampling techniques were employed to get a sample size to be studied.

3.6.4.1 Traditional or Non-probability sampling

Traditional sampling is the sampling procedure which does not involve estimating the probability of each population item to be included in the sample. Non-probability sampling is alternatively known as deliberate sampling, or purposive sampling or judgement sampling; and also includes quota sampling. However, it should be noted that purposive sampling involves selecting a particular unit of the population to set up a sample which represent the entire population (Rahi, 2017). Preliminarily, to best understand the research problem, purposive sampling was used to select the studied ward (Mzumbe ward) from the seventeenth in Mvomero district council.

3.6.4.2 Probability sampling

Probability sampling is alternatively known as random sampling or chance sampling. It involves sampling procedures that estimate the probability of each item in the population to be included in the sample. Unlike the tradition sampling technique, estimation error can be measured, and the technique is bias-free. Moreover, random sampling can be referred to as without replacement if it is from a finite population, thus if an item is once selected cannot be considered in the sample again. Whereas, with replacement means after the item is selected, it is returned to the population bearing again an equal chance to be selected again. Probability sampling is categorised into systematic sampling, stratified sampling, cluster sampling, area sampling, and multi-stage sampling (Dawson, 2002). However, a stratified random

sampling accommodated this study by stratifying the entire population into subpopulation (strata) then sample items were drawn from each stratum randomly (Rahi, 2017). Therefore, stratified random sampling technique was used to draw a sample size from the purposively selected Mzumbe ward, in which the selected villages (say, Changarawe, Vikenge, Sangasanga, and Tangeni) were considered as stratum from which households were randomly selected.

3.7 Data analysis

Data analysis may be in term of the qualitative or quantitative method. The qualitative method of data analysis can be grouped into content analysis and extracting themes; whereas, the quantitative method of data analysis is grouped into a descriptive statistic and inferential statistic. This study employed a quantitative method of analysis for the data collected from respondents. Creswell, (2014) further suggested three methods of data analysis with respect to convergent parallel mixed method. These include side by side approach, data transformation method, and joint display of data method. For this case, the study employed data transformation approach to alter qualitative codes or themes into quantitative to obtain a single quantitative dataset prior to the presentation of results (Edmonds & Kennedy, 2017)**.**

3.7.1 Descriptive data analysis

Descriptive statistic techniques such as measures of sample distribution and measures of central tendency were used to analyse the profile of the respondents. Furthermore, tabulation techniques were used and so were the graphical representation of the collected data. Being the case, Statistical Packages for Social Sciences (SPSS) version 25.0 and excel spreadsheet programs were used to aid the descriptive statistical analysis.

3.7.2 Econometric data analysis

The econometric analysis involved running a Probit binary outcomes regression model through statistical data analysis programs. STATA version 13.0 was used to determine the influence of explanatory variables indicated in Table 2.1 on the household's WCB.

3.7.2.1 Model for analysis (Probit Model)

Expression of the Binary outcome (Probit) model

This study estimated a Binary outcomes (Probit) model taking WCB (How often are you careful in avoiding water pollution activities?) as the dependent variable which is the function of explanatory variables. WCB has a binary coded response of 1 if the household is always careful in avoiding water pollution activities and 0 otherwise. Generally, a binary outcome model for estimating the probability that $WCB_i = 1$ is expressed as in equation (3.2); such that:-

$$P = Prob[WCB_i = 1|X_j] = F(X'\beta) \quad (3.2)$$

Where WCB_i stand for Water Conservation Behaviour; $F(X'\beta)$ is the cumulative density function of the standard normal distribution for the case of Probit model. Also, X_j represent the socio-economic and psychological factors that influence the households' WCB, whereas j denote the j^{th} explanatory variable, while i denotes the i^{th} observation.

Specifically, the Probit model expression that determine the probability (restricted between 0 and 1) of an individual households to always avoid water pollution activities is given by equation (3.3) and equation (3.4) such that:-

$$P = F(X'\beta) = \phi(X'\beta) \quad (3.3)$$

$$WCB_i = \begin{cases} 1 \; if \; WCB_i' = 1 \\ 0 \; Otherwise \end{cases} \quad (3.4)$$

Where, $\phi(X'\beta)$ is the functional form of the standard normal distribution; while β is vector of a parameter; and x' is the variable column vector that influenceWCB_i. Furthermore, equation (3.4) implies that, if an individual household will often be careful in avoiding water pollution activities; then $WCB_i = 1$ and if otherwise $WCB_i = 0$; thus, if $WCB_i' = 1$, then $WCB_i = 1$ and if $WCB_i' = 0$, then $WCB_i = 0$.

Marginal effects for Binary outcome (Probit) model

The partial derivative of equation (3.2) gives the marginal effects for the Binary outcome models as expressed in equation (3.5) such that:-

$$\frac{\partial P}{\partial X_j} = \frac{\partial Prob[WCB_i=1|X_j]}{\partial X_j} = F'(X'\beta)\beta_j \quad (3.5)$$

Specifically, the partial derivative of equation (3.3) gives the marginal effects for Probit model as expressed in equation (3.6) such that:-

$$\frac{\partial P}{\partial X_j} = F'(X'\beta)\beta_j = \phi(X'\beta)\beta_j \quad (3.6)$$

However, the average marginal effect for each explanatory variable is given by an expression in equation (3.7) such that:-

$$\frac{\partial P}{\partial X_j} = \frac{1}{n}\sum[F'(X'\beta)\beta_j] = \frac{1}{n}\sum[\phi(X'\beta)\beta_j] \quad (3.7)$$

Furthermore, the average marginal effect for the dummy variable is given by an expression in equation (3.7) such that:-

$$\frac{\partial P}{\partial X_j} = \frac{1}{n}\sum\left[[\phi(X'\beta)|X_j = 1] - [\phi(X'\beta)|X_j = 0]\right] \quad (3.8)$$

Eventually, an equation (3.9) was established to accommodate all the factors that are considered as explanatory variables in this study.

$$WCB_i = X_j'\beta + \varepsilon \quad (3.9)$$

Alternatively:-

$$\boldsymbol{WCB} = \beta_0 + \beta_1 Age + \beta_2 Gender + \beta_3 MaritalStatus + \beta_4 Income + \beta_5 Education + \beta_6 HHsize + \beta_7 EnvKnowledge + \beta_8 Attitude + \beta_9 SubNorms + \beta_{10} LandOwnership + \beta_{11} PerBehControl + \beta_{12} Participation + \beta_{13} Benefits + \beta_{14} Costs + \mathcal{E} \quad (3.10)$$

3.7.2.2 Probit Regression Model Diagnostics

i. Model specification error test

The assumptions while generating a Probit regression model is that, Probit outcome variable is a linear combination of the explanatory variables. By considering the left hand side of the outcome's link function expressed in equation (3.10); we assumed that using Probit function is the right call. To the left-hand, it is assumed that all relevant variables are included in the model and neglect all irrelevant one. Therefore, model specification error (model misspecification) occurs when link function (Probit

function) is an incorrect choice; or when there is a non-linear combination or relationship between Probit of outcome variable and the explanatory variables. Henceforth, a linktest command in STATA V. 13.0 issued after the Probit command was used to detect the model misspecification. Rule of thumb is that, except by chance, no additional explanatory variables should be statistically significant. Thus, the explanatory variables to rebuild the model, say a linear predicted value (_hat) and its squared (_hatsq) should be statistically significant; and insignificant respectively (Long & Freese, 2014).

ii. Model goodness-of-fit test

Testing the goodness-of-fit of the model at hand gives us a general snapshot or measurement of how the model fits the data. Therefore, to achieve this goal, the log likelihood Chi-square; pseudo-R-squared for the model; and Hosmer and Lemeshow's goodness-of-fit test; altogether were employed. Rule of thumb is that the log likelihood Chi-square should be two times the difference between the log likelihood of the current model and that of the intercept-only model. For pseudo-R-squared, it should be a change proportion in terms of log-likelihood (Long & Freese, 2014). Alternatively, for Hosmer and Lemeshow's goodness-of-fit test computed as Pearson Chi-square is that, the more closely the predicted or expected frequency matches the observed frequency and the greater the *p-value*, the better the fit (Long & Freese, 2014). Eventually, classification statistics and table was established to provide the statistical summary for all observations; and to estimate their extent of predictions to the binary outcomes.

iii. Multicollinearity test

Multicollinearity, alternatively collinearity occurs when two or more explanatory variables in the model have an approximately linear relationship with other explanatory variables in the exact same model. This creates difficulties to uniquely estimate regression coefficients with all the explanatory variables in the model (Long & Freese, 2014). The degree of multicollinearity varies and so are its effects on the model. As a remedy for multicollinearity, if any, STATA drop or omit the explanatory variable that is perfectly correlated, and retaining those which are not so as to uniquely estimate their coefficients. Therefore, to test for multicollinearity,

Variance Inflation Factors (VIF) and Tolerance combined table were generated by a command in a STATA V. 13.0. Rule of thumb is that a concern for multicollinearity should be raised when a tolerance is less or equal to 0.1; equivalently when VIF is greater or equal to 10.

3.8 Data Reliability and Validity

For a valuable interpretation of the data, both validity and reliability measuring instruments of data have to be taken into consideration. Altogether are crucial for giving suitability judgement of a measurement instrument or a test. As reliability reveals about the consistency of the produced scores; validity, on the other hand, tells about the appropriateness of a test.

3.8.1 Data Reliability

According to Gay et al. (2012) reliability is the degree to which a test consistently measures whatever it is measuring. The data collected is said to be reliable if it provides consistent results over time and represents the entire population under study. There are five steps of reliability such as test-retest, an alternative form, equivalent and stability, internal consistency (Split-half, Kuder-Richardson, or Cronbach's alpha) and scorer. In this study to ensure reliability, some of the questionnaire items were extracted from previous tested studies (See, Aprile & Fiorillo, 2017; Chang, 2013; Fielding et al, 2012) to test the concepts in the model. Also, to ensure that data collected provided a consistent result, the questionnaire survey were interviewer-administered so as to provide convenience in communication and collection process. Notwithstanding, along with piloting questionnaires, questions were designed to ask and obtain relevant information that was vital for the study in a different way to permit consistency.

3.8.2 Data Validity

According to Gay et al. (2012), validity usually reveals the relationship between study concepts and its respective indicators used for measurement. It refers to the degree to which a test measures what it is supposed to measure to aid appropriate interpretation of results. They further described four types of validity, such that; content validity which usually reflects the extent to which the test measures an

intended content area through both item and sampling validity. Criterion-related validity reflects the extent the test highly correlate with another test through concurrent validity and predictive validity. Also, construct validity gives the extent to which test reflect the construct it is supposed to measure through methods such as convergent, divergent, and content-related evidence. Finally, consequential validity which gives the extent to which the test create harmful consequences for the respondents.

Therefore, to ensure content validity, purposive sampling was preliminarily employed and later a stratified random sampling technique to enable collection of data from households in the intended area of study. The study further conducted a pilot study to test all content of the questionnaire to ensure item validity. The study further employed a quantitative data analysis to aid the generalization of the findings, and this allowed internal validity. To ensure external validity the study employed a cross-sectional survey study in gathering data from the respondents, to avoid any variation in the unit of analysis.

CHAPTER FOUR
PRESENTATION OF FINDINGS

4.1 Overview

This chapter presents the findings on households' behaviour towards WCAs in Mvomero, District. Descriptive statistics aids findings presentation of households' socio-economic characteristics; their extent of participation in; and costs and benefits from WCAs. Inferential statistics, on the other hand, provides the econometric results regarding the factors influencing households' WCB in the study area.

4.2 Descriptive statistics

4.2.1 Households' socio-economic characteristics

The socio-economic characteristics of the interviewed households have an important implication in their decision to avoid water pollution activities in their area. Such socio-economic characteristics include age, gender, marital status, education level, household size, income, occupation, assets ownership, and basic needs expenditure. Eventually, different techniques such as two-sample t-test, Kruskal- Wallis H test, and one-way Analysis of variance (ANOVA) were employed to test for statistically significant of variables. However, Appendix XV exhibits the test result for variables' normality prior to the test of significance.

4.2.1.1 Age of households

Table 4.1 shows that the average age of the respondent was 36 years with a minimum and maximum age of 21 and 67 years respectively. It further shows that 13.3% of the respondents in Sangasanga villages fall under 18-35 years, whereas, 7.6%, 4.3% and 1% of the respondents fall within a range of 36-45, 46-5 and above 55 years respectively. In Vikenge village, 14.3%, 5.7%, 2.9% and 1% of the respondents are within 18-35, 36-45, 46-55 and above 55 years respectively. Also, in Changarawe village, the respondents that fall within 18-35, 36-45, 46-55 and above 55 years were 17.6%, 6.2%, 1.9% and 0.5% respectively. Finally, 17.6%, 3.8%, 1.4% and 1% of the respondents in Tangeni village falls within 18-35, 36-45, 36-55 and above 55 years respectively. Generally, 62.9% of the respondents in Mzumbe ward falls within 18-35 years, while 23.3%, 10.5% and 3.3% are within 36-45, 46-55, and above 55

years respectively. A two-sample t-test results revealed a statistically significant difference in mean age between households with WCB and those without (p=0.0008; p<0.05). This implies that there is a variation in mean respondent age across households with different WCB. However, a one-way ANOVA test gave opposite results when tested between all four villages in Mzumbe ward (p=0.3535; p>0.05).

Table 4.1: Distribution of households' age

Age	Mzumbe ward villages				Total (%)
	Sangasanga	Vikenge	Changarawe	Tangeni	
18-35	13.3	14.3	17.6	17.6	62.9
36-45	7.6	5.7	6.2	3.8	23.3
46-55	4.3	2.9	1.9	1.4	10.5
56 and above	1.0	1.0	0.5	1.0	3.3
Total	26.2	23.8	26.2	23.8	100.0

4.2.1.2 Gender (sex) of households

Figure 4.1 exhibit that 41.9% of respondents in Mzumbe ward were female, while 58.1% were male. Village wise, 11.4%, 12.4%, 10.5% and 7.6% of the respondents in Sangasanga, Vikenge, Changarawe, and Tangeni respectively were female; while 14.8%, 11.4%, 15.7% and 16.2 were males. The Kruskal-Wallis H-test, on the other hand, reveals that there is a statistically significant difference in households' WCB between male and female ($\chi^2(1)$= 8.465; p=0.0036). This implies that there is a variation in WCB between female and male in Mzumbe ward.

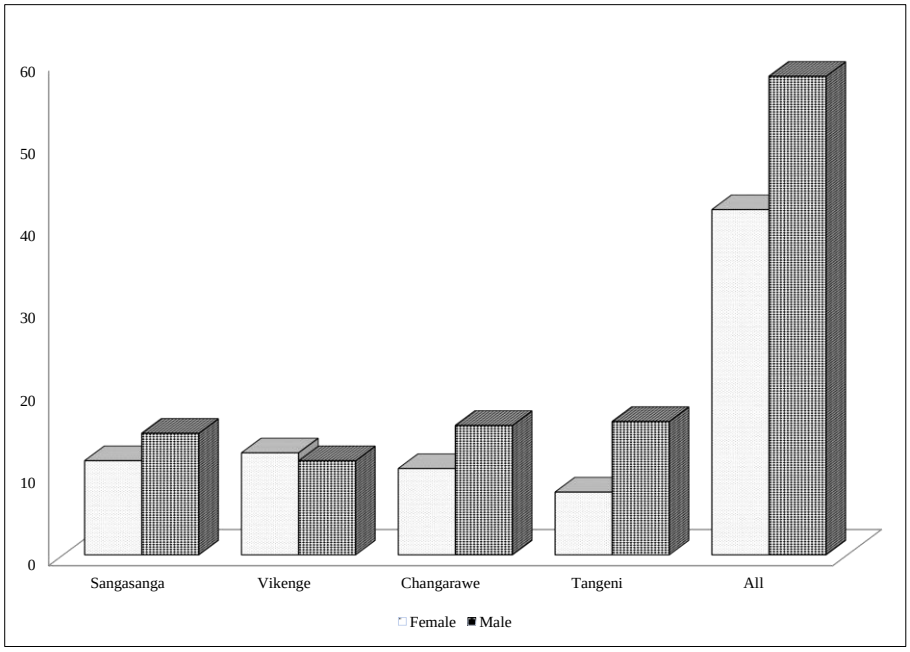

Figure 4.1: Gender of households

4.2.1.3 Marital Status

Figure 4.2 shows that 24.8% of the respondents in Mzumbe ward were single, while 73.3% and 1.9% were married and widow respectively. Village wise, 5.7%, 19%, 1.4% of respondents in Sangasanga village were single, married and widow respectively. In the same manner 7.1%, 16.2%, and 0.5% in Vikenge village, 7.1%, 19%, and 0% in Changarawe village; and 4.8%, 19%, and 0% in Tangeni village were single, married and widow respectively; while, no respondents with a divorce status in Mzumbe ward. Finally, a Kruskal-Wallis H test reveals that there is a statistically significant difference in households' WCB among the single, married and widow ($\chi^2(2)=9.970$; $p=0.0068$); implying a presence of variations in households' WCB between marital status in Mzumbe ward.

