THE AFRICAN RESOURCES DEVELOPMENT JOURNAL

Contents

Form
To be published both online and hard print forms.

Contents

Editorial

Dear readers,
Welcome to the sixth issue of the African Resources Development Journal. This journal publishes articles which expose potentials and challenges available in Africa in the exploitation and utilization of its natural resources for sustainable development of the continent. The editorial team wish to congratulate all authors whose papers are published in this issue. After passing through a double-blind independent peer-review, seven papers were recommended for publication in this issue.

The journal publishes original research articles and review papers. Paper submitted to this journal must contain original unpublished work and should not be under consideration for publication elsewhere. Any paper submitted to this journal will be subjected to the journal's double-blind review process.

Finally, let me take this opportunity to thank all authors who submitted their manuscript to us and congratulate those who have their articles published in this issue. The editorial team appreciates the work well done by the peer-review experts who have enabled the Sixth Issue of Volume 1 of the African Resources Development Journal (ARDJ) to roll out. We hope that the articles published herein will widen the knowledge on abundant natural resources available in Africa and thus meet expectations and aspiration of our different esteemed readers of the journal. You are most welcome to send us your research manuscripts and book reviews for consideration in the upcoming issues.

Prof. Emmanuel Patroba Mhache
Chief Editor
The African Resources Development Journal

Motivational Factors as Correlates of Women's Participation in Community Development Programmes in Ilorin Metropolis, Kwara State Nigeria

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Abstract
Smallholder farmers are significantly considered being amongst the poorest that are most affected by climate change. Climate change is rated the greatest threat to smallholders' food production in the 21st century. Despite scientists agreeing that the world is getting warmer, it was important for this study to assess whether climate change is a reality that is known and experienced by smallholder farmers in Malawi. This paper assesses smallholder farmers' Knowledge, Attitudes and Perceptions (KAP) towards climate change in comparison with available meteorological data for 50 years. Descriptive research design with a mixed approach of both qualitative and quantitative research methods was adopted. A sample of 183 respondents was randomly and purposefully selected to include both household heads and key informants. Data collection method included Survey Questionnaire, Key Informants Interviews, Focused Group Discussions as well as literature review. Meteorological data for 50 years was analysed to underpin farmers' perceptions on climate change. The result shows that survey respondents' knowledge of climate change is derived from their experiences, thoughts and ideas about how to cope with changing drought and rainfall seasons. Those results are in tandem with the conventional view based on scientific evidence that suggests changing climate in Malawi with profound impact on seasons.

Keywords: *Community, community development, motivation, initiative and participation*

1.0 INTRODUCTION

Motivation involves a number of psychological factors that start and maintain activities towards the achievement of personal goals and it also refers to the reasons that underlie behaviour that is characterised by willingness and volition. Motivation is a combination of goals towards which human behaviour is directed, the process through which those goals are pursued and achieved. An individual is motivated through certain motivational factors that direct and sustain behaviour. Motivation is also the force that initiates, guides and

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maintains goal-oriented behaviour of human beings. Motivation as a desire to perform an action is usually defined as having two parts, directional such as directed towards a positive stimulus or away from a negative one, as well as the activated comprising the seeking phase and consummator liking phase. A motivated person works better and harder. Motivation on the right path leads the individual to success.

Hornby (2006) defined motivation as eagerness and willingness to do something without being told or forced to do it. Motivation is a critical component of participation, it is important in getting citizens to engage in development activities (Bernstein, 2011). There are two types of motivation, extrinsic and intrinsic (Okafor, 2005). Extrinsic motivation is determined by outside forces. Intrinsic motivation can be found within the individual since the task can be viewed as valuable. Therefore, when applying the effect that motivation has on the development process, it is clear that people participate better based on the perceived value of the task, subject matter, personal goals, financial incentives and wide array of different factors. As a gardener must know or should have sought to know which soil is most suitable to the plant and when and how much water is required by plant, so must a community leader know how a citizen participates, how the factors like motivation facilitate the development process (Fapohunda, 2012). Motivation is vital in any development; it is viewed by UNDP (1995) as a process by which people choose between alternative forms of behaviour in order to achieve personal goals. Motivation is viewed by Cole (2009) as the force or condition within the organism that impels it to act or respond.