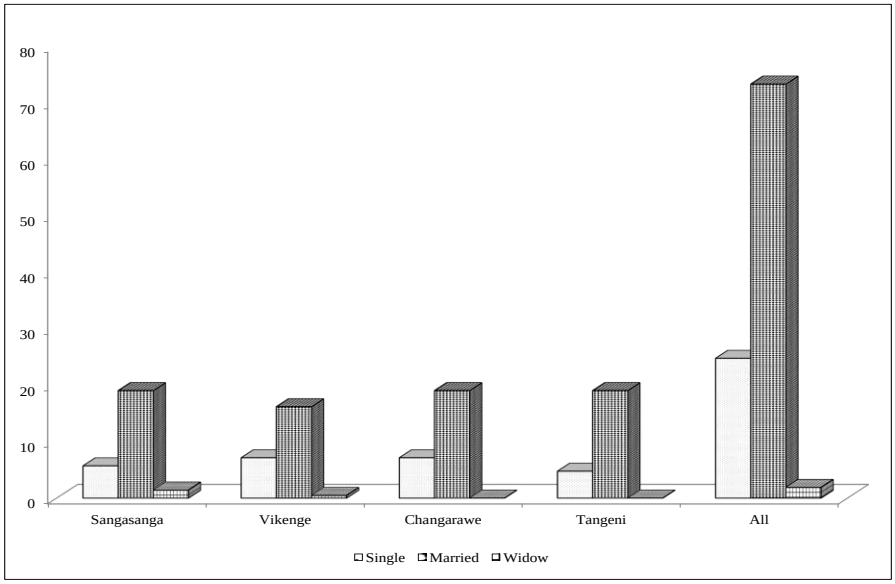

Figure 4.2: Marital status of households

4.2.1.4 Education of households

Figure 4.3 reveals that 15.7%, 8.6% and 1.9% of respondent attained primary, secondary and college or university education respectively in Sangasanga. Likewise, 15.7%, 7.1%, and 0.5% in Vikenge; 19%, 6.2% and 0.1% in Changarawe village; while 19%, 4.8%, and 0% in Tangeni village have reached primary, secondary, and college or university respectively. Overall, 0.5% of the respondents in Vikenge village and in Mzumbe ward, in general, have not reached any level of education; while 69.5%, 26.7%, and 3.3% of the respondents in Mzumbe ward had a primary, secondary and university level of education. Moreover, mean years of education was however statistically significant difference between households with water conserving behaviour and those without through a two-sample t-test (p=0.0000).

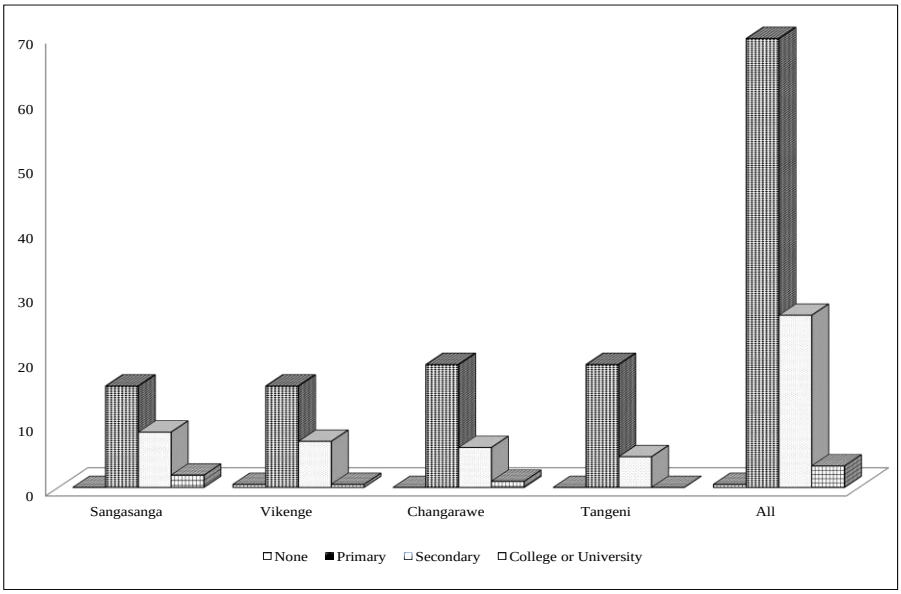

Figure 4.3: Households' education level

4.2.1.5 Household size

Regarding household size, Figure 4.4 shows that average person per household was 3.5 in Sangasanga village; 2.9 in Vikenge; 3.1 in both Changarawe and Tangeni villages; while 3.17 in Mzumbe ward in general. Furthermore, a household with 1-3 family members were 12.4%, 14.8%, 15.2%, and 16.2% in Sangasanga, Vikenge, Changarawe and Tangeni respectively. Likewise, a household with 4-6 family members were 11.9%, 8.1%, 10%, and 7.1%; whereas, 7-10 family members were 1.9%, 1%, 1% and 0.5% in the same earlier arrangement of villages. Overall, households with 1-3, 4-6, and 7-10 family members in Mzumbe ward were 58.6%, 37.1% and 4.3% respectively. Therefore, the difference in mean household size across all four villages in Mzumbe ward was found to be statistically insignificant (p=0.1977; p>0.05). Yet, there is a statistically significant difference in mean household size between households with WCB and those without.

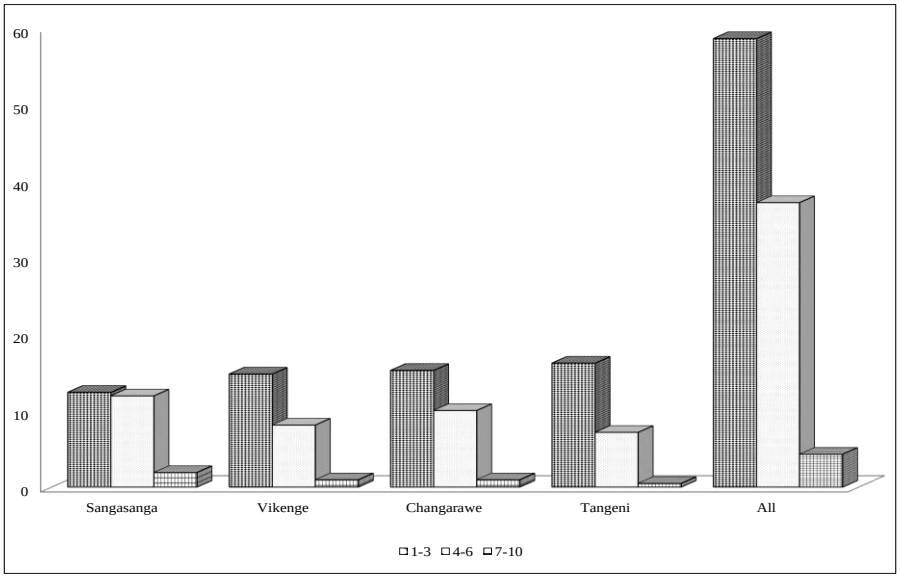

Figure 4.4: Household size

4.2.1.6 Main occupation activities

Table 4.2 reveals that in Sangasanga village respondents who employed themselves as farmers were 9.5%; 5.2% being female, and 4.3% male. Furthermore, 1.4% of labours were female and 3.3% male; respondents employed by the government were 4.8% with the equal proportion between genders; while all 0.5% of private employees were male. Nevertheless, 0.5% and 3.8% of traders were female and male respectively; whereas, 1.9% of respondents in other occupation were female 1.9% and 0.5% male. In Vikenge village, 4.8% of respondents who employed themselves as farmers were equally distributed between genders, while 1.4% of labourers were female and 1% male. Likewise, 0.5% of the government employees were female and 2.9% were male; yet 0.5% of private employees were female and 1.4% male. Nevertheless, 5.2% and 3.8% of traders were female and male respectively; while 2.4% of all respondents in other occupations were female. In Changarawe village, 3.8% of respondents who employed themselves as a farmer were female and 4.3% male; while 2.4% of labourers were female and 0.5% male. Again, 4.8% and 1.9% of all government and private employees respectively were male; whereas 2.9% of traders were female and 4.3% were male; yet, 1.4% of all those in other occupations

were female. In Tangeni village, 4.3% of respondents who are farmers were female, and 4.8% male. Furthermore, 2.9% of labourers were female and 0.5% male; while 1.9% and 1.4% of all government and private employees respectively were male. As none of the respondents claimed to be in other occupations, 0.5% of self-traders were female, while 7.6% were male. Overall, farmers in Mzumbe ward sum to 31.4% with equal proportion between genders; labourers were 13.3%, female being 8.1% and male 5.2%; traders were 28.6%, female being 9% and 19.5% male; government employee was 14.8%, male being 11.9% and female 2.9%; private employees were 5.7%, male being 5.2% and female 0.5%; whereas, 5.7% and 0.5% of 6.2% respondents in other occupations were female and male respectively.

Table 4.2: Households' main occupation activities

Mzumbe ward villages	Gender (sex)	Households' Occupation					
		Self-employed as farmer	Self-employed as labourer	Employees		Self-employed as a trader	Others
				Government	Private		
Sangasanga	Female	5.2	1.4	2.4	0.0	0.5	1.9
	Male	4.3	3.3	2.4	0.5	3.8	0.5
	Total	**9.5**	**4.8**	**4.8**	**0.5**	**4.3**	**2.4**
Vikenge	Female	2.4	1.4	0.5	0.5	5.2	2.4
	Male	2.4	1.0	2.9	1.4	3.8	0.0
	Total	**4.8**	**2.4**	**3.3**	**1.9**	**9.0**	**2.4**
Changarawe	Female	3.8	2.4	0.0	0.0	2.9	1.4
	Male	4.3	0.5	4.8	1.9	4.3	0.0
	Total	**8.1**	**2.9**	**4.8**	**1.9**	**7.1**	**1.4**
Tangeni	Female	4.3	2.9	0.0	0.0	0.5	0.0
	Male	4.8	0.5	1.9	1.4	7.6	0.0
	Total	**9.0**	**3.3**	**1.9**	**1.4**	**8.1**	**0.0**
All	Female	15.7	8.1	2.9	0.5	9.0	5.7
	Male	15.7	5.2	11.9	5.2	19.5	0.5
	Total	**31.4**	**13.3**	**14.8**	**5.7**	**28.6**	**6.2**

4.2.1.7 Households average monthly income and its sources

Table 4.3 shows that the average monthly income of respondents in Sangasanga is TZS 434,454.55, while TZS 429,400 in Vikenge, TZS 378,363.64 in Changarawe; TZS 360,400 in Tangeni village, and TZS 400,928.57 in overall Mzumbe villages. However, average person per household in Sangasanga is 3.5, while 2.9 in Vikenge,

3.1 in both Changarawe and Tangeni, and 3.17 in overall Mzumbe ward; this marks a monthly per capita income of TZS 124, 129.87; TZS 148.068.97; TZS 122,052.79; TZS 116,258.06; and TZS 126,475.89 in Sangasanga, Vikenge, Changarawe, Tangeni and overall Mzumbe ward respectively.

Table 4.3: Average monthly income and per capita income

Mzumbe ward villages	Average Monthly income (TZS)	Average person per household	Monthly Per capita income (TZS)
Sangasanga	434,454.55	3.5	124,129.87
Vikenge	429,400.00	2.9	148,068.97
Changarawe	378,363.64	3.1	122,052.79
Tangeni	360,400.00	3.1	116,258.06
All	400,928.57	3.17	126,475.89

Pertaining households' sources of income, Table 4.4 reveal that 39.7%, 12.7%, 24.8%, 16.8% and 6% of the total income in Sangasanga village comes from farming activities, wages, salary, business profit, and other sources respectively; while 36.4%, 18.2%, 20%, 16.4%, and 9.1% represent their respective households' participation rate.. In Vikenge village 18.1%, 7.8%, 27.7%, 39.3%, 21.8%, and 4.5% represents a share of total income from farming activities, wages, salary, business profits and other sources respectively; while their respective households' participation rate stall at 20%, 10%, 22%, 38%, and 10%. In Changarawe village the households' participation rate in farming activities, wages, salary, business profit and other sources were 30.9%, 10.9%, 25.5%, 27.3% and 5.5% while their share from total income was 28.6%, 8.8%, 36.3%, 21.8% and 4.5% respectively. Finally, in Tangeni village, the share from total income for farming activities, wages, salary, and business profit is 38.3%, 11.9%, 21.8%, and 28% respectively; with 38%, 14%, 14%, and 34% as their respective households' participation rate.

Overall, 31.4%, 13.3%, 20.5%, 28.6% and 6.2% of respondents in Mzumbe ward earn their income from farming activities, wages, salary, business profit, and other sources respectively. Nevertheless, households in Mzumbe ward earned an average monthly income of TZS 397,500 from farming activities; TZS 310,000 from wages; TZS 543,023 from salary; TZS 367,167 as a profit from business; while TZS 300,000 from other sources. Yet, farming activities dominated the share of the total

monthly income by 31.2%; whereas income earned from wages, salary, profit, and other sources had 10.3%, 27.7%, 26.2%, and 4.6% share respectively.

Table 4.4: Households average monthly income by sources

Mzumbe ward villages	Households' Income Sources	Average monthly income	Participation rate (%)	Share (%) total income
Sangasanga	Farming activities	474,750	20 (36.4)	39.7
	Wages	303,000	10 (18.2)	12.7
	Salary	539,091	11 (20.0)	24.8
	Business Profit	445,556	9 (16.4)	16.8
	Others	286,000	5 (9.1)	6.0
	Total	23,895,000	55 (100.0)	100.0
Vikenge	Farming activities	388,000	10 (20.0)	18.1
	Wages	336,000	5 (10.0)	7.8
	Salary	540,000	11 (22.0)	27.7
	Business Profit	443,684	19 (38.0)	39.3
	Others	308,000	5 (10.0)	7.2
	Total	21,470,000	50 (100.0)	100.0
Changarawe	Farming activities	350,588	17 (30.9)	28.6
	Wages	305,000	6 (10.9)	8.8
	Salary	539,286	14 (25.5)	36.3
	Business Profit	302,667	15 (27.3)	21.8
	Others	310,000	3 (5.5)	4.5
	Total	20,810,000	55 (100.0)	100.0
Tangeni	Farming activities	363,158	19 (38.0)	38.3
	Wages	305,714	7 (14.0)	11.9
	Salary	561,429	7 (14.0)	21.8
	Business Profit	297,059	17 (34.0)	28.0
	Total	18,020,000	50 (100.0)	100.0
All	Farming activities	397,500	66 (31.4)	31.2
	Wages	310,000	28 (13.3)	10.3
	Salary	543,023	43 (20.5)	27.7
	Business Profit	367,167	60 (28.6)	26.2
	Others	300,000	13 (6.2)	4.6
	Total	84,195,000	210 (100.0)	100.0

4.2.1.8 Physical assets of households

Figure 4.5 reveals that 22.4% of the respondents in Sangasanga village, 21.9% in Vikenge, 21.9% in Changarawe, and 19.5% in Tangeni village own physical assets. Yet, households who do not own physical assets represent 3.8% for Sangasanga, 1.9% for Vikenge, and 4.3% for both Changarawe and Tangeni villages.

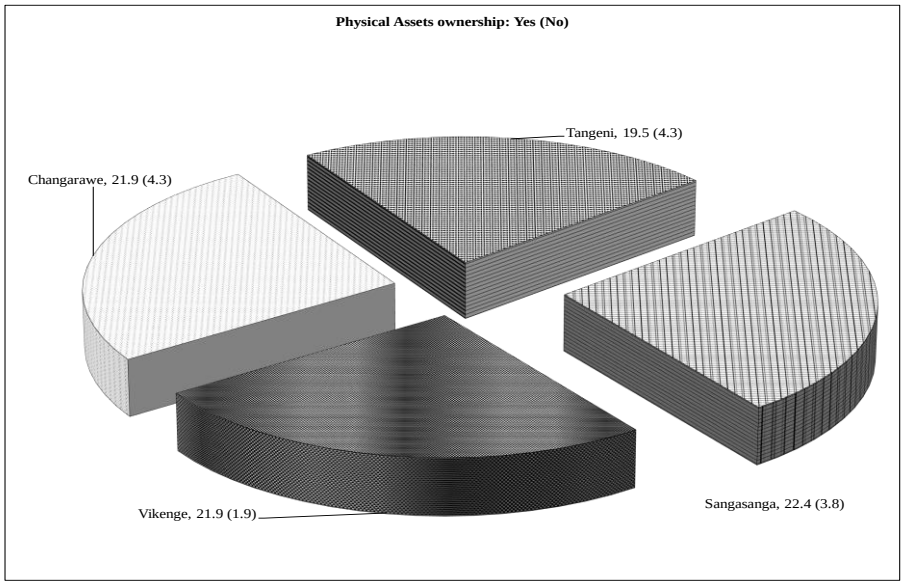

Figure 4.5: Physical assets ownership

Figure 4.6 (a) reveal that 43.3%, 39.5%, 31.9%, and 13.3% of respondents in Mzumbe ward own house asset, Transportation assets, Farmland asset, and Business assets respectively. Village wise, Figure 4.6 (b) reveal that 14.3%, 10.5%, 8.6% and 1.9% of respondents in Sangasanga; 9.5%, 9%, 5.2%, and 8.1% in Vikenge; 10.5%, 9.5%, 8.1%, and 2.9% in Changarawe; while 9%, 10.5%, 10%, and 0.5% in Tangeni village, owned a house, transportation, farmland, and business assets respectively.