The concept of participation describes the involvement of community members in the affairs or activities that are designed to enhance the development of the community. In the case of community development, it implies the involvement of community members in the community development programmes. Women participation implies much more than involvement. It calls forth other features, namely democracy or democratic participation, self-helps and education. The idea of participations is based on the tested tradition of free enterprise and the rights of the community members. When we strive towards effecting a change for the well-being of community members, the point must always be remembered that the individual has his inherent and legal right to humane treatment. The ability to solicit his support and participation are the primary ingredients of the free enterprise and thereby democratic participation. Citizens' participation is a process which provides individuals an opportunity to influence public decisions. It has long been a component of the democratic decision-making process (Smith, 2006). Citizens' participation is an education empowering process in which the implementation of the public participation process is important for the democratization of social values and better planning and fulfilment of public needs. It is also useful for educating the public especially regarding government development programmes. This will potentially

influence social or personal changes amongst community members, which can then be used to incorporate diverse public interests and thus accord people with the right to participate in decisions that will affect their lives.

It is now widely accepted that community participation contributes a lot to the development of projects. Sabran (2013) pointed out the importance of community participation as follows; The approach helps the project to be sustainable as communities themselves learn how to adopt and correct changes resulting from the project, participation helps to protect interest of the people concerned, it enhances dignity and self-reliance among people because they are enabled to obtain and do things by themselves, communities become aware of the project implementation, they understand their local needs and the nature of their environment better than outsiders, they can easily transmit the new knowledge they acquired to other communities, thus cause a rapid increase in growth of the new idea, participation promotes a sense of ownership among the community members of equipment used in the projects.

It is believed that participation ensures success as people get involved when they have a sense of ownership of project and feel that the project meets their needs. This makes them willingly oversee construction and then take care of the facilities to ensure their sustainability (Hamilton, 2015). In addition, it is suggested that participation can lead to greater community empowerment in the form of strengthened local organisations, a greater sense of pride and the undertaking of new activities (Sorhum,2011). Community participation creates an enabling environment for sustainability by allowing users not only to select the level of services for which they are willing to pay, but also to make choices and commit resources in support of the choices made by the community (Sara and Katz, 2008).

Women participation in development is viewed by Ogbonna (2000) as the engagement by women in all the various decision-making processes in project implementation. Women participation is not just all about getting them involved in decision-making process, it also involves the ability to understand and share in the experiences of others since there is usually a lesson to learn from other peoples' situations. The principle of women participation implies that the workers have to supply the necessary and needed stimulus for the success of projects (Anyanwu, 2002). By participating in the decision-making process, the public will realise the importance of their involvement in deciding their future (Egenti, 2002). According to Johnson and Thompson (2007), public participation is a means to convey individual's and the society's personal interests and concerns with regard to the development plans, given that these planning activities would consequently affect the public generally and certain groups specifically. To a greater extent, public participation stimulates information exchange among all the proposed development projects stakeholders (the public, government and nongovernment organizations) which will further

enhance the mutual understanding and relationship between the stakeholders and resulting in the proposed development projects enjoying instilled support (Bretty, 2013).

Community development has to be viewed as involving the improvement of the systems of values in a community, its structure, as well as the usages through which it functions and is maintained. This still brings out the fact that the central idea of community development is that it implies change, involvement of people in community development activity is necessary. For instance, Ogbonna (2000) defined community development as a movement designed to promote better living for the whole community, with the active participation and, if possible, on the initiative of the community. However, community development can be conceptualized as a change process causing improvement in life activities and programme, and social relations that aim at meeting the needs and aspiration of people of similar historical and cultural heritage living together in their quest to reduce complete dependence on external sustainability (Onah, 2015). Therefore, community development could be seen as development process embracing the effort of individuals, self-help groups, non-governmental and governmental organizations, collective thinking, collective action and participation of each unit or body, identifying with different roles towards increasing the social and economic well-being of the people toward nation's growth.

The socio-cultural factors that motivate women participation in community development refers to how a particular community looks at their values, customs, beliefs and their traditions. Socio-cultural factors involve both social and cultural elements of society (Mulwa, 2008). They are facts and experiences that influence women personality, attitudes and lifestyle. They include discrimination, population, culture and limits of cultural interpretations. Todaro and Smith (2019) have suggested that youth enterprise support programmes in developing countries should consider socio-cultural constraints that limit the participation of women in particular young women who want to engage in income generating activities.