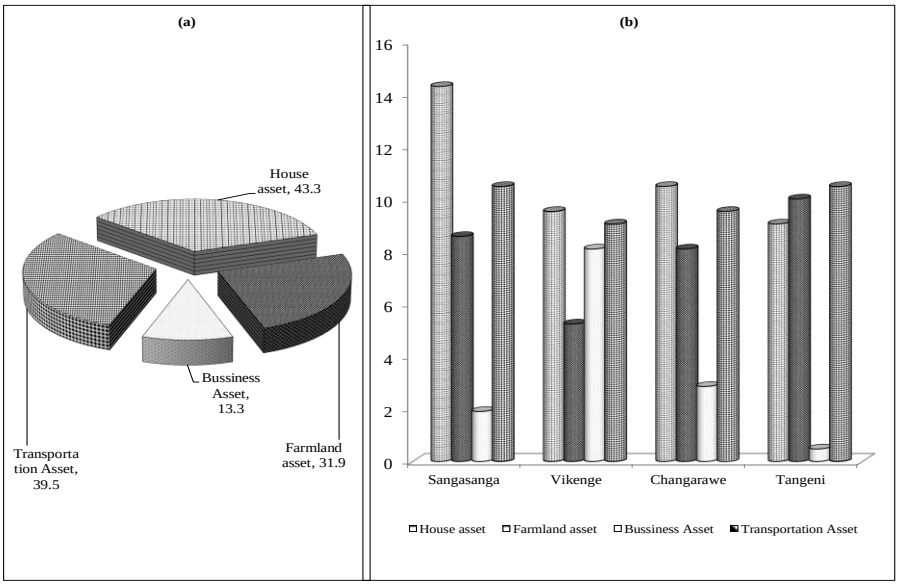

Figure 4.6: Type of physical assets owned by households in Mzumbe villages

4.2.1.9 Households' financial Access

Pertaining financial assets, Table 4.5 reveal that 5.2%, 5.7%, 3.8% and 5.2% of respondents in Sangasanga, Vikenge, Changarawe, and Tangeni villages respectively, reported to have access to or use financial sources for their farming activities; while 21%, 18.1, 22.4%, and 18.6% reported otherwise. Overall, 20% of the respondents in Mzumbe ward reported to have access to or use financial sources for farming activities, while 80% claimed otherwise. However, the proportion of respondents who reported not to access or use financial sources provided their reasons. Therefore, the findings revealed that 14.8%, 1%, and 5.2% of respondents in Sangasanga; 8.1%, 0.5% and 9.5% in Vikenge; 5.7%, 1%, and 15.7% in Changarawe; while 5.2%, 1%, and 12.4% in Tangeni village reported a lack of awareness; high valued collateral; and involvement in non-farming business respectively, as among the reasons for not using or accessing financial sources for their farming activities. Overall, such reasons occupied a total of 33.8%, 3.3% and 42.9% in Mzumbe ward in general.

Table 4.5: Households access to financial sources for farming activities

Financial sources use/access	Reasons for not accessing financial sources	Mzumbe ward villages				Total
		Sangasanga	Vikenge	Changarawe	Tangeni	
Yes		5.2	5.7	3.8	5.2	20.0
No	Lack of awareness	14.8	8.1	5.7	5.2	33.8
	High valued collateral	1.0	0.5	1.0	1.0	3.3
	Not engaging in farming activities	5.2	9.5	15.7	12.4	42.9
Total- No		21.0	18.1	22.4	18.6	80.0
Total	All	26.2	23.8	26.2	23.8	100.0

4.2.1.10 Land ownership

Regarding land ownership, Table 4.6 shows that 16.2%, 18.1%, 20% and 13.3% of respondents in Sangasanga, Vikenge, Changarawe and Tangeni villages respectively did not own any land; while 10%, 5.7%, 6.2%, and 10.5% reported otherwise. For Mzumbe ward in general, the results revealed that 32.4% of the respondents had their own land, while 67.6% had none. However, those who owned land reported several means of ownership. The findings revealed that 28.6%, 0.5%, 0.5%, and 0.5% of respondents in Mzumbe ward inherit; purchased land from farm earning, formal credit, and farm income respectively; while 2.4% reported owning their land through other means of ownership. However, with a $\chi^2(1)= 0.490$; and $p=0.4840$, a Kruskal-Wallis H test revealed that the difference in households' WCB between those who own land and those who do not is statistically insignificant.

Table 4.6: Households' land ownership

Land Ownership	Means of land ownership	Villages				Total
		Sangasanga	Vikenge	Changarawe	Tangeni	
No		16.2	18.1	20.0	13.3	67.6
Yes	Inheritance	8.1	5.2	5.7	9.5	28.6
	Purchase-farm earning	0.5	0.0	0.0	0.0	0.5
	Purchase-formal credit	0.5	0.0	0.0	0.0	0.5
	Purchase-farm income	0.5	0.0	0.0	0.0	0.5
	Others	0.5	0.5	0.5	1.0	2.4
Total- Yes		**10.0**	**5.7**	**6.2**	**10.5**	**32.4**
Total		26.2	23.8	26.2	23.8	100.0

However, Figure 4.7 reveals that 23.8%, 21.9%, 23.3%, and 22.4% of respondents in Sangasanga, Vikenge, Changarawe, and Tangeni villages respectively, reported not to own a rented land; while 2.3%, 1.9%, 2.9, and 1.4% rented the land they own. These results mark an overall of 91.4% of respondents in Mzumbe ward with no rented land while the remaining 8.6% owned a rented land.

4.2.1.11 Households' average monthly expenditure on basic needs

The results in Figure 4.8 shows that respondents in Mzumbe ward spend 55% of their expenditure on food; 16% on clothes, and 10% on house rent (shelter). Nevertheless, 19% of their expenditure is spent on other services such as water bills, electricity bills, cooking energy, transport expenses, health services and farm preparation expenses.

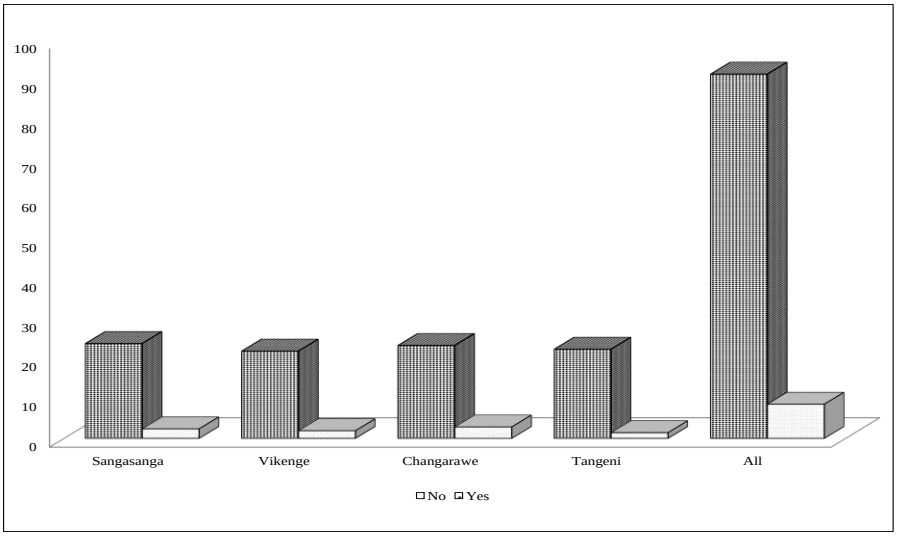

Figure 4.7: Rented land

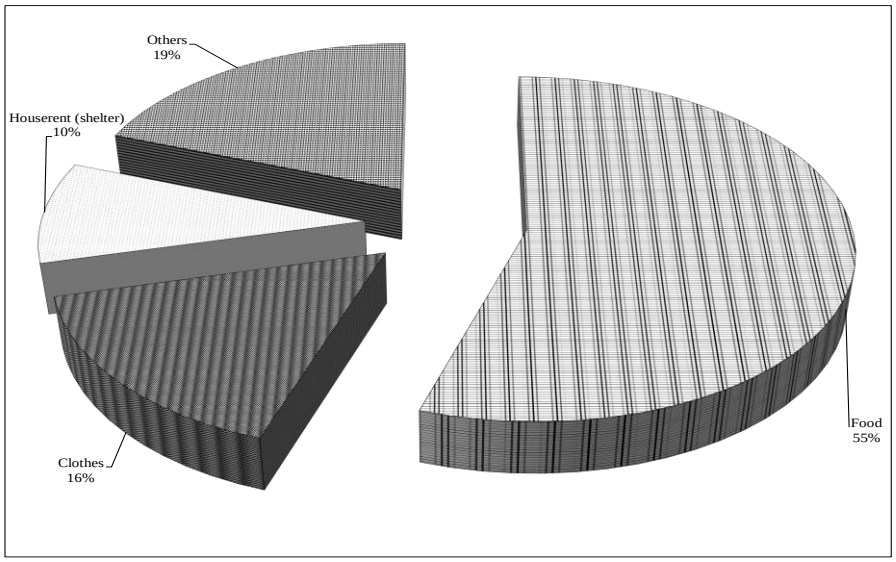

Figure 4.8: Households' average monthly expenditure

4.2.2 Extent of Households' Participation in WCAs

Table 4.7 reveals that, 39.5% of the respondents in Mzumbe ward were aware of WCAs while 60.5% were not. The portion (39.5%) of respondents who were aware of the WCAs, 24.8%; 10%; and 4.8% identified digging holes for waste disposal; building traditional trenches for wastewater; and general cleanliness, as the existing WCAs.

Table 4.7: Households' awareness on practiced WCAs

Variables	Criteria	Number of respondent	Percentage (%)
Households' Awareness on WCAs	No	127	60.5
	Yes	83	39.5
WCAs practiced by households	Digging holes for waste disposal	52.0	24.8
	Digging trenches for wastewater	21.0	10.0
	General cleanliness	10.0	4.8

Also, Table 4.8 shows that, 39.5% of respondents in Mzumbe ward were participating in WCAs while 60.5% were not. Concerning the extent of households' participation in WCAs, 4.3%, 26.2%, and 9%, of the participating respondents (39.5%) indicated that they highly participate, participating, and moderately participating in WCAs respectively. However, 52.4% indicated that they were not participating in WCAs, while 8.1% were completely not participating. Therefore, Generally, a Kruskal-Wallis H test shows that the difference in households' WCB between 127 respondent who participated in WCAs and 83 who did not participate is statistically significant with a p=0.0001; $\chi^2(1)$= 136.825.

Table 4.8: Extent of households' participation

Variables	Criteria	Number of respondent	Percentage (%)
Households' participation in WCAs	No	127	60.5
	Yes	83	39.5
Extent of households' participation in WCAs	Highly participating	9	4.3
	Participating	55	26.2
	Moderately	19	9.0
	Not participating	110	52.4
	Completely not participating	17	8.1

Furthermore, the findings also identified the ways in which 39.5% of respondents used to participate in WCAs. Table 4.9 shows that 19.5%, 10.5%, 8.1%, and 1.4% of the respondents participated in WCAs through labour contribution; protection and maintenance; information sharing and meetings respectively.

Table 4.9: Ways of participation in WCAs

Variables	Criteria	Number of respondent	Percentage (%)
Households' means of participation in WCAs	Meetings	3	1.4
	Labour contribution	41	19.5
	Protection and Maintenance	22	10.5
	Information sharing	17	8.1

However, concerning the reasons for participating in WCAs; Table 4.10 reveals that 14.3% of the respondents participated because of strictly village follow-up; 9.5% because they have environmental knowledge; whereas, 6.2%, 4.3%, 3.8% and 1.4% participated because of law enforcement, personal interest, strict bylaws, and penalties respectively.

Table 4.10: Reasons for participating in WCAs

Variables	Criteria	Number of respondent	Percentage (%)
Reasons for participating in WCAs	Law enforcement	13	6.2
	Strictly Village follow-up	30	14.3
	Environmental knowledge	20	9.5
	Strict by laws	8	3.8
	Personal interest	9	4.3
	Penalties	3	1.4

On the other hand, the portion of respondents (60.5%) who did not participate in WCAs identified reasons for their decision. Table 4.11 reveal that, 19.5% of respondents did not participate in WCAs due to lack of time; 18.1% due to lack of incentives from WCAs; 11.4% due to lack of environmental knowledge; whereas, 6.2% and 5.2% did not participate because of lack of information on WCA, and absence of laws respectively.

Table 4.11: Reasons for not participating in WCAs

Variables	Criteria	Number of respondent	Percentage (%)
Reasons for not participating in WCAs	Lack of time	41	19.5
	Absence of laws	11	5.2
	Lack of environmental knowledge	24	11.4
	Lack of incentives	38	18.1
	Lack of information	13	6.2

4.2.2.1 Responsibility of administering WCAs

Figure 4.9 shows that 60% of the respondents in Mzumbe ward villages reported that local government (village government) is the body they think responsible for administering WCAs. Notwithstanding, 29.5% and 10.5% believed that community at large; and individual household respectively, are responsible for administering WCAs in their area. Village wise, 1%, 17.1% and 8.1% in Sangasanga; 3.3%, 12.4%, and 8.1% in Vikenge; 0%, 18.6%, and 7.6% in Changarawe; while 6.2%, 11.9%, and 5.7% in Tangeni believe that individual households; local government; and Community at large, respectively are responsible for administering WCAs.

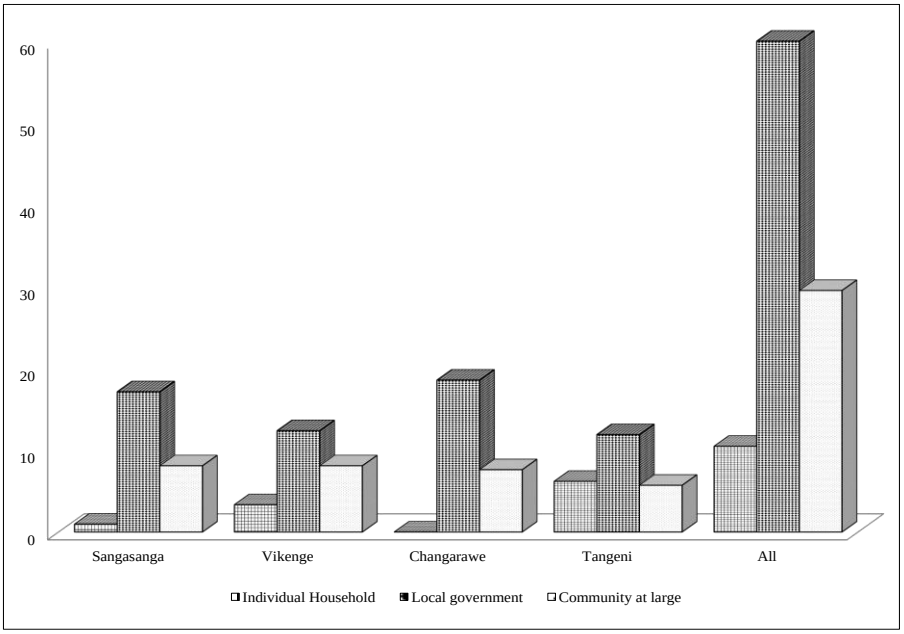

Figure 4.9: Responsibility of administering WCAs

4.2.2.2 Social capital and WCAs

Figure 4.10 reveals that 17.6%, 19%, 20.5%, and 18.6% of respondents in Sangasanga, Vikenge, Changarawe and Tangeni villages said no when asked if there were social groups that in any case influence them to participate in WCAs; while in the same manner of villages arrangement 8.6%, 4.8%, 5.7%, and 5.2% said yes. Overall, 75.7% and 24.3% of the respondents in Mzumbe ward replied no and yes respectively to the same question.

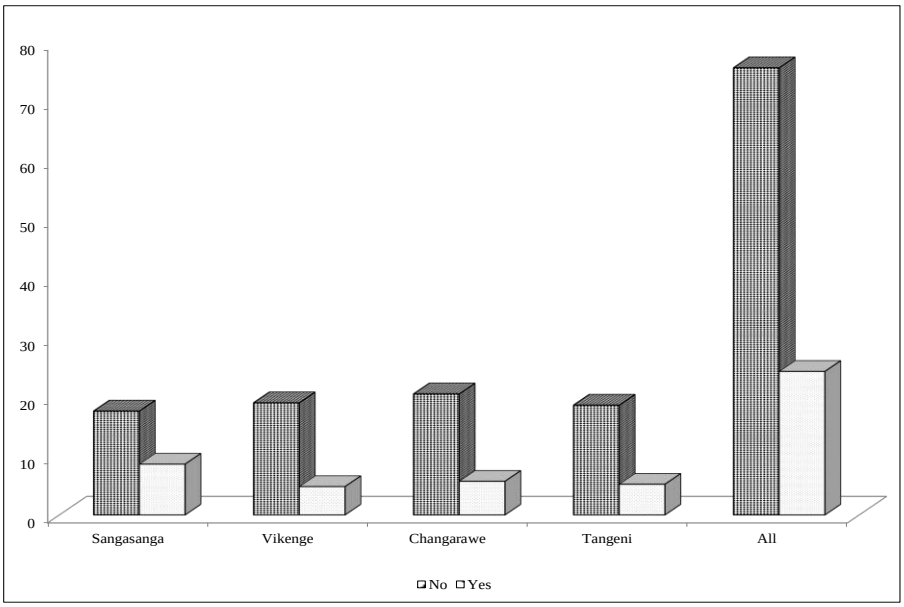

Figure 4.10: Existence of social groups

On the other hand, Figure 4.11 reveals that 1% of respondents who acknowledged the existence of social groups in Sangasanga and Vikenge villages; while none in Changarawe and 3.3% in Tangeni disagreed to be a member of such groups. However, 7.6%, 3.8%, 5.7% and 1.9% of the respondents agreed to be a member of the existing social groups; yet, 19% of the respondents in Mzumbe ward agreed that they are members of the social groups, while 5.3% disagreed.

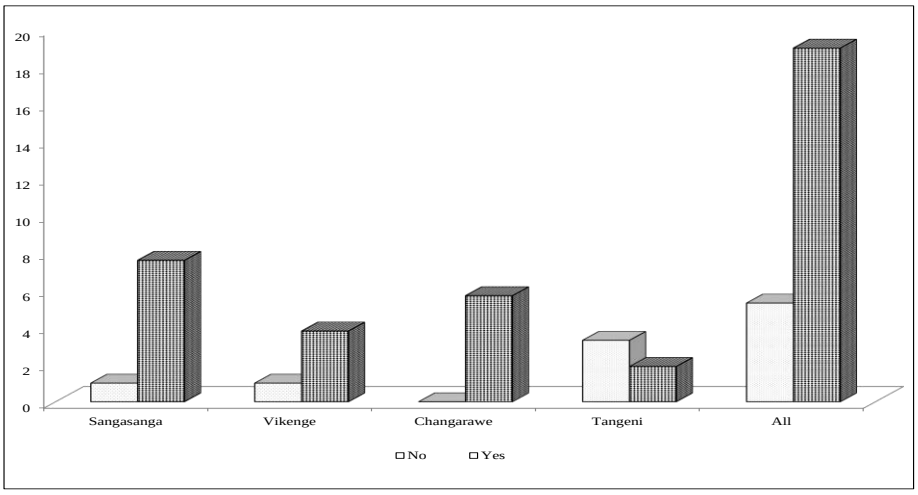

Figure 4.11: Households' membership in social groups

Concerning how the social groups influence their members to participate in WCAs; Figure 4.12 exhibit that 3.3% of the respondents in Sangasanga, 2.4% in Vikenge; and 1.4% in both Changarawe and Tangeni villages said they were influenced by their groups; while 4.3%, 1.4%, 4.3%, and 0.5% of the respondents in Sangasanga, Vikenge, Changarawe and Tangeni respectively were highly influenced.

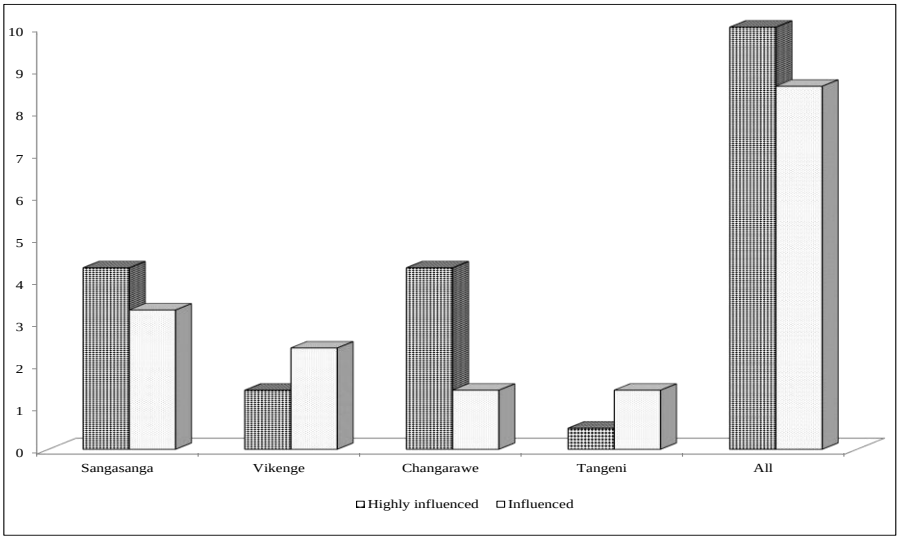

Figure 4.12: Social groups influence on participation in WCAs

4.2.2.3 Sources of information on Environmental issues

Table 4.12 shows that 6.2%, 1.9%, 2.4 and 1.9% of respondents in Sangasanga, Vikenge, Changarawe and Tangeni villages respectively, agree to follow environmental issues on TV and radio; while 20%, 21.9%, 23.8%, and 21.9% of the respondents disagreed. Nevertheless, 1.9% of all respondents who agreed that they read environmental issues on newspaper were from Sangasanga villages; whereas, 24.3%, 23.8%, 26.2%, and 23.8% of respondents in Sangasanga, Vikenge, Changarawe, and Tangeni villages respectively disagreed to read environmental issues on newspaper. With exception to Sangasanga village which has 4.3% of respondents who agreed to obtain environmental information from environmental associations; and 0.5% from environmental conferences; the rest of the villages had none on the particular sources. However, 21.9% and 25.7% of respondents in Sangasanga disagreed to obtain information from environmental associations and conferences respectively; while 23.8%, 26.2% and 23.8% in Vikenge, Changarawe and Tangeni disagreed to obtain environmental information from the two sources. Overall, 12.4%, 1.9%, 4.3%, and 0.5% of respondents in Mzumbe ward agreed to obtain environmental information from TV and Radio, newspapers, environmental associations and conferences respectively; while 87.6%, 98.1%, 95.7%, and 99.5% disagreed.

Table 4.12: Sources of environmental information

Sources of environmental information	Criteria	Mzumbe ward villages				All
		Sangasanga	Vikenge	Changarawe	Tangeni	
I follow environmental issues on TV & Radio	Agree	6.2	1.9	2.4	1.9	12.4
	Disagree	20.0	21.9	23.8	21.9	87.6
I read environmental issues on newspaper	Agree	1.9	0.0	0.0	0.0	1.9
	Disagree	24.3	23.8	26.2	23.8	98.1
I obtain environmental information from associations	Agree	4.3	0.0	0.0	0.0	4.3
	Disagree	21.9	23.8	26.2	23.8	95.7
I attend environmental issues' conferences, training and programmes	Agree	0.5	0.0	0.0	0.0	0.5
	Disagree	25.7	23.8	26.2	23.8	99.5
Total		26.2	23.8	26.2	23.8	100.0

4.2.3 Perceived benefits and costs from WCAs

Pertaining benefits from WCAs; Figure 4.13(a) reveal that 71%, 21%, and 8% of respondents in Mzumbe ward perceived health advantages (diseases and death control), access to clean water, and development of other sectors respectively. Hitherto, Figure 4.13(b) shows that 63%, 29%, and 8% of respondents in Mzumbe ward perceived time consumption, lack of incentives, and contributions to conservation activities respectively, are among the costs from WCAs.

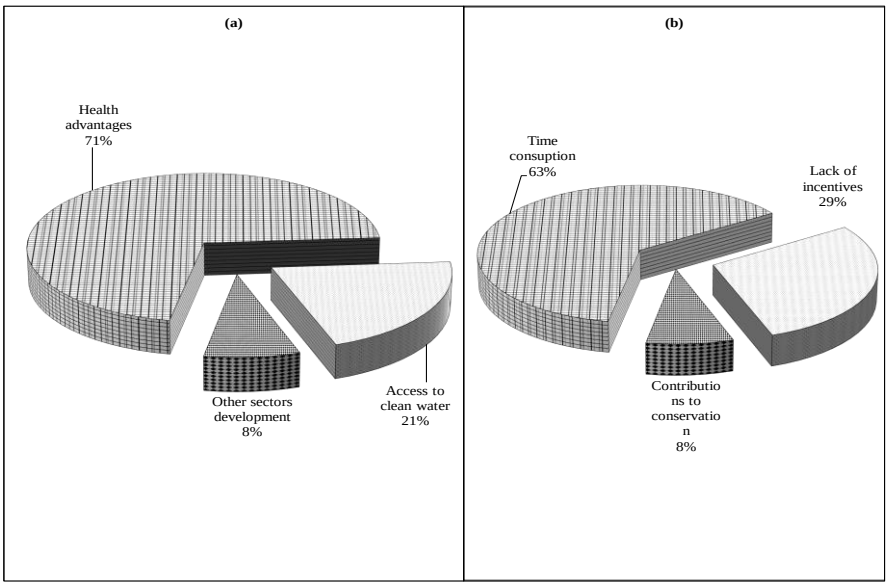

Figure 4.13: Perceived benefits and costs from WCAs

Village wise Figure 4.14 reveal that, 15.2%, 6.7%, and 4.3% of respondents in Sangasanga; 18.1%, 4.3%, and 1.4% in Vikenge; 21.4%, 3.8%, and 1% in Changarawe; while, 16.7%, 5.7%, and 1.4% in Tangeni village perceived health advantages (diseases and death control), access to clean water, and development of other sectors respectively, as benefits associated with WCAs. Hitherto, Figure 4.15 shows that 12.9%, 8.6%, and 4.8% of respondents in Sangasanga village perceived time consumption, lack of incentives, and contributions to conservation activities respectively, as the costs associated with WCAs. Likewise, 15.2%, 6.7%, and 1.9% of respondent in Vikenge; 17.6%, 7.6%, and 1% in Changarawe; and 17.1%, 6.2%,

and 0.5% in Tangeni villages perceived time consumption, lack of incentives , and contributions to conservation activities respectively as costs from WCAs.

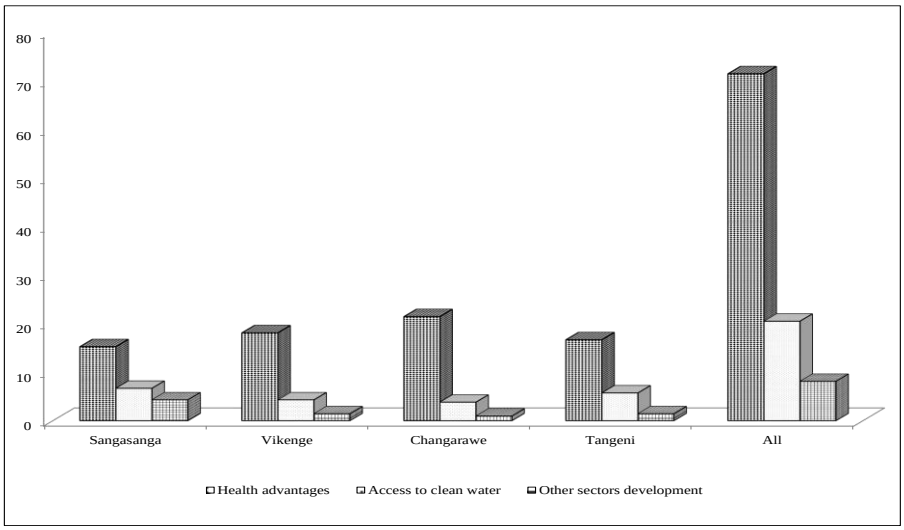

Figure 4.14: Perceived benefits from WCAs by villages

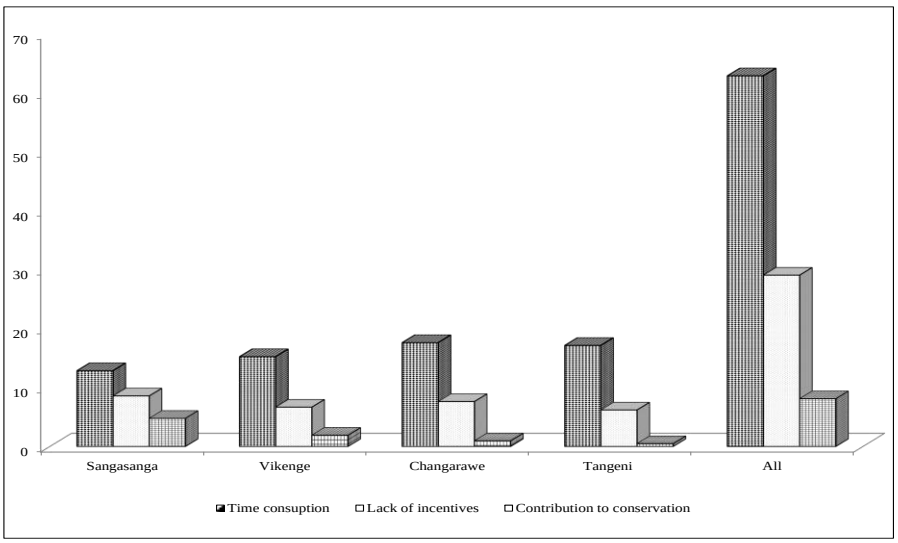

Figure 4.15: Perceived costs from WCAs by villages

4.3 Econometric Results

This section displays the estimated results of the Probit Regression Model expressed in chapter three as equation (3.10) regarding the factors influencing households' WCB. Subsection 4.3.1 provides the correlation results, followed by Probit regression model results in 4.3.2; while subsection 4.3.3 gives the diagnosis results of the Probit regression model covering model specification error test, the model goodness of fit, and multicollinearity test.

4.3.1 Variable descriptive analysis

Table 4.13 exhibit the descriptive analysis of all the variables in the model covering their mean and standard deviation. All the variables in the model bears the same number of observations, thus 210. However, for a meaningful presentation the statistics covering the min and max were neglected as twelve out of fifteen variable, are dummy variables.

Table 4.13: Variable descriptive summary

Variable	Observation	Mean	Std. Dev.
Aged*	210	0.410	0.493
Male*	210	0.581	0.495
Married*	210	0.733	0.443
Widow*	210	0.019	0.137
Education	210	8.105	2.319
Household size	210	3.167	1.668
Income	210	408565.300	207430.400
Participation*	210	0.367	0.483
Environmental knowledge*	210	0.390	0.489
Attitude*	210	0.205	0.404
Subjective norm*	210	0.205	0.404
Perceived behavioural control*	210	0.862	0.346
Land ownership*	210	0.324	0.469
Benefits from WCAs*	210	0.719	0.451
Costs from WCAs*	210	0.333	0.473

* represent a dummy variable

4.3.2 Correlations for Probit model variables

Correlation exhibits the relationship among the explanatory variables so as to determine a unique coefficient of the respective variable. The correlation among explanatory variable is inevitable, however, concern should be raised to variables

that are highly correlated. Therefore, Appendix XIV reveals the results of correlation test, such that none of the explanatory variables are highly correlated to the degree that concern should be raised.

4.3.3 Factors influencing households' WCB

Table 4.14 exhibit the results of Probit regression model which cover all the independent variables, their respective coefficients, marginal effects, significant levels and standard errors; it further reveal the Chi-Square, log-likelihood value and Pseudo R- square. Pertaining the joint test of significant of all variables in the Probit model, the results in Table 4.14, exhibit a Chi-square of 205.87 (df=15) and *p-value* of 0.0000 which implies that all variables predict the model correctly at 1% level of significance. The results further implies the acceptance of alternative hypothesis, and rejection of null hypothesis that households' WCB is not influenced by its predictors (say, aged, gender, marital status, education level, income, household size, participation, environmental knowledge, attitude, subjective norms, perceived behavioural control, land ownership, benefits and costs from WCAs). Moreover, pseudo R- squared of 0.714 from Probit regression implies that, explanatory variables explain the variation in the dependent variable (WCB) by approximately 71%; while they does not explain it by approximately 29%. However, the subsequent results are of each explanatory variable in the Probit regression model, beginning with the variables found to be statistically significant.

Education of households

Table 4.14 reveals that the education of an individual household has a positive influence on WCB, and statistically significant at 5% level ($p<0.05$). It further has a marginal effect of 0.02 such that other things being equal, an increase in the number of years spent in school by an individual household would result in a 2% probability of adopting water conservation behaviour.

Average monthly income of households

Table 4.14 shows that income of households has a negative statistically significant influence on WCB at 10% level ($p<0.1$). It has a negative marginal effect coefficient of -0.093, such that under ceteris paribus, the probability of an individual household

to adopt a water conserving behaviour decrease by 9.3% following a unit increase in his income.

Table 4.14: Probit regression model results: WCB as a dependent variable

Explanatory Variables	Coefficient (Std. Errors)	Marginal Effect (Std. Errors)
Aged	0.389	0.042
	(0.478)	(0.052)
Male	0.319	0.034
	(0.356)	(0.038)
Married	-0.556	-0.060
	(0.542)	(0.059)
Widow	-0.0372	-0.004
	(1.018)	(0.110)
Education	0.182 **	0.020 **
	(0.0844)	(0.009)
Household size	0.171	0.018
	(0.174)	(0.019)
Income	-0.858 *	-0.093 *
	(0.479)	(0.052)
Participation	1.495 **	0.161 **
	(0.613)	(0.066)
Environmental knowledge	1.910 ***	0.207 ***
	(0.578)	(0.060)
Attitude	0.948 **	0.102 **
	(0.389)	(0.042)
Subjective norm	0.239	0.026
	(0.428)	(0.046)
Perceived behaviour control	0.767	0.083
	(0.515)	(0.056)
Land ownership	0.250	0.027
	(0.432)	(0.047)
Benefits from WCAs	-0.902	-0.097
	(1.513)	(0.164)
Costs from WCAs	-1.216	-0.131
	(1.507)	(0.163)
Constant	7.954	
	(6.276)	
Number of observations		210
LR chi2(15)		205.87
Prob > chi2		0.000
Log-likelihood value		-41.251
Pseudo R-squared		0.714

Note: ***; **; and *; represent a significant level at 1% *(P<0.01)*; 5% (*p<0.05)*; and 10% (*p<0.1)* respectively.

Participation in WCAs

Again, Table 4.14 reveal that participation in WCAs by an individual household has a positive influence on WCB, and statistically significant at 5% level ($p<0.05$). It further reveal a marginal effect coefficient of 0.161, such that other things held

constant, households who participate in WCAs are 16.1% more likely to adopt water conserving behaviour compared to none participant households.

Environmental knowledge

Table 4.14 reveal a positive influence of environmental knowledge on household's WCB. Environmental knowledge is statistically significant at 1% level ($p<0.01$) with a marginal effect coefficient of 0.207. The marginal effect coefficient implies that other things being equal, households having environmental knowledge are 20.7% more likely to adopt water conserving behaviour compared to households lacking environmental knowledge.

Attitude toward WCAs

Attitude is also statistically significant at 5% level ($p<0.05$), and has a positive influence on the household's WCB. With a marginal effect coefficient of 0.102, it implies that, other things being equal, households with a positive attitude towards WCAs are 10.2% more likely to adopt water conservation behaviour compared to households with negative attitude (See, Table 4.14).

Age of a household

Table 4.14 further reveals that, age of a household (base category is household below 35 years) has a positive influence on WCB, yet statistically insignificant. It also has a marginal effect coefficient of 0.042; such that, other things being constant, households aged 35 years and above are 4.2% more likely to adopt water conserving behaviour compared to households below 35 years.

Marital status of a household

Table 4.14 shows that marital status of households presented with single status as a base category, is statistically insignificant but with a negative influence on WCB in case of a widow (marginal effect of -0.004); and married households (marginal effect of -0.060) as well. These marginal effect results implies that, other things held constant, married respondents are 6% less likely to be water conserver compared to single respondents; while widows are 0.4% less likely to avid water pollution activities compared to single households.

Gender (Sex)

Table 4.14 reveal that gender (male) represented by female as a base category, has a positive influence on WCB, yet statistically insignificant. With a marginal effects of 0.034 implies that, other things being equal, male respondents are 3.4% more likely to be water conserver (often avoid water pollution activities) compared to their opposite sex.

Household size

Table 4.14 shows that holding other things constant; an increase in the number of family member increases the likelihood of an individual household to adopt a conserving behaviour by 1.8% (marginal effect of 0.018). However, the size of the household has a positive influence on WCB, yet statistically insignificant.