Ogbonna (2000) states that understanding culture is the starting point for learning the meaning of development, the values that guide people's actions and the behaviour of administrators. Cultural differences emerge in many types of development settings, from assumptions to project design to technology transfer and management styles. The technocrats from outside may not be familiar with local resources and are accustomed to different approaches to project management practices. This in turn causes conflict of interest, puts extra pressure on executives and frustrations which restrain project progress. This leads to lost opportunities, cost overruns and schedule delays. Cultural misfit of the project objectives and a lack of local knowledge and understanding can result into rejection of projects by intended beneficiaries.

The study is anchored on two theories; Maslow's hierarchy theory of needs and theory of community participation propounded by Sherry Amstein in 1969. Historically, Abraham Maslow was a famous psychologist who contributed significantly to the growth and development of human psychology as evidently shown in the study of human needs and motivation in human environment in the contemporary society. Abraham Maslow was, indeed, regarded to be among the founding fathers of human psychology and motivation in human environment. Mulwa (2008) rightly views Abraham Maslow as one of the founding fathers of the study of human psychology and motivation in the contemporary society. Abraham Maslow propounded the theory of human needs which is popularly known as Maslow's hierarchy of needs in human environment in the society. The hierarchy of needs which was developed by Abraham Maslow can be used as a method of assessing needs in community development in various communities in the contemporary society. This method of hierarchy of needs which Abraham Maslow developed emphasized that there are certain basic needs which must be met before other needs can be considered in various communities.

Maslow's theory of motivation describes the motivations and behaviours of people in their pursuit to meet their physical and social needs. These needs, ranked in hierarchical order and depicted as a triangle, are necessary for human development. Maslow's hierarchy of needs describes levels of needs that must be reached prior to an individual's attainment of needs on the next level. The needs, in order from basic to advanced, are as follows; Physiological, safety, love/belongingness, esteem, and self-actualization. Physiological needs are rudimentary and encompass requirements for survival such as food, water, and sex. Safety needs include shelter, secure surroundings, and no or limited threats to survival and finances. Love/belongingness needs stem from the desire to share life with an individual and be part of a community. These needs involve family bonds, friendships, social relationships, and community affiliation. Self-actualisation is realised when an individual has reached full social, academic, and life potential, capability, and capacity.

To foster community development and change, trust must be built among residents, stakeholders, partners, and public administrators. Trust is the foundation of social connectedness and collaboration. According to Brewer (2013), social trust begets cooperation with strangers. In communities with a sense of social trust, residents are more willing to assist with community building because they know their fellow neighbours will help carry the burden. Communities with low social connectedness, paltry interest in local politics, and limited civic engagement have weakened political power and are not positioned to effect change.

The theory of community participation called a ladder of citizen participation which was introduced by Sherry R. Arnstein, who propounded the theory of

citizen participation in the year 1969 in America. Arnstein explained that this classification is necessary to reveal the manipulation of people in the grab of community participation projects by authorities and policy holders. The ladder has eight rungs, each matching to a different level of participation, that is, manipulation, therapy, informing, consultation, placation, partnership, delegated power and citizen control. The rungs at the bottom of the ladder are the ones with minimum citizen participation or non-participation and include manipulation and therapy. Informing, consultation and placation occupy the middle rungs of the ladder and edge between manipulation at the bottom and citizen control at the top and is called as tokenism where the people are permitted to participate only to the extent of expressing their views but have no real say in the matters.

The last three rungs, partnership, delegated power and finally citizen control at the top of the ladder are termed equal to citizen power and this is where true and meaningful participation takes place. This categorisation of the various types of people involvement is actual vital in clarifying the mix-up between non-participation and true citizen power also to identify the real reasons behind participatory projects, which are often used by critics as short coming of the concept of participation. The theory is relevant to the study where there is manipulation done by local authorities and local leaders about community participation development projects funds which leads to communities' loss of interest towards participation in development projects.

The pressure of participating in community planning and attaining a higher level of well-being can overwhelm residents and leave them feeling unable to meet the challenge. At the same time, community stakeholders are being asked to commit to several projects and partnerships, local and national organizations are being asked to contribute funds to various community programs, leaving them overburdened with obligations**.** In Nigerian society today, most people don't want to participate in community development due to some negative factors such as cultural, socio- economic, awareness, planning, and religions among others. But empowering people to become aware of the importance of community participation will help to eliminate the inhibiting factors. Government is expected to motivate and provide basic needs such as good drinking water, good road, health care delivery system, better agricultural and literacy education including effective security of lives and properties but unfortunately, this has not been completely achieved. Therefore, people must come together as a social unit to develop their communities by ignoring their differences. Apart from this, involvement of people in the development process usually results in lack of ownership and sustainability of development programmes. This often causes the communities to lose interest in these programmes, which in turn increases dependency on government resources.

The study is expected to be of much value to women and policy makers because it will enable women at local level to see the importance of participating in community development projects. It will help policy makers at the local level of governance to involve women in decision making on matters concerning their well-being. This study examined the motivational factors as correlates of women participation in community development in Ilorin Metropolis. The objective of the study is to; (i) ascertain the extent of women participation in community development projects in Ilorin Metropolis (ii) determine the correlation between motivational factors and women participation in community development in Ilorin Metropolis. Research Hypothesis for this study was: Ho 1: There is no significance correlation between motivational factors and women participation in community development in Ilorin Metropolis, Kwara State, Nigeria.

2.0   RESEARCH METHODOLOGY

Survey research design was adopted for the study. This design was considered vital because it enabled the researcher to generate data through the structured designed instrument. The researcher was aware of many Local Authorities which could provide information about the importance of women participation in community development activities, the researcher limited this research to Ilorin Metropolis to get data about women participation in community development activities at local government level in Ilorin Metropolis. The population of this study comprised of all women within four local governments in Ilorin Metropolis, these were Ilorin West, Ilorin East, Ilorin South and Asa Local Government Areas. A clustered sampling technique was used for the study. This was carried out by visiting communities within each of the local government areas and getting the details about the day, venue and time of community meetings. Thereafter, each community was revisited during the time of meetings and all the women present were sampled. Thus, a total number of 53, 49, 62 and 36 women who participated in community development programmes from Ilorin West, Ilorin East, Ilorin South and Asa Local Government Areas were randomly selected for the study and the total was 200 women.

The instrument used for data collection was researcher designed questionnaire titled Influence of Motivational Factors on Women Participation in Community Development Instrument (MFWPCDI). The instrument was used to elicit information on the motivational factors as correlates of women participation in community development in Ilorin metropolis, Kwara State Nigeria. The instrument was based on a four-point Likert scale of very high, high, low and very low. The instrument used for the study was validated by experts in the field of adult education and measurement and evaluation. The errors pointed out by the experts were corrected in the instruments, this helped to enhance the face, content and construct validity of the instrument. The Pilot study was conducted in the Irewolede community in Ilorin South to test the reliability of the instrument, this was determined through the use of test re-test method of reliability within three weeks. Sixty copies of the questionnaire were

administered to sixty women participants in Irewolede community in Ilorin. The two sets scores obtained were analysed with Prime Product Moment Correlation (PPMC) to determine the reliability of the instrument and value of 0.86 was obtained. The hypothesis raised for the study was analysed with linear multiple regression while the research question was analysed with descriptive statistics.

3.0 RESULTS

Research Question One: What is the extent of women participation in community development projects in Ilorin Metropolis?

Table 1: Level of women Participation in Community Development Projects in Ilorin Metropolis

Women Participation	Range Score	Frequency	Percentage
High Extent	13 – 16	64	32
Moderate Extent	9 – 12	96	48
Low Extent	4 – 8	40	20
Total		200	100

As shown in Table 1, the level of women participation in community development projects was at moderate level with 48%. Thus, if women are motivated to participate in the community development projects, this will increase their levels of participation in community development projects.

Hypotheses Testing

The hypothesis tested in this study was analysed using inferential statistics of a Linear Multiple Regression at 0.05 level of significance.

Ho$_1$: There is no significance correlation between motivational factors and women participation in community development in Ilorin Metropolis.