Subjective norm

A subjective norm as depicted in Table 4.14 has a positive influence on WCB, yet statistically insignificant. It has a marginal effect coefficient of 0.026, such that other things being constant; households who agree that there is social pressure towards WCAs are 2.6% more likely to be water conserver (avoid water pollution activities) compared to those who disagree.

Perceived behavioural control

Furthermore, Table 4.14 reveals that perceived behavioural control has a positive influence on WCB, however statistically insignificant. It has a marginal effect coefficient of 0.083 such that, under ceteris paribus, households who agreed that there is easiness towards participation in WCAs are 8.3% more likely to adopt WCB compared to those who perceived difficulties towards WCAs.

Land ownership

As depicted in Table 4.14, land ownership has a positive influence on WCB, however not statistically significant. It has a marginal effect coefficient of 0.027 such that, other things being constant, households who own lands are 2.7% more likely to adopt WCB through participation in WCAs compared to those have no land.

Benefits and costs from WCAs

Table 4.14 further reveal that both benefits and costs from WCAs have a negative influence on households' WCB; with marginal effect coefficients of -0.097 and -0.131 respectively. These marginal effect coefficients imply that, other things being the same, households who perceive that WCAs creates benefits are 9.7% less likely to adopt WCB compared to those who perceive otherwise. Yet, those who perceived that WCAs creates costs are 13.1% less likely to adopt WCB compared to households who perceive otherwise.

4.3.4 Probit Regression Model Diagnostics results

The results of Probit regression model diagnostics test covers model specification error test, model goodness-of-fit test and test for multicollinearity. However, the results displayed herein are made with reference to specific condition (say, rule of thumb) narrated in subsection 3.7.2.2 of chapter three.

4.3.4.1 Model Specification Error Test

Linktest results for model specification error test as depicted in Appendix VIII reveal that *_hat* is significant at 1% level $p<0.01$ and *_hatsq* is statistically insignificant such that neither of relevant variables were omitted nor irrelevant variables were included in the model. The result further implies that the use of Probit link function was the right call and it was correctly specified.

4.3.4.2 Model goodness-of-fit test

For the case of our Probit regression model, the log likelihood of the current model is 144.18648 and that of intercept-only model is 41.250785; such that log-likelihood Chi-square is 205.87, thus (144.18648-41.250785)*2. On the other hand, pseudo R-squared is 0.7139, thus {(144.18648-41.250785)/144.18648}. Stalling to these results, the Probit model proves to obey the rule of thumb; and the model actually fits the data. Alternatively, Hosmer and Lemeshow's goodness-of-fit test results as depicted in Appendix IX, reveal that the expected and observed frequencies in most of the groups closely matches; while *p-value*=0.172 is greater than *p-value*=0.05; implying that the Probit regression model fits the data. Eventually, Appendix XIV shows that the overall classification was correctly estimated at a rate of 93.33%;

while the normal weight group was correctly classified at 95.73% and 90.32% for the low weight group.

4.3.4.3 Multicollinearity Test

The results of multicollinearity test as depicted in Table 4.15 reveals that our model obeyed the rule of thumb, and multicollinearity is not a serious concern as the Variance Inflation Factor (VIF) for our model's explanatory variables are between 1-6.60.

Table 4.15: Multicollinearity test

Variables	VIF	SQRT VIF	Tolerance	R- Squared
WCB	4.07	2.02	0.2454	0.7546
Aged	2.30	1.52	0.4353	0.5647
Male	1.22	1.10	0.8207	0.1793
Married	2.45	1.57	0.4080	0.5920
Widow	1.31	1.14	0.7634	0.2366
Education	1.70	1.31	0.5870	0.4130
Household size	3.88	1.97	0.2581	0.7419
Income	1.27	1.13	0.7880	0.2120
Participation	5.33	2.31	0.1878	0.8122
Environmental knowledge	6.50	2.55	0.1539	0.8461
Attitude	1.13	1.06	0.8870	0.1130
Subjective norm	1.17	1.08	0.8576	0.1424
Perceived behaviour control	1.05	1.02	0.9530	0.0470
Land ownership	1.37	1.17	0.7281	0.2719
Benefits from WCAs	5.02	2.24	0.1990	0.8010
Costs from WCAs	4.89	2.21	0.2044	0.7956
Mean VIF				**2.79**

CHAPTER FIVE
DISCUSSION OF THE FINDINGS

5.1 Overview

This chapter provide detailed information and arguments of the findings presented in chapter four regarding households behaviour towards WCAs. The aim of this study was to establish the general understanding on the extent of households' participation in WCAs, costs and benefits from WCAs, and factors (both socio-economic and psychological) that influences WCB. Regarding participation, the study examined the households' awareness on practiced WCAs, ways and their extent of participation and reasons for (not) participating in WCAs. On the other hand, study considered age, gender, marital status, household size, education level, and income; participation in WCAs, attitude, subjective norm, perceived behavioural control, land ownership, benefits and costs from WCAs as factors influencing WCB. Being the case, the key findings relevant to the study objectives are discussed in the subsequent sections.

5.2 Extent of households' participation in WCAs

Table 4.7-11 provides clear evidence that majority of households in Mzumbe ward are not fully aware of the practiced WCAs in their area; yet, majority are limitedly participating in them. Furthermore, the findings justifies the scarcity of WCAs in the study area, in which case the households were able to identify only three practiced WCAs (say digging holes for domestic waste disposal; digging traditional trenches for wastewater; and general cleanliness). On the other hand, only limited number of households' proportion participated in WCAs were highly participating while the majority of them were just participating. Since the study is centred in rural context, these results differ from those of previous studies (See, Adams, 2014; Aprile & Fiorillo, 2017; Arbues et al., 2015; Chang, 2013) that are mostly centred in urban context in which most of the population are educated and well aware of conservation initiatives. Similarly to the study by Biratu and Asmamaw (2016) most of the households participated in WCAs in terms of meetings, labour contribution, information sharing while others through protection and maintenance.

Moreover, the results depicted in Figure 4.9 confirmed that most of the individual household do not consider themselves responsible for administering WCAs in their area. This is well evidenced as majority of households return the burden firstly to local government as the responsible organ for administering WCAs, seconded by community at large. Again, majority of households did not participate due to time limitation, as they would rather spend time in the farm which provides most of their basic needs. Also, incentive expectation which was not deemed was among the reasons for other households do not participate in WCAs. While others claimed lack of information to be a major obstacles towards participation in WCAs despite their lack of interest to obtain environmental issues' information; other households took advantage of poor enforced law regarding water conservation. Similarly to previous studies by Aprile and Fiorillo (2017) and Fielding et al, (2012), households in different social groups (social capital) in the study area were well influenced to participate in WCAs despite the few social groups (say village water council, VICOBA, and Bodaboda driver associations) and smaller number of households as members. Therefore, it is important for the local government authorities and other stakeholders to establish conservation campaigns that create awareness among rural households, which will consequently make conservation practices a personal interest for a successful adaptation of conservation initiatives.

5.3 Benefits and costs from WCAs

It is unlikely for any intervention not to be associated with benefits or costs derived from it. Being the case, Figure 4.13(a) revealed that majoirty of respondents reported to deriver health associated benefits in terms of diseases prevention and death control. Nevertheless, as a support to the findings of previous studies (See, Cosgrove & Loucks, 2015; Febriani, 2017), access to clean water and development of other sectors are among other benefits derived from WCAs. Hirtherto, the benefits identified appear to have link, such that with the access to clean water it is ultimately convenient to control waterborne diseases which ultimately reduce cost of treatement to diseases such as cholera. Furthermore, households' health improvement will provide healthy and readily available man power to other sectors like agriculture which is a dominant activity performed by the majority (31.4%) of households.

Figure 4.13(b) on the other hand confirmed that, there are costs associated with WCAs. Despite the case that these costs are not serious as one can thought of, majority of respondents sees WCAs as time consuming with lack of incentives attached to it; consequently households devote their time in farming activities which provides for their basic needs. Nevertheless, frequent contributions to conservation activities (though to a very smaller extent) was also identified as among the costs associated with WCAs. Eventually, in relation to WCB, costs are more likely considered to create challenges towards participation in WCAs. This finding is similar to those of Febriani (2017) and Cosgrove and Loucks (2015). Therefore, benefits and costs are usually expected from any initiatives, such that it is vital for the conservation stakeholders and relevant authorities to neutralize the costs created by conservation initiatives while controlling the benefits among households to avoid a free-riding problem.

5.4 Factors influencing households' WCB

Table 4.13 reveals that education of household, households' monthly average income, household's participation in WCAs, environmental knowledge and attitude of household towards WCAs are the factors which significantly influence households' WCB.

Education level of households is statistically significant, with a positive coefficient sign as expected. This implies that, all other variables held constant, households with higher level of education or with increasing years of schooling are more likely to be water conserver through avoiding water pollution activities. This is the case since households who have attained higher level of education or spent more years in schools are well aware, and informed of present WCAs. Yet, they are in possession of knowledge concerning environmental issues, associated consequences; and respective conservation practices. This result supports the findings of other previous studies (See, Dupont & Renzetti, 2013; Maas, et al., 2017; Moges & Taye, 2017) and contradicts the findings of studies by Adams (2014), Aprile and Fiorillo (2017), and Fan, et al (2014). Therefore, it is important for the responsible authorities to ensure

access to education for all the households in rural context so as to control the emerging water pollution activities and encourage participation in WCAs.

Monthly average income of household was found to be statistically significant on influencing households' WCB; however, bearing an expected negative sign. The negative sign implies that, other thing being constant, increase in households average monthly income, decreases the likelihood that an individual household avoid water pollution activities, thus adopt WCB. This may be contributed by the fact that farming activities dominate the share of total income and it increase to a rate that cover only their basic needs, failing to support other facilities such as better sanitation. These results however support the findings of previous studies (see, Adams, 2014; Aprile & Fiorillo, 2017; Fan et al., 2014; Fielding,et al., 2012); yet contradict the findings by Dupont and Renzetti (2013) that households with higher income are more of water conserver than those with lower income. Being the case, it is important for the local authorities and other stakeholders to design other non-farming income sources to boost rural households' income. This will allow them to finance their basic needs and yet pay for other services such as good sanitation to avoid pollution activities.

Participation in WCA is among the unique variable that is not considered in past studies and is found to be statistically significant in influencing households' WCB. By bearing an expected positive sign it implies that the likelihood of an individual household to avoid water pollution activities increases as often he or she participate in WCAs. This is necessarily the case since household participating in WCAs are more likely to develop a pro-environmental conservation behaviour through conservation meetings they attend, labour contribution and through protection and maintenance of environment. Also, because most of the households with higher level of education are the main participant in WCAs. Therefore, these findings support those of Biratu and Asmamaw (2016). However, it is important for the local authorities and other stakeholders to encourage participation in WCAs as it provides an individual household with a chance to practically exercise conservation initiatives

as a personal interest act; yet, it strongly influence water conserving behaviour of households.

As expected environmental knowledge on the other hand has a positive sign and significantly influence households' WCB. The sign implies that an increase in households' knowledge pertaining environmental issues and associated consequences will more likely increase his or her water conserving behaviour, thus strong WCB. This is consider to be the case, an individual who has a sound environmental knowledge are the one with higher level of formal education able to access environmental information from different sources (say radio and TV, reading newspaper and magazines, training and programmes). Yet, this results support the theoretical approach by Stern and Dietz (1994), such that household conserve the environment if consequences on it affect them personally (Egoistic) or others (Altruistic). This result further supports the findings of previous studies by Adams (2014) and Aprile and Fiorillo (2017). However, it is important to take environmental knowledge into consideration since unlike formal education, it can be valuable to influence the conservation behaviour of rural households who can not afford formal education. Furthermore, this variable requires further research in both rural and urban context to find out if there is any difference in arguments with regards to WCB.

Attitude of households is also among the factors that influence WCB in a positive manner as expected. The sign implies that, the stronger the attitude of household towards WCAs, the stronger the intention to conserve water. This result supports the theory of planned behaviour by Ajzen (1991) and the theory of reasoned action by Fishbein and Ajzen (1975); thus, an individual household strongly perform certain behaviour when his attitude gets stronger regarding such behaviour. These results are consistent with the findings of Abraham et al. (2016), Chang (2013), Fan et al. (2014), and Fielding et al (2012). However, attitude is an intrinsic feature of an individual household which influences his decision toward conservation. Being the case, it is important to local authorities and other conservation stakeholders to initiate

activities that trigger the positive side of an individual toward conservation initiatives in their area.

The results depicted in Table 4.13 further exhibit that age of households, gender (male), marital status (married and widow), households size, benefits and costs from WCAs, and psychological factors (perceived behavioural control and subjective norms) are statistically insignificant on influencing households' WCB. However, unexpectedly, age of household bear a positive sign implying that, other things being equal, the older an individual household become, the more likely he or she avoids water pollution activities in his area. This is happen to be the case since elders are believe to be capable of making matured decision to protect the environment compared to youths. Furthermore, these results contradicts the findings of previous studies (See, Fielding et al., 2012; Moges & Taye, 2017) while on the other hand consistent with the findings of Aprile and Fiorillo (2017) and Fan et al. (2014) who postulated that older households are more likely to be water conserver. Therefore, since the majority of households fall under youth category, it is crucial to channel conservation initiatives through youths for a successful implementation of such initiatives.

Gender represented by a dummy male who are believed to spend less time at home with less domestic chores that are subjected to water pollution activities, was found to be more of water conserver as expected than their opposite sex. This results must have been triggered by the fact that most of the respondents with higher level of education and possession of environmental knowledge were men, unlike their opposite sex. Pertaining marital status, as expected households who are married (similarly to widows) were less likely to avoid water pollution activities compared to singles. These results support the findings of Aprile and Fiorillo (2017) and Fan et al (2014); and inconsistent with the findings of Adams (2014). Culturally, in most of rural areas especially of developing countries men have a final say, thus initiating conservation activities through them will yield better fruits and boost household conservation behaviour.

Household size unexpectedly exhibited a positive sign in relation to WCB, implying that under ceteris paribus, an increase in the number of a family member will increase the likelihood of such households to avoid water pollution activities. This is the case as households with a larger number of a family member are more likely to engage in WCAs through labour contribution. This finding is consistent with that of Aprile and Fiorillo (2017), Fielding et al. (2012), yet contradict that of Dupont and Renzetti (2013).

Regarding the psychological factors, perceived behavioural control and subjective norm, both exhibited an expected positive sign in relation to WCB. As the support to theory of planned behaviour by Ajzen (1991) and theory of reasoned action by Fishbein and Ajzen (1975), this result implies that the stronger the subjective norm and the greater the perceived behavioural control, the more likely the individual household will engage in WCAs and avoid water pollution activities. These results contradict the argument by Chang (2013) and Fielding et al. (2012) who postulated that subjective norm (presence of social pressure on an individual household toward conservation) significantly influence WCB. Therefore, involving community at large and creating easiness while neutralizing the difficulties towards participation in conservation activities is a crucial strategy to encourage water conservation behaviour among households in rural areas.

Especially in rural context of developing countries, land ownership is believed to have a significant role in decision making. Despite of portraying a none significant influence on household's WCB, land ownership has an expected positive sign implying that an increase in the size or number of land owned by an individual household would increase the likelihood of such an individual household to avoid water pollution activities. Thus, individual owning land are believed to dominate decision making process (say, to engage in WCAs) than households without such ownership. This result is consistent with Behrman (2017) and Kwayu et al. (2014). However, a weak positive correlation observed between land ownership and WCB, implies that land ownership can only influence WCB to a very smaller extent. Therefore, since land is generally owned by the government, few households literally

owned the land. This implies that land ownership is of no significant urgent to be considered as among the key means for building a strong WCB among households.

Finally, both benefits and costs created from WCAs revealed a negative sign in relation to WCB despite of being statistically insignificant. Benefits from WCAs exhibited unexpected sign implying that increase in the benefits derived from WCAs will less likely motivate households to avoid water pollution activities. This is unusual , but it might be trigger by the fact that people are more of free rider in regards to social desired services. Thus, they would rather enjoy the benefits from WCAs than devoting their time to participate and avoid pollution activities. This argument support the theoretical approach of Stern and Dietz (1994) regarding biospheric environmental concerns. On the other hand, costs from WCAs gave the expected sign implying that, other things being equal, increase in costs from WCAs would less likely motivate an individual household to participate in WCAs; consequently poor behaviour towards water conservation. This argument is necessarily the case as households in most rural area of developing countries are more sensitive to costs associated with a certain intervention than the benefits derived from it. These argument further supports the theoretical approach of Stern and Dietz (1994) regarding egoistic environmental concern, thus, households neglect to conserve the aspect of environment if they perceive personal costs to be high. These results are consistent with Cosgrove and Loucks (2015) and Febriani (2017) who postulated that individual household facing challenges in WCA are less likely to be water conserver.

In a nutshell, water conservation is completely a socially desired act which may result to an overstatement of households' information regarding conservation behaviour; consequently, mismatch among key factors determining WCB and underestimation of their relationships. Again, the findings support the theory of reasoned action that all socioeconomic variables are external variables that indirectly influence psychological variables towards performing a particular behaviour. Eventually, the findings of this study are satisfactory relatively to past water conservation studies.

CHAPTER SIX
SUMMARY, CONCLUSION, AND POLICY IMPLICATIONS

6.1 Overview

This chapter take into account of the entire study summary and conclusion; policy implication and winding up with suggested area for future studies.

6.2 Summary and Conclusion

The study aimed at examining households' behaviour towards water conservation activities. Specifically it intended to examine the extent of households' participation in WCAs; costs and benefits from it and finally, the factors influencing households' WCB. To achieve this, a convergent parallel mixed method was employed to study 210 sample representatives in all four villages of Mzumbe ward. Prior to interpretation both descriptive and inferential statistics were employed to analyse the data collected from respondents. Therefore, next is the summary and conclusion of the discussed results.

Concerning the extent of households' participation, majority (60.5%) of the respondents are not aware of the practiced and not participating in WCAs; yet, there are only few WCAs (say, digging holes and traditional trenches for waste disposal; and general cleanliness). Moreover, majority of households (19.5%) consider lack of time to be the reason for not participating being preoccupied with farming activities; while 18.1% expected incentives that were in vain. Stalling to such results, participation in WCAs seems to be not a willing act among households as majority of them (60%) turned the burden of administering WCAs to local government and not individual households. Nevertheless, those who participated (39.5%) was highly because of strictly village follow up (14.3%) while only few (4.3%) for personal interest. However, lack of environmental knowledge, limited in social groups that would have influence the households to participate; and scanty access of environmental issues' information from different sources such as media deteriorates the participation rate of households in WCAs.

Pertaining benefits and costs from WCAs; the majority of benefits are dominated by health advantages (71%) than non-health benefits (29%). However, health-associated benefits are in term of water-borne diseases prevention and death control; while none-health includes access to clean water (21%) and development of other sectors or activities (8%). Surprisingly, the majority of the households acknowledge the benefits derived from WCs, yet are reluctant to participate in conservation activities. On the other hand, costs created by WCAs are not serious, since time consumption (63%) is the major associated cost; such that households would rather spend time in farming activities which render them basic needs than in conservation activities.

Finally, few factors turn out to be of significant influence on household's WCB after running a Probit regression model. Only average monthly income and environmental knowledge are statistically significant at 10% and 1% level respectively; while attitude of households, education level and participation in WCAs are significant at 5% level. On the other hand, other factors such marital status, benefits, and costs from WCAs negatively influence households' WCB, yet, statistically insignificant. Nevertheless, gender, household size, subjective norm, perceived behavioural control, and land ownership are statistically insignificant but positively influence households' WCB.

Conclusively, lack of participation in WCAs in the study area remains a challenging act among majority of households. However, despite all the causes of problem pointed out, lack of personal interest by individual households make the whole process of participation to become obstacle-ridden. Consequently, it increases burden to local government authority on administering WCAs. On the other hand, benefits derived from WCAs cannot be considered as a bargaining chip for intensive households' participation in WCAs as the results indicate majority of the households to be free riders. Generally, formal education, participation in WCAs, positive attitude of households and sound knowledge regarding the environmental issues and its consequences are paramount important towards influencing households' conservation behaviour.

6.3 Policy implication

The results confirmed that majority of the households are not aware of the few practiced WCAs, yet not participating. Nevertheless, majority of them participated because of strictly village follow-up rather than personal interest; while other did not participate due to lack of time and incentives associated with WCAs. Being the case, designing sound water conservation initiatives, sufficient investment in media to create awareness, and creation of incentives associated with the designed initiatives; altogether have significant impact on enhancing WCB in rural areas. Therefore, policy makers can take such issues into consideration in designing future policies which promote water conservation, especially in rural context.

Regarding social capital, the results reveal the presence of very limited social groups which are crucial towards influence WCB among households in rural areas. Since the rural areas are dominated by informal groups or social networks such as UPATU, VICOBA, and Boda-boda driver associations to mention the few; future policy interventions supporting informal groups can enhance WCB among households. However, this is necessarily possible as policy makers can fairly take advantage of the informal groups in rural areas to conduct conservation training, meetings, discussions, and promote information flow.

Moreover, marginal analysis results reveal that households' education, income, participation in WCAs, attitude and environmental knowledge which could be easily supported by policy intervention have a significant influence towards avoiding water pollution activities (WCB). Therefore, investment in the formal education system; programs that impose positive conservation attitude and provision of sufficient environmental knowledge stall as a future policy option towards enhancing strong WCB in rural areas.

Marginal analysis results further reveal that other factors such as gender, household size, subjective norm, perceived control and land ownership have a positive influence on WCB. Henceforth, using men who are more likely to have influence on decision making process in rural areas; and larger family size that can contribute labour in conservation activities is a crucial future conservation policy options. Nevertheless,

encouraging social pressure to households (subjective norms) while creating easiness and neutralizing difficulties (perceived behavioural control) towards participation in WCAs also underline the future policy options to be considered by policy makers and other stakeholders towards enhancing strong WCB among households; and conveniently achieve SDGs goal 6.

Eventually, the outcome of this study accommodate the households' lifestyles, their behavioural groupings and complexity which are crucial as future policy options towards enhancing WCB among households. These concepts are further important to policy makers who successfully desire to enhance WCB since a 'simple-one-policy-fits-all approaches' is less likely to provide sound and meaningful outcomes.

6.4 Research limitations

Despite the desirable outcomes of the current study, it also associated with number of limitations. Firstly, the study used a sample size of 210 respondents whom are randomly selected based solely from Mzumbe ward villages of Mvomero district. For that reason, such sample may not accommodate the generalizability purpose; importantly calling for caution while extending these results to other rural areas in the country. Nevertheless, such sample limit the strength of representativeness as the households interviewed might have been of more interest to water conservation than it would have been the case for the entire population. Therefore, it is of greater importance to policy makers and other stakeholders wishing to design strategies that accommodates broader population to understand the WCB of other areas country wise.

Secondly, since water conservation is socially desirable, information collected from respondents (households) might have been subjected to biases. Thus, households might have overstated their WCB; consequently, deteriorating the relevance of variables at hand; yet underestimate their stated relationship. Furthermore, the current study is dominated by cross-sectional data that limit the establishment of causal relationship between variables. For instance, it is quite challenging to fully establish the interaction between households and environmental knowledge in the

absence of longitudinal data which allows the assessment of households' water conserving behaviour before and after impacted with environmental knowledge.

6.5 Area for further studies

In line with the stated limitation of the current study, future similar studies in different rural area of the country, extended to all key actor groups with the greater representative sample is highly desirable. Therefore, such studies will provide detailed information regarding WCB; which is of great importance to policy makers and other stakeholders in designing water policies, strategies and initiatives for a broader community.

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APPENDECES

Appendix I: Questionnaire for Household behaviour toward water conservation in Mvomero District, Tanzania

Questionnaire Number: _____

Date: _____

Name of interviewer: _____ (Optional)

Ward: _____

Location (Street/Village): _____

Telephone number (if available) _____

A:	**Identification**

First of all, I would like to thank you for taking the time for this interview. My name is LAMECK, Emanuel and I am collecting data for a Master Dissertation with the purpose of investigating the household behaviour towards water conservation in Mvomero District, Tanzania. In total, I will talk to 210 households in Mzumbe ward- Mvomero, District. The findings of this study will be essential for conservation of water from pollution activities in your area, thus preservation, control and development of water resources and prevention of pollution. This is made possible as the results will provide vital recommendations to policy makers in local authority and other stakeholders in Mvomero district. Eventually, the data collected will be used for analysis only, with no reference to specific households or their names in the final published report.

B: General Information

S/N	Question	Response			
1	Age of household head	_____ Years			
2	Gender of household head	[ ] Male [ ] Female			
3	Marital Status of household head	[ ] Single [ ] Married [ ] Widow [ ] Divorced			
4	How many years of formal education do you have?	_____ Years			
5	Which level of formal education have you received?	[ ] None [ ] Primary Education [ ] Secondary Education [ ] College or University			
6	How many members are in your household?	_____ Numbers			
7	Number of household members (apart from the household head), their respective age, gender and education level	Number	Sex (M/F)	Age (years)	Years of formal education
		01			
		02			
		03			
		04			
		05			
		06			
		07			

Question 8 (a)	**Occupation/ Activity**	**Source of income**	**Estimated Amount in TZS**	**Rank in number**
What is/are your source(s) of income?	Self-employed as farmer [ ]	Farming Activities		
	Self-employed as livestock keeper [ ]			
	Self-employed as a labourer [ ]	Wages		
	Government employee [ ]	Salary		
	Private sector employee[ ]			
	Retired [ ]	Pension Fund		
	Self-employed as Trader [ ]	Profit from Business		
	Self-employed as Consultant [ ]			
	Investor [ ]	Interest		
	Land lord [ ]	Rent		
	With other activities [ ]	Remittances from relatives		
	Without other activities[ ]			
	Other Cash Income (Specify) _____			
	Total Monthly Income			
Question 8 (b)	**Consumption type**		**Average cost per month**	**Total Average**
What is the average household expenditure on the following?	food			
	drinks			
	Clothes			
	Water bill			
	Electricity bill			
	Cooking energy			
	House rent			
	Transport			
	Health services			

	Fee		
	Assisting others		
	Other social ceremony costs		
	Farm preparations cost		
	Others _____		

Question 9: How serious is water pollution a problem in your area?

[ ] Extremely serious [ ] Serious [ ] Hard to tell

[ ] Not serious [ ] definitely not serious

Question 10: How often are you careful in avoiding water pollution activities in your area?

[ ] Always [ ] Sometimes [ ] Seldom [ ] Never

C: Households' Participation and Water Conservation Activities

Question 11: Are you aware of the present water conservation activities in your area?

[ ] Yes (Go to question 12) [ ] No (Go to Question 13)

Question 12: Which water conservation activities are practiced in your area?

_____

Question 13: Do you participate in water conservation activities in your area?

[ ] Yes (Go to Question 14) [ ] No (Go to Question 15)

Question 14: What is/are the reason(s) for participating in water conservation activities?

[ ] law enforcement [ ] Strict by-laws [ ] Penalties

[ ] Strict village follow-up [ ] Personal Interest

[ ] Environmental Knowledge [ ] Others (Please specify)

_____

Question 15: What is/are the reason(s) for not participating in water conservation activities at your area?

[ ] Lack of time [ ] Lack of incentives [ ] Absence of laws

[ ] Lack of information [ ] Lack of Environmental Knowledge

[ ] Others (please specify)

_____

Question 16: In which way do you participate in water conservation activities in your area?

[ ] Meetings [ ] Information sharing [ ] Labour contribution

[ ] Training and programmes [ ] Protection and maintenance

[ ] Others (please specify)

_____

Question 17: Is/are there any appropriate area/place(s) to dispose/discharge waste as a water conservation strategy?

[ ] Yes (Please mention below) [ ] No

_____

Question 18: Who is responsible for administering water conservation activities at your area?

[ ] Individual household [ ] Non-Governmental Organization

[ ] local government [ ] Community at large

[ ] Others (Please specify)

_____

Question 19: To what extent would you agree that household participate in water conservation activities at your area?

[ ] Strongly Disagree [ ] Disagree [ ] Neutral [ ] Agree

[ ] Strongly Agree

Question 20: To what extent do you participate in water conservation activities in your area?

[ ] Highly Participating [ ] Participation [ ] Moderately

[ ] Not Participating [ ] Completely not participating

D:	Psychological factors and Water Conservation Activities

- **Attitude of the household**

Question 21: How do you perceive water conservation activities?

[ ] Extremely Good [ ] Good [ ] Neutral [ ] Bad

[ ] Extremely Bad

Question 22: How important are water conservation activities at your area?

[ ] Very important [ ] Important [ ] Unsure

[ ] Unimportant [ ] Completely Unimportant

- **Subjective Norms**

Question 23: Are there any groups involved in water conservation activities in your area?

[ ] Yes (Go to Question 24) [ ] No (Go to Question 26)

Question 24:

a) Please mention these groups

_____

b) Are you a member in any of the above mentioned group?

[ ] Yes (Go to Question 25) [ ] No (Go to Question 26)

Question 25: To what extent do these groups influence you to conserve water in your area?

[ ] Highly Influenced [ ] Influenced [ ] Moderately

[ ] Not Influenced [ ] Completely Not Influenced

Question 26:

a) It is expected of me that I conserve water in my area

[ ] Strongly Agree [ ] Agree [ ] Neutral [ ] Disagree

[ ] Strongly Disagree

b) I feel that there is a social pressure to conserve water in my area

[ ] Strongly Agree [ ] Agree [ ] Neutral [ ] Disagree

[ ] Strongly Disagree

c) People who are important to me want me to conserve water in my area

[ ] Strongly Agree [ ] Agree [ ] Neutral [ ] Disagree

[ ] Strongly Disagree

- **Perceived Behavioural control**

Question 27:

a) I am confident that I could conserve water in my area if I want to

[ ] Strongly Agree [ ] Agree [ ] Neutral [ ] Disagree

[ ] Strongly Disagree

b) The decision to conserve water around my area is within my control

[ ] Strongly Agree [ ] Agree [ ] Neutral [ ] Disagree

[ ] Strongly Disagree

c) The decision to conserve water around my area is beyond my control

[ ] Strongly Agree [ ] Agree [ ] Neutral [ ] Disagree

[ ] Strongly Disagree

Question 28: What factors or circumstances that would make it easier or enable you to conserve water?

_____

Question 29: What factors or circumstances that would make it difficult or prevent you from conserving water?

_____

E:	**Farm size and their characteristics**

Question 30:

a) Experience in farming_____ (Number of years)

b) Do you own any farmland? [ ] Yes [ ] No

c) If YES, Do you own this farmland yourself or jointly with someone else? [ ] Owned alone [ ] Owned Jointly

d) How many hectors of the land do you own?

_____ (Number of hectors)

F:	**Land Ownership**

Question 31:

a) Do you have access to or own a land?

[ ] Yes [ ] No

b) How did you acquire land? Tick where appropriate

Tick (V)	**Means of acquiring Land**
	Inheritance from your elders
	Purchase with own earnings from farming
	Purchase using credit from formal institutions
	Purchase using credit from informal institutions
	Purchase using income from farming activities

c) Rented land

Question	**Response**
Rented farmland: YES/ NO	
How many hectors do you rent out? (in hectors)	
How much do you rent out your land to other? (in TZS)	
How many hectors do you rent in? (in hectors)	
How much did you pay as farm when you rent in? (in TZS)	
How many hectors of the shared land do you have? (in hectors)	

d) What is the land primarily used for? Tick where appropriate

Tick (V)	**Use of Land**
	Farming for home consumption
	Farming for home consumption and market
	Farming for marketing of the produce
	Livestock production
	Rented

e) What types of crops grown on your agricultural land?

No	**Types of crops grown**
1	
2	
3	
4	
5	

G:	Housing and Settlement

Question 32:

a) Do you own your house? [ ] Yes [ ] No

If YES, How did you acquire your house? Tick where appropriate

Tick (V)	Means of acquiring house
	Inheritance from your elders
	Purchase with own earnings from farming
	Purchase using credit from formal institutions
	Purchase using credit from informal institutions
	Build using income from farming activities

b) Do you rent your house? [ ] Yes [ ] No

i) If YES, what are terms and price of the rented house?

_____

ii) If YES, Does farming activities enable you to pay your house rent and other social basic needs? [ ] Yes [ ] No

H:	Other Assets

Question 33: **Non- Farming Business**

a) Do you engage in any non-farming business [ ] Yes [ ] No

If YES, mention type of non-farming business conducted by your household

_____

b) Mention number of household members who are engaged in any non-farm businesses?

Type of non-farm business	Number of household members	Amount of average income per month or year

Question 34: **Physical Assets Possessed** (Tick where appropriate)

Tick (V)	Assets possessed	Number	Estimated TZS
	House		
	Bicycle		
	Motorcycle		
	Vehicle		
	Farmland (Acre)		
	Livestock (Cow, goat, pig etc)		
	Business (mention)		
	Others		

Question 35: **Financial Assets**

a) Do you access/use any financial sources for your farming activities? [ ] Yes [ ] No

If NO, Why? Give reasons

_____

b) Which are formal institutions providing credit to farmers in your area? Please mention

No.	Formal institution	Amount able to offer (TZS)	Collateral YES/NO	Value of Collateral
1				
2				
3				
4				

c) Which are informal institutions providing credit to farmers in your area? Please mention

No.	Informal institution	Amount able to offer (TZS)	Collateral YES/NO	Value of Collateral
1				
2				
3				
4				

d) Rank the following formal sources according to your preference

Formal Source	Rank in number
Commercial banks	
Member based organization (SACCOS, AMCOS)	
NGO's (PRIDE, BRAC, MEDA, SEDA, FINCA)	

Give reasons for your rank number 1

_____

e) Rank the following informal sources according to your preferences

Informal source	Rank in number
Family and friends	
Money lenders	
VICOBA	
VSLA	
UPATU	
Others, Specify_____	

Give reasons for your rank number 1

_____

I: Information on environmental issues

Question 36:

a) I follow programs on environmental issues on TV and the radio

[ ] Strongly Agree [ ] Agree [ ] Neutral [ ] Disagree

[ ] Strongly Disagree

b) I read news on environmental issues from newspapers, magazine, and books

[ ] Strongly Agree [ ] Agree [ ] Neutral [ ] Disagree

[ ] Strongly Disagree

c) I attends environmental issues' conferences, training and programs

[ ] Strongly Agree [ ] Agree [ ] Neutral [ ] Disagree

[ ] Strongly Disagree

d) I obtain information on environmental issues from environmental associations

[ ] Strongly Agree [ ] Agree [ ] Neutral [ ] Disagree

[ ] Strongly Disagree

J: Cost and Benefits of Water Conservation Activities

Question 37:

a) What do you see as the benefits of conserving water at your area?

_____

b) What do you see as the costs associated with water conservation activities at your area?

_____

E: End of Interview

I would like to express my sincere gratitude for your precious time and the information you provided us

Question 38: Is there any information left out of this questionnaire that you think can be useful to policy makers to improve access to clean and safe water in rural area? Please narrate:

_____

Thank you again for your time.