Table 2: Regression Analysis of Motivational Factors and Women Participation in Community Development Projects in Ilorin Metropolis

Model	Sum of Square	df	Mean Squares	F	Sig.
Regression	121.317	2	60.568		
Residual	2121.724	197	10.770	5.632	0.021
Total	2253.041	199			

a. Dependent variable Citizens' Participation in Community Development Projects
b. Predictors: (constant), Motivational (fringe benefit and empowerment) factors

The model in Table 2 indicated the linear combination of predictor variables motivational factors such as fringe benefit and empowerment. The F-value is 5.632with 2 and 197 degree of freedom at 0.05 critical level of significance. Since the p-value of 0.021 is less than 0.05 level of significance, the null hypothesis was rejected. Therefore, the combination of the independent variables significantly related to the dependent variable (F= 5.632, p<0.05). Thus, there was a significant correlation among motivational variables such as fringe benefit and empowerment and women participation in community development projects in Ilorin. In order to ascertain the contributions of the two independent variables together, R-square was calculated and output was presented in Table 3.

Table 3*: Regression Model Summary of motivational variables (fringe benefit and empowerment factors and women participation in community development

Model	R	R-Square	Adjusted R- Square	Std. Error of the Estimate
1	0.146	0.232	0.005	7.429

    (i)   Predictors: (constant), Motivational (fringe benefit and empowerment) factors

As shown in Table 3. The two independent variables (fringe benefits and empowerment) jointly contributed R-Square of 0.232, representing 23.2% of the dependent variable (women participation in community development). Thus, the total variance of women participation in community development was accounted for through the combination of fringe benefits and empowerment motivational factors. This implies that motivational variables such as fringe benefit and empowerment factors jointly explained 23.2% of the total variance on women participation in community development projects in Ilorin metropolis. To determine the contribution of each of the independent variable, Beta weight was calculated and the outputs were shown in Table 4.

Table 4: Relative Contributions of Independent Variables to women participation in community development projects in Ilorin metropolis

Model	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	T	Sig.
(Constant)	41.359	2.374		25.399	0.000
Empowerment	0.239	0.496	0.033	0.127	0.183
Fringe Benefit	0.617	0.342	0.064	0.315	0.000

    a.   Dependent Variable: Women participation in community development projects
    b.   Predictors: (constant), motivational (fringe benefit and empowerment) factors

Table 4 shows the relative contributions of each of the independent variable. The table revealed that fringe benefit has the highest contribution with Beta weight of 0.617 with t-value 0.315 when compared to the empowerment having the Beta weight of 0.239 with t-value 0.127 on women participation in community development projects in Ilorin Metropolis. This implied that the fringe benefits given to women contributed more to their participation in community development projects in Ilorin Metropolis. The contributions were presented in the equation below;

$$Y = a + biX_1 + b_2X_2 \dots bnXn$$

Thus, the weight of each independent variable in this study was therefore substituted in the equation as

$$Y = 41.359 + .239X_1 + .617X_2$$

where

    Constant (a) = (other variables that were not considered in this study but related to women participation in community development projects) = 41.359
    Empowerment (bi) = - 0.239
    Fringe Benefits (b_2) + 0.617

4.0 DISCUSSION OF THE FINDINGS

The finding of this study revealed that women participation in community development in Ilorin Metropolis was enhanced through the fringe benefits given to them as a result of their participation. This finding substantiates Russell, Greenhalgh, Byrne and McDonnell (2008) whose study submitted that being motivated as being moved to do something, implies that when a person is not moved or inspired to do something, such person is said to be unmotivated. This also corroborates Rafiu (2007) who affirmed that being motivated means that a person is encouraged to participate in a task with the aim of achieving the objectives. According to these scholars' individuals have different kinds of motivation.

Findings also indicated that the participation of a majority of women in Ilorin Metropolis in community development projects was at moderate level. As such 64 (32%) of them were of high extent of participation in community development projects; 96 (48%) of the women participated moderately in community development projects while 40 (20%) of the participants were of low extent of participation in community development projects. People's participation in any of the types of development projects is usually directed at the improvement of the general welfare and living conditions of the community members, the distribution of power and a rise in life expectancy this is in line with Fouke, (2012) whose study indicated that young citizens play essential role in building of schools and construction of roads in their communities.