Appendix II: Summary of the literature review

SN	Studies	Dependent Variable		Independent Variable		Sign
		Variable	Description	Variable	Description	
1	Aprile and Fiorillo (2017)	Water Conservation Behaviour (WCB)	How often are you careful in not wasting water at home? (1: if respondent always saves water at home; 0 if otherwise)	General Environmental Concern (EC)	What ae the worrying environmental problems?	+/-
				• *EC1: Pollution*	0-5 scale: Air, soil, water, electromagnetic, noise	+
				• *EC2: Climate change*	0-2 scale: greenhouse effect, climate change	+
				• *EC3: Resource exhaustion*	0-2 scale: depletion of natural resources, destruction of forest	+
				• *EC4: Alteration of environmental heritage*	0-2 scale: extinction of species, destruction of the landscape	-
				Water Price	Water rates	+
				Age	Individual's number of years	+
				Gender	1 if female; 0 otherwise	+
				Marital status	1 if married; 0 if single 1 if separated/ divorced 1 if widowed	-
				Household size	Number of people who live in family	-
				Education level	Low education = 1 if no education, completed elementary school and completed junior high school; 0 if high school (diploma) Bachelor degree = 1 if university degree and/or doctorate	-
				Household income (ln)	Natural logarithm of household income	-
				Employment status		-
				Entrepreneur	1 if entrepreneur; 0 otherwise	

				Employed	1 if employed; 0 otherwise	-
				Unemployed	1 if unemployed; 0 if another status	+
				Retired	1 if retired; 0 otherwise	+
				Social capital		+
				Volunteering	1 if passive and/or active participation in voluntary associations	
				Church attendance	1 if church attendance one or more times a week	+
2	Moges and Taye (2017)	Perception of Soil and Water Conservation (SWC)	1 if the farmer perceives erosion can be controlled; 0 otherwise	Age	Number of years of the household head	Statistically significant (-)
				Area managed by single farmers	Measured in Hectare	Statistically significant (+)
				Family size	Measured in Numbers	Not significant
				Plot distance from the residence	Measured in walking minutes	Statistically significant (-)
				Education level	1 if literate; 0 otherwise	Statistically significant (+)
				Extension contact	1 if the farmer get extension service; 0 otherwise	Statistically significant (+)
				Training of household head	1 if the farmer has been trained	Statistically significant (+)
				Social position	1 if a household head has social position in the community; 0 otherwise	Not significant
				Plot ownership type	1 if the plot is owned by household head; 0 otherwise	Statistically significant (+)
				Land security	1 if the farmer perceive land will remains for a life time; 0 otherwise	Not significant
				Slope of plots	1 if steep slope; 0 otherwise	Statistically significant (+)
3	Dupont and Renzetti (2013)	Indoor water conservation choices And	A value of 0, 1, 2, 3 if this is the number of times per week the respondent report to watering his/her garden respectively	Water prices	• 1 if household faces an increasing block rate structure; 0 otherwise • Marginal price of a cubic meter of water at an average monthly consumption level of $25m^3$	Statistically significant

		Outdoor water conservation choices	4: if watering frequently per week.	Household size	• Number of person in the household • 1 if there are children in the household; 0 otherwise	• Statistically significant (+) • Statistically significant (-)
				Household income	The level of after tax household income	Statistically significant (+)
				Education level	1 if completed university or college; 0 otherwise	Statistically significant (+)
				Non-price conservation policy	1 if water utilities employ any measures relating to non-pricing conservation measure; 0 otherwise	Statistically significant (-)
				Climate influence	• Total rainfall in the area for June, July and August • Number of days during June, July and August when the average daytime temperature is above 18^{o}C • The average summer daytime temperature in the area in which household lives.	Statistically significant
4	Fielding et al (2012)	Curtailment actions (everyday actions to save water)	Asking respondents whether they engaged in everyday actions to save water	Attitude	Likert scale: whether engaging in everyday actions to save water around the house and garden was: extremely bad/extremely good, extremely harmful/extremely beneficial, extremely worthless/extremely valuable, and extremely unpleasant/extremely pleasant	+
				Subjective Norms	• It is expected of me that I save water around the house and garden • I feel like there is social pressure to save water around the house and garden, and • People who are important to me want me to save water around the house and garden	+

					(1= strongly disagree, 7 = strongly agree).	
				Perceived Behavioural control	• I am confident that I could save water around the house and garden if I wanted to • The decision to save water around the house and garden is beyond my control (reversed) • Whether I save water around the house and garden or not is entirely up to me (1= strongly disagree, 7 = strongly agree)	+
				Intention to engage	• I expect I will engage in everyday actions to save water around the house and garden in the next six months, • I intend to engage in everyday actions to save water around the house and garden in the next six months • I want to engage in everyday actions to save water around the house and garden in the next six months (1= strongly disagree, 7 = strongly agree)	+
				Household water culture	Likert scale (1 = strongly disagree, 7 = strongly agree)	+
				Water curtailment habits	how often in the last six months the household had engaged in curtailment actions (1 = never, 5 = always) water conservation habit index (range 6-30)	-

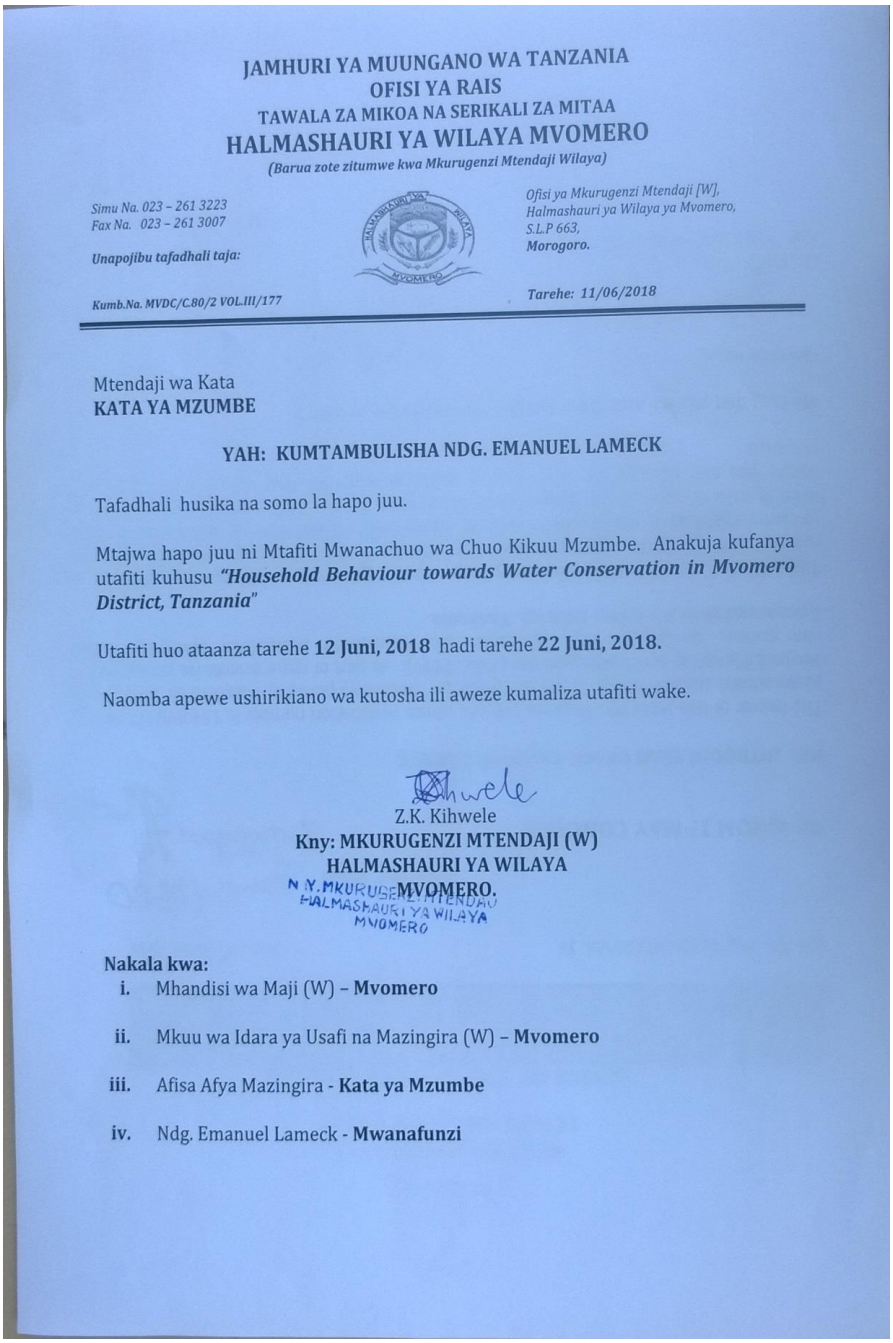
		Efficiency actions (installing water efficient appliances)	Asking whether the respondent had installed each of the eleven water appliances a their home	Household water use	Average daily water use for each household for six months	+
				age	Number of years of the household	Significant with + sign
				Education level	1 if primary/secondary, technical/ Trade; 0 tertiary education	Not significant
				Household income	Gross annual income of the household	Significant with + sign
				Household size	Number of people in the household	Significant with + sign
5	Adams (2014)	Water Conservation Behaviour	How often do household choose to save or re-use water for environmental reasons?	Age	Number of years of the household	Not significant
				Gender	1= female and 0= male	Significant
				Education level	Household's number of years of education	Not significant
				Household income	Coded in 25 categories based on the midpoint of ranges	Not significant
				Employment status	1= employed and 0= unemployed	Not significant
				General environmental concern	Asking respondents about their willingness to Recycle, energy conservation and to sacrifice for the environment	Significant
6	Chang (2013)	Water Conservation Behaviour	• Tooth brushing (using a single glass) • Showering (turning off the faucet when soaping) • vegetable washing and dishwashing (filling the sink with water and then turning • off the faucet) • laundry (washing by hand for small loads • reusing water by mopping	General environmental concerns	Five items of the NEP scale. Using five-point Likert scale strongly agree (5), mildly agree (4), unsure (3), mildly disagree (2) and strongly disagree (1)	Significant (+)
				Local water resources beliefs	Measured using three items:- There is a shortage of water in Zhangye City; There is significant competition between industries and agriculture for water resources	Significant (+)

			using a Likert scale to respond to the above items of water conservation behaviour (4 if always, 3 if sometimes, 2 if seldom and 1 if never)		in Zhangye City; There is significant competition between economic development and the ecological environment for water resources in Zhangye City Using Likert scale; strongly agree (5), agree (4), unsure (3), disagree (2) and strongly disagree (1).	
				Attitude	Measured using four items:- The importance of household water conservation for relieving water shortages in Zhangye City; The importance of household water conservation for increasing the water supply in the lower reaches; The importance of household water conservation for increasing local vegetation coverage; The importance of household water conservation for controlling local sandstorms. Using Likert scale; completely unimportant (1), unimportant (2), unsure (3), important (4) and very important (5)	Significant (+)
				Subjective norms	Measured using three items:- My family members want me to save water;	Significant (+)

					My friends want me to save water; The local government wants me to save water Using Likert scale; strongly agree (5), agree (4), unsure (3), disagree (2) and strongly disagree (1).	
				The dimension of frugality	Measured using 8 ideas:- I think that wasting things is bad; I feel regretful if I waste things; I think it is not good to waste anything; We should cherish everything If you take good care of your possessions, you will definitely save money in the long run; If you can reuse an item you already have, there is no sense in buying something new; I believe in being careful in how I spend my money; I discipline myself to get the most from my money. Using Likert scale; Strongly agree (5), agree (4), unsure (3), disagree (2) and strongly disagree (1).	Significant (+)

				Incremental water conservation knowledge	Measured using five items:- Incremental knowledge from - newspapers - broadcasting - television, - leaflets - billboards Using a Likert scale of none (1), a little (2), some (3) and much (4).	Significant (+)

Appendix III: Letter of Approval for data collection



JAMHURI YA MUUNGANO WA TANZANIA
OFISI YA RAIS
TAWALA ZA MIKOA NA SERIKALI ZA MITAA
HALMASHAURI YA WILAYA MVOMERO
(Barua zote zitumwe kwa Mkurugenzi Mtendaji Wilaya)

Simu Na. 023 – 261 3223
Fax Na. 023 – 261 3007

Unapojibu tafadhali taja:

Ofisi ya Mkurugenzi Mtendaji [W],
Halmashauri ya Wilaya ya Mvomero,
S.L.P 663,
Morogoro.

Kumb.Na. MVDC/C.80/2 VOL.III/177

Tarehe: 11/06/2018

Mtendaji wa Kata
KATA YA MZUMBE

YAH: KUMTAMBULISHA NDG. EMANUEL LAMECK

Tafadhali husika na somo la hapo juu.

Mtajwa hapo juu ni Mtafiti Mwanachuo wa Chuo Kikuu Mzumbe. Anakuja kufanya utafiti kuhusu ***"Household Behaviour towards Water Conservation in Mvomero District, Tanzania***"

Utafiti huo ataanza tarehe **12 Juni, 2018** hadi tarehe **22 Juni, 2018.**

Naomba apewe ushirikiano wa kutosha ili aweze kumaliza utafiti wake.

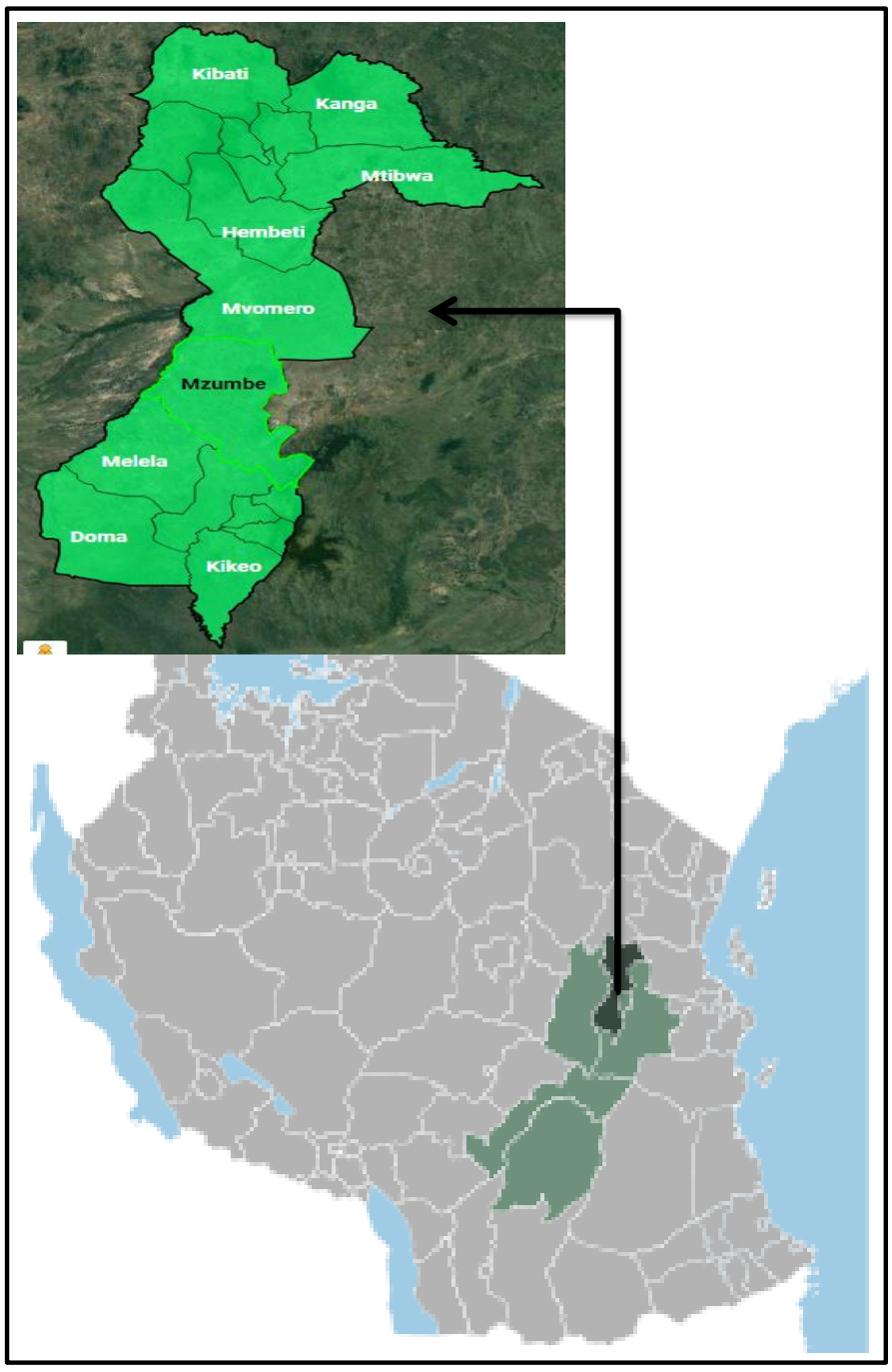
Z.K. Kihwele
Kny: MKURUGENZI MTENDAJI (W)
HALMASHAURI YA WILAYA
MVOMERO.