In the same vein, Ogun eye, Adetona and Oladeinde (2013) observed that, official and voluntary assistance also stimulates the desire of the community members to participate in community development. It fosters the ability of community members to contribute to the development of their communities through self-help. Women can bring about desired change by expressing one's desire, either individually or through a community group. Women learn how to make desired changes, learn how to resolve conflicting interests for the general welfare of the group, and learn to understand and appreciate the individual needs and interests of all community groups. Women participation in community development develops pride of ownership in them after successfully completing a community development project. They will perceive the project as 'ours' rather than 'theirs'. Connell and Kubisch (2018), states that women participation in community development is educative and therefore an essential ingredient of any educational process. According to him, the lesson may be such that leads to behaviour modification or even the consolidation of the values of self-help. In its educational form, women participation possesses educative psychological properties of development.

In addition, findings showed that there was a significant correlation between motivational (fringe benefit and empowerment) factors and women participation in community development projects in Ilorin. Motivational (fringe benefit and empowerment) factors jointly explained 23.2% of the total variance on women

participation in community development projects in Ilorin Metropolis. Fringe benefits given to women contributed more to their participation in community development projects in Ilorin Metropolis. This agrees with Batwel (2008) who revealed in his study that the benefits can be of infinite nature. They can range from personal wants to desired ends sought by a group. They can be economic in nature or might include an activity to improve the morals of community residents. Community development itself is filled with a lot of benefits. It is only when women come together that they can tap those benefits. The main purpose of community development is to de-emphasize regurgitate reliance on government to bring development to the community.

5.0 CONCLUSION AND RECOMMENDATIONS

Based on the findings of this study, it could be concluded that the motivational factors of women towards their participation in community development project are relatively moderate. As a result, women in Ilorin Metropolis were found participating abstemiously in community development projects. Despite this, their motivational (fringe benefit and empowerment) factors significantly correlate women participation in community development projects in Ilorin metropolis. The fringe benefits given to women contributed more to their participation in community development projects in Ilorin Metropolis.

With respect to the findings of this study, the following recommendations were proffered;
  i)   Women should always be motivated by the government and development policy makers   towards partaking in community development projects so as to cultivate the sense of being useful not only to themselves alone but also to their immediate community at large
 ii)   Women should always be empowered socially and economically within the community by the Government at the state and local government. This could assist in motivating and fostering their participation towards the development of their various communities
iii)   Government and non-government organisations should periodically empower citizens through the provision of financial assistants and health facilities as well as sensitising citizens on political rights, duties and obligations which could enable them to partake and contribute to the community development
iv)   Government and NGOs should continue to assist communities to plan, provide financial assistance, implement, monitor and maintain sustainable and socially inclusive multi-sectoral micro-projects for developmental purposes.

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Assessment of Factors Influencing Sexual Reproductive Health Communication between Parents and Adolescents in Tabora Region

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Abstract

The study assessed the factors influencing Sexual Reproductive Health (SRH) communication between adolescents and Parents in Tabora region. It adopted a mixed study design whereby both qualitative and quantitative methods of data collection were used in the field. The general objective of the study is to provide an understanding on the factors influencing parent-adolescent communication on sexual and reproductive health behaviours in Tanzania. The specific objective of the study was to assess the factors influencing parent-adolescent communication on SRH in Nzega District. It also used in-depth interview, focused group discussion and observation to answer the research objective. The results indicated that, communication on SRH were gender sensitive with more communication between female adolescents and mothers leaving male adolescents with low levels of communication with both parents. This was the result of gender gap in children grooming which attach a big role to mothers than fathers. Apart from that religion was also found to be an important predictor of SRH communication between parents and adolescents. Moreover, parents' attitude on the importance of SRH communication and their perceived ability to communicate SRH topics with adolescents also predicted the levels of communication concerning SRH because positive parents' attitudes and perceptions were associated with high levels of SRH communication. The study recommends that SRH should be strengthened at community level to reduce early adolescent child birth and maternal mortality. Also, it concludes that SRH communication is essential for raising awareness on issues of reproductive health which govern future population growth. Therefore, it should be enhanced through promoting positive parents' attitude and perception towards such communications.

Keywords: *Adolescent, Parents, Sexual Reproductive Health, parent-adolescent communication*

1.0 INTRODUCTION

The study assessed the factors influencing Sexual Reproductive Health (SRH) communication between adolescents and Parents in Tabora region. It adopted a mixed study design whereby both qualitative and quantitative methods of data

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collection were used in the field. The general objective of the study is to provide an understanding on the factors influencing parent-adolescent communication on sexual and reproductive health behaviours in Tanzania. The specific objective of the study was to assess the factors influencing parent-adolescent communication on SRH in Nzega District. It also used in-depth interview, focused group discussion and observation to answer the research objective. The results indicated that, communication on SRH were gender sensitive with more communication between female adolescents and mothers leaving male adolescents with low levels of communication with both parents. This was the result of gender gap in children grooming which attach a big role to mothers than fathers. Apart from that religion was also found to be an important predictor of SRH communication between parents and adolescents. Moreover, parents' attitude on the importance of SRH communication and their perceived ability to communicate SRH topics with adolescents also predicted the levels of communication concerning SRH because positive parents' attitudes and perceptions were associated with high levels of SRH communication. The study recommends that SRH should be strengthened at community level to reduce early adolescent child birth and maternal mortality. Also, it concludes that SRH communication is essential for raising awareness on issues of reproductive health which govern future population growth. Therefore, it should be enhanced through promoting positive parents' attitude and perception towards such communications.

Tanzania is experiencing high risky sexual behaviours among adolescents and their associated health outcomes (MoHCDGEC, 2018). Moreover, communication concerning sexuality with young people has a long history in Tanzanian societies as it was practiced in different regions and was commonly known as "Jando na Unyago" (Anu, 2017). The practice was done before puberty to initiate a child to adolescence with key messages with respect to elders, life skills, personal hygiene, family life as well as sexuality and sexual activities (Halley, 2012). During these events adolescent communication responsibilities were done by elders in the community locally known as "kungwi" rather than parents themselves. This practice was superseded by indirect SRH communication through external sources such as teachers, grandparents, aunts and uncles (Maina et al. 2020). Mekonen et al. (2018) and Adam et al. (2020) put parents especially mothers at the central point of SRH information sharing to adolescents. Despite the increasing demand of parent-adolescent communication about SRH issues, the level of communication is very low with limited topics of discussion (Baku et al. 2017; Akida, 2018). Parents especially mothers communicate more with female adolescents than male counterparts due to the assumptions that female adolescents are more vulnerable to negative reproductive health outcomes than male adolescents (Akida, 2018; Oyebuyi et al. 2019). Hence as indicated above the study recommends that SRH should be strengthened at community level to reduce early adolescent child birth and maternal mortality. Also, it concludes that SRH communication is essential

for raising awareness on issues of reproductive health which govern future population growth. Therefore, it should be enhanced through promoting positive parents' attitude and perception towards such communications.

A number of studies indicate low rates of parent-adolescent communication concerning SRH issues in high and low-middle income countries. For example, the study by Vongsavanh et al. (2020) in Vientiane found that only a quarter of high school adolescents had frequently discussed SRH topics with their parents. Similarly, in the studies by Habte et al. (2017) and Ojebuyi et al. (2019) in Ethiopia and Nigeria respectively, they found low rates of parent-adolescent SRH communication. However, gender differentials have been the main determinant of parent-adolescent SRH communication. For instance, mothers discuss SRH issues more with daughters than sons. Whereby, the discussions are in many cases dominated by menstruation and pregnancies topics (Ojebuy et al. 2019). On the other hand, Guilamo-Ramos et al. (2019) found that fathers feel comfortable to discuss sexuality issues with their adolescent sons than daughters although in rare cases. These studies indicate that the low levels and gender biasness in SRH communication prevail without geographical location limits.

Parents education has been addressed as one of the factors influencing SRH communication between parents and adolescents whereas having formal and higher education promotes such communication (Sailaja and Nana, 2017; Ojebuyi et al. 2019). However, this was contrary to the study by Malango, Hegena and Assefa, (2020) on SRH discussions between parents and adolescents and the associated factors in Ethiopia who found that parents do not need high levels of education to communicate SRH topics with their children. On the other hand, religious and cultural beliefs have been documented as the barriers to SRH communication between parents and adolescents. The study done by Baku et al. (2018) in the Accra Metropolis, Ghana revealed different feelings on SRH communication among religious believers whereby