N.Y. MKURUGENZI MTENDAJI
HALMASHAURI YA WILAYA
MVOMERO

Nakala kwa:

i. Mhandisi wa Maji (W) – **Mvomero**
ii. Mkuu wa Idara ya Usafi na Mazingira (W) – **Mvomero**
iii. Afisa Afya Mazingira - **Kata ya Mzumbe**
iv. Ndg. Emanuel Lameck - **Mwanafunzi**

Appendix IV: A Map of Mvomero District (Mzumbe ward)



Appendix V: Correlation of Probit Model Variables

```
. corr WCB aged Male Married Widow Education HHsize Income Participation EnvKnowledge Attitude SubNorms PerBeh
> Control LandOwnership Benefits Costs
(obs=210)

             |      WCB     aged     Male  Married    Widow Educat~n   HHsize   Income Partic~n EnvKno~e
-------------+---------------------------------------------------------------------------------------
         WCB |   1.0000
        aged |   0.2713   1.0000
        Male |   0.2326  -0.0778   1.0000
     Married |   0.1908   0.4146  -0.0538   1.0000
       Widow |  -0.0541   0.1673  -0.1641  -0.2311   1.0000
   Education |   0.5315   0.1590   0.3097   0.2275  -0.1720   1.0000
      HHsize |   0.2853   0.7199  -0.0309   0.7012   0.0489   0.2256   1.0000
      Income |  -0.0355   0.1695   0.1147   0.1593  -0.0056   0.1102   0.2716   1.0000
Participat~n |   0.7938   0.2103   0.1856   0.2130  -0.1060   0.4739   0.2505  -0.0717   1.0000
EnvKnowledge |   0.8388   0.2465   0.2050   0.2178  -0.1115   0.5292   0.2719  -0.0319   0.8899   1.0000
    Attitude |   0.1178   0.0094   0.1200  -0.0676   0.0156   0.1097  -0.0154   0.1280  -0.0188   0.0293
    SubNorms |   0.1415   0.1294   0.0005   0.0925  -0.0707   0.1148   0.1549   0.2762   0.0547   0.1018
PerBehCont~l |  -0.0322  -0.0596  -0.0043   0.0083   0.0558  -0.0117  -0.0512   0.0160  -0.0964  -0.0757
LandOwners~p |   0.0591   0.3757  -0.0929   0.2792   0.1269  -0.1149   0.3895   0.1854  -0.0408   0.0093
    Benefits |  -0.1039  -0.0827   0.0059  -0.0415   0.0871  -0.1732  -0.0647  -0.0638  -0.0740  -0.1295
       Costs |   0.0203   0.0274  -0.0341  -0.0076  -0.0246   0.1077   0.0020   0.0564   0.0070   0.0552

             | Attitude SubNorms PerBeh~l LandOw~p Benefits    Costs
-------------+------------------------------------------------------
    Attitude |   1.0000
    SubNorms |   0.1812   1.0000
PerBehCont~l |   0.0321  -0.0021   1.0000
LandOwners~p |  -0.0485   0.0271  -0.0475   1.0000
    Benefits |  -0.1291  -0.1029  -0.0660  -0.0429   1.0000
       Costs |   0.0918   0.0918   0.1074  -0.0144  -0.8840   1.0000
```

Appendix VI: Probit Regression Model Output

```
Probit regression                                 Number of obs   =        210
                                                  LR chi2(15)     =     205.87
                                                  Prob > chi2     =     0.0000
Log likelihood = -41.250785                       Pseudo R2       =     0.7139

------------------------------------------------------------------------------
         WCB |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        aged |   .3894587   .4784856     0.81   0.416    -.5483559    1.327273
        Male |   .3190218   .3556114     0.90   0.370    -.3779637    1.016007
     Married |  -.5560454   .5422851    -1.03   0.305    -1.618905    .5068138
       Widow |  -.0372201   1.017779    -0.04   0.971    -2.032029    1.957589
   Education |   .1816048   .0843533     2.15   0.031     .0162753    .3469343
      HHsize |   .1708739   .1744471     0.98   0.327    -.1710361    .5127839
      Income |  -.8580091   .4794686    -1.79   0.074     -1.79775     .081732
  Particip~n |   1.495284   .6125888     2.44   0.015     .2946316    2.695936
  EnvKnowlge |   1.910052   .5782243     3.30   0.001      .776753     3.04335
    Attitude |   .9484029   .3885349     2.44   0.015     .1868885    1.709917
    SubNorms |   .2389461    .428316     0.56   0.577    -.6005379     1.07843
  PerBehCont |   .7672315   .5145845     1.49   0.136    -.2413357    1.775799
  LandOwnerp |   .2496929   .4318769     0.58   0.563    -.5967703    1.096156
    Benefits |  -.9024223   1.512763    -0.60   0.551    -3.867383    2.062538
       Costs |  -1.215845   1.507346    -0.81   0.420    -4.170188    1.738499
       _cons |   7.953579   6.275718     1.27   0.205    -4.346603    20.25376
------------------------------------------------------------------------------
```

Appendix VII: Marginal effect of Probit Regression Models

```
. margins, dydx(*)

Average marginal effects                        Number of obs   =        210
Model VCE    : OIM

Expression   : Pr(WCB), predict()
dy/dx w.r.t. : aged Male Married Widow Education HHsize Income Participation
EnvKnowledge Attitude SubNorms PerBehControl LandOwnership Benefits Costs

------------------------------------------------------------------------------
             |            Delta-method
             |    dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      Aged |   .0420365   .0515571     0.82   0.415    -.0590134    .1430865
      Male |   .0344339   .0384837     0.89   0.371    -.0409929    .1098606
   Married |  -.0600172   .0587778    -1.02   0.307    -.1752195    .0551851
     Widow |  -.0040174   .1098574    -0.04   0.971     -.219334    .2112993
 Education |   .0196017   .0089904     2.18   0.029     .0019807    .0372226
    HHsize |   .0184434   .0188408     0.98   0.328     -.018484    .0553708
    Income |  -.0926099   .0524279    -1.77   0.077    -.1953666    .0101469
Particip~n |   .1613946   .0655676     2.46   0.014     .0328845    .2899047
 EnvKnow~e |   .2061629   .0595292     3.46   0.001     .0894878     .322838
  Attitude |   .1023666   .0420053     2.44   0.015     .0200377    .1846955
  SubNorms |   .0257908   .0461366     0.56   0.576    -.0646353     .116217
PerBehCont |   .0828117   .0558284     1.48   0.138      -.02661    .1922334
LandOwnerp |   .0269508   .0466298     0.58   0.563    -.0644419    .1183435
  Benefits |  -.0974036   .1635303    -0.60   0.551    -.4179171    .2231098
     Costs |  -.1312331   .1629441    -0.81   0.421    -.4505976    .1881314
------------------------------------------------------------------------------
```

Appendix VIII: Probit Regression Model specification error test

```
. linktest

Probit regression                                 Number of obs   =        210
                                                  LR chi2(2)      =     206.39
                                                  Prob > chi2     =     0.0000
Log likelihood = -40.992202                       Pseudo R2       =     0.7157

------------------------------------------------------------------------------
         WCB |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |   1.018929    .129742     7.85   0.000      .764639    1.273218
      _hatsq |   .0675765   .0954632     0.71   0.479    -.1195279     .254681
       _cons |  -.1183755    .230198    -0.51   0.607    -.5695553    .3328044
------------------------------------------------------------------------------
```

Appendix IX: Probit Model Goodness-of-fit test

```
. lfit, group(10) table

Probit model for WCB, goodness-of-fit test

  (Table collapsed on quantiles of estimated probabilities)
  +--------------------------------------------------------+
  | Group |   Prob | Obs_1 | Exp_1 | Obs_0 | Exp_0 | Total |
  |-------+--------+-------+-------+-------+-------+-------|
  |     1 | 0.0114 |     1 |   0.1 |    20 |  20.9 |    21 |
  |     2 | 0.0291 |     1 |   0.4 |    21 |  21.6 |    22 |
  |     3 | 0.0564 |     1 |   0.8 |    19 |  19.2 |    20 |
  |     4 | 0.0882 |     0 |   1.4 |    21 |  19.6 |    21 |
  |     5 | 0.1737 |     2 |   2.9 |    20 |  19.1 |    22 |
  |-------+--------+-------+-------+-------+-------+-------|
  |     6 | 0.6765 |     7 |   7.0 |    13 |  13.0 |    20 |
  |     7 | 0.9549 |    18 |  18.1 |     3 |   2.9 |    21 |
  |     8 | 0.9914 |    21 |  20.6 |     0 |   0.4 |    21 |
  |     9 | 0.9979 |    21 |  20.9 |     0 |   0.1 |    21 |
  |    10 | 1.0000 |    21 |  21.0 |     0 |   0.0 |    21 |
  +--------------------------------------------------------+

      number of observations =       210
            number of groups =        10
    Hosmer-Lemeshow chi2(8) =        11.57
                Prob > chi2 =        0.1715
```

Appendix X: Multicollinearity Test

```
. collin WCB aged Male Married Widow Education HHsize Income Participation
EnvKnowledge Attitude SubNorms PerBehControl LandOwnership Benefits Cost
> s
(obs=210)

Collinearity Diagnostics
```

Variable	VIF	SQRT VIF	Tolerance	R-Squared
WCB	4.07	2.02	0.2454	0.7546
aged	2.30	1.52	0.4353	0.5647
Male	1.22	1.10	0.8207	0.1793
Married	2.45	1.57	0.4080	0.5920
Widow	1.31	1.14	0.7634	0.2366
Education	1.70	1.31	0.5870	0.4130
HHsize	3.88	1.97	0.2581	0.7419
Income	1.27	1.13	0.7880	0.2120
Participation	5.33	2.31	0.1878	0.8122
EnvKnowledge	6.50	2.55	0.1539	0.8461
Attitude	1.13	1.06	0.8870	0.1130
SubNorms	1.17	1.08	0.8576	0.1424
PerBehControl	1.05	1.02	0.9530	0.0470
LandOwnership	1.37	1.17	0.7281	0.2719
Benefits	5.02	2.24	0.1990	0.8010
Costs	4.89	2.21	0.2044	0.7956
Mean VIF	2.79			

Appendix XI: One-way ANOVA output

```
. oneway Age VILLAGES, tabulate

                    Analysis of Variance
    Source              SS         df      MS            F     Prob > F
------------------------------------------------------------------------
Between groups      247.973939      3   82.6579798      1.09     0.3535
 Within groups      15590.7927    206   75.6834598
------------------------------------------------------------------------
    Total           15838.7667    209   75.7835726

. pwmean Age, over(VILLAGES) mcompare(tukey) effects

Pairwise comparisons of means with equal variances

------------------------------------------------------------------------------
           |                                    Tukey              Tukey
       Age |   Contrast   Std. Err.      t     P>|t|     [95% Conf. Interval]
-----------+------------------------------------------------------------------
  VILLAGES |
Vikenge vs Sanga|-1.705455  1.699921   -1.00   0.748   -6.108462    2.697553
Changa vs Sanga |-2.490909  1.658953   -1.50   0.438   -6.787805    1.805986
Tangeni vs Sanga|-2.745455  1.699921   -1.62   0.372   -7.148462    1.657553
Changa vs Vikeng|-.7854545  1.699921   -0.46   0.967   -5.188462    3.617553
Tangeni vs Viken|-1.04      1.739925   -0.60   0.933   -5.546622    3.466622
Tangeni vs Chang|-.2545455  1.699921   -0.15   0.999   -4.657553    4.148462
```

```
. oneway HHsize VILLAGES, tabulate

                    Analysis of Variance
    Source              SS         df      MS            F     Prob > F
------------------------------------------------------------------------
Between groups      12.9939394      3   4.33131313      1.57     0.1977
 Within groups      568.172727    206   2.75812004
------------------------------------------------------------------------
    Total           581.166667    209   2.78070175


. pwmean HHsize, over(VILLAGES) mcompare(tukey) effects

Pairwise comparisons of means with equal variances

------------------------------------------------------------------------------
           |                                  Tukey              Tukey
    HHsize |   Contrast   Std. Err.      t     P>|t|     [95% Conf. Interval]
-----------+------------------------------------------------------------------
  VILLAGES |
Vikenge vs Sanga|-.6854545  .3245151   -2.11  0.153    -1.525989    .1550799
Changa vs Sanga |-.4        .3166943   -1.26  0.587    -1.220278    .4202777
Tangeni vs Sanga|-.4654545   .3245151  -1.43  0.479    -1.305989    .3750799
Changa vs Vikeng| .2854545   .3245151   0.88  0.815     -.5550799  1.125989
Tangeni vs Viken| .22        .3321518   0.66  0.911     -.6403145  1.080314
Tangeni vs Chang|-.0654545   .3245151  -0.20  0.997     -.905989    .7750799
------------------------------------------------------------------------------
```

Appendix XII: Independent t-test (two-sample test) output

```
. ttest Age, by(WCB1)

Two-sample t test with equal variances
------------------------------------------------------------------------------
Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
-------+----------------------------------------------------------------------
Otherwis|   117     33.8547    .7832675    8.472333    32.30334    35.40606
Always |     93    37.87097    .8833595     8.51881    36.11654     39.6254
-------+----------------------------------------------------------------------
combined |  210    35.63333     .600728    8.705376    34.44907     36.8176
-------+----------------------------------------------------------------------
 diff |           -4.016267    1.179865               -6.342294    -1.69024
------------------------------------------------------------------------------
diff = mean(Otherwis) - mean(Always)                          t =  -3.4040
Ho: diff = 0                                     degrees of freedom =      208

Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
Pr(T < t) = 0.0004       Pr(|T| > |t|) = 0.0008          Pr(T > t) = 0.9996

. ttest MonthlyIncome, by(WCB1)

Two-sample t test with equal variances
------------------------------------------------------------------------------
Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
-------+----------------------------------------------------------------------
Otherwis|   117    345870.6    11336.48    122622.8    323417.2    368323.9
Always |     93    487439.3    26940.92    259808.8    433932.3    540946.3
-------+----------------------------------------------------------------------
combined |  210    408565.3    14314.06    207430.4    380346.9    436783.8
-------+----------------------------------------------------------------------
diff |           -141568.8    27167.14                -195127   -88010.52
------------------------------------------------------------------------------
diff = mean(Otherwis) - mean(Always)                          t =  -5.2110
Ho: diff = 0                                     degrees of freedom =      208

Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
Pr(T < t) = 0.0000       Pr(|T| > |t|) = 0.0000          Pr(T > t) = 1.0000

. ttest HHsize, by(WCB1)

Two-sample t test with equal variances
------------------------------------------------------------------------------
Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
-------+----------------------------------------------------------------------
Otherwis |  117     2.74359    .1442246    1.560028    2.457935    3.029245
Always |     93    3.698925    .1714723    1.653619    3.358366    4.039483
-------+----------------------------------------------------------------------
combined |  210    3.166667    .1150714    1.667544    2.939817    3.393516
-------+----------------------------------------------------------------------
diff |           -.955335    .2225689               -1.394115    -.516555
------------------------------------------------------------------------------
diff = mean(Otherwis) - mean(Always)                          t =  -4.2923
Ho: diff = 0                                     degrees of freedom =      208

Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
Pr(T < t) = 0.0000       Pr(|T| > |t|) = 0.0000          Pr(T > t) = 1.0000
```

```
. ttest Education, by(WCB1)

Two-sample t test with equal variances
------------------------------------------------------------------------------
Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
-------+----------------------------------------------------------------------
Otherwis |  117    7.008547    .1192469    1.289852    6.772363    7.244731
Always |     93    9.483871    .2677163    2.581763    8.952163    10.01558
-------+----------------------------------------------------------------------
combined |  210    8.104762    .1600079    2.318735    7.789326    8.420198
-------+----------------------------------------------------------------------
diff |            -2.475324    .2735077               -3.014527   -1.936121
------------------------------------------------------------------------------
diff = mean(Otherwis) - mean(Always)                          t =  -9.0503
Ho: diff = 0                                 degrees of freedom =      208

Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
Pr(T < t) = 0.0000       Pr(|T| > |t|) = 0.0000          Pr(T > t) = 1.0000
```

Appendix XIII: The Kruskal-Wallis H-test output

```
. kwallis WCB, by(Gender)

Kruskal-Wallis equality-of-populations rank test
  +-------------------------+
  | Gender | Obs | Rank Sum |
  |--------+-----+----------|
  | Female |  88 | 10450.00 |
  |   Male | 122 | 11705.00 |
  +-------------------------+
chi-squared with ties =     8.465 with 1 d.f.
probability =     0.0036


. kwallis WCB, by(MaritalStatus)

Kruskal-Wallis equality-of-populations rank test
  +---------------------------+
  | Marita~s | Obs | Rank Sum |
  |----------+-----+----------|
  |   Single |  52 |  6533.50 |
  |  Married | 154 | 15113.00 |
  |    Widow |   4 |   508.50 |
  +---------------------------+
chi-squared with ties =     9.970 with 2 d.f.
probability =     0.0068


. kwallis WCB, by(Participation)

Kruskal-Wallis equality-of-populations rank test
  +---------------------------+
  | Partic~n | Obs | Rank Sum |
  |----------+-----+----------|
  |       No | 127 | 18043.50 |
  |      Yes |  83 |  4111.50 |
  +---------------------------+
chi-squared with ties =   136.825 with 1 d.f.
probability =     0.0001


. kwallis WCB, by(LandOwnership)

Kruskal-Wallis equality-of-populations rank test
  +---------------------------+
  | LandOw~p | Obs | Rank Sum |
  |----------+-----+----------|
  |       No | 142 | 15247.00 |
  |      Yes |  68 |  6908.00 |
  +---------------------------+
chi-squared with ties =     0.490 with 1 d.f.
probability =     0.4840
```

Appendix XIV: Classification statistics and table

```
. estat classification

Probit model for WCB

              -------- True --------
Classified |         D            ~D  |      Total
-----------+--------------------------+-----------
     +     |        84             5  |         89
     -     |         9           112  |        121
-----------+--------------------------+-----------
   Total   |        93           117  |        210

Classified + if predicted Pr(D) >= .5
True D defined as WCB != 0
-------------------------------------------------
Sensitivity                     Pr( +| D)   90.32%
Specificity                     Pr( -|~D)   95.73%
Positive predictive value       Pr( D| +)   94.38%
Negative predictive value       Pr(~D| -)   92.56%
-------------------------------------------------
False + rate for true ~D        Pr( +|~D)    4.27%
False - rate for true D         Pr( -| D)    9.68%
False + rate for classified +   Pr(~D| +)    5.62%
False - rate for classified -   Pr( D| -)    7.44%
-------------------------------------------------
Correctly classified                        93.33%
-------------------------------------------------
```

Appendix XV: Shapiro Wilk test of normality

```
. swilk aged Male Married Widow Education HHsize Income LandOwnership

                    Shapiro-Wilk W test for normal data

    Variable |    Obs       W           V         z       Prob>z
-------------+--------------------------------------------------
        Aged |    210    0.99702      0.464    -1.771    0.96170
        Male |    210    0.99904      0.150    -4.373    0.99999
     Married |    210    0.98858      1.778     1.327    0.09222
       Widow |    210    0.99984      0.025    -8.508    1.00000
   Education |    210    0.93634      9.910     5.290    0.00000
      HHsize |    210    0.98816      1.844     1.411    0.07909
      Income |    210    0.95459      7.068     4.511    0.00000
LandOwners~p |    210    0.99092      1.414     0.799    0.21213
```

A variable is only normally distributed when P>0.05 in Prob>z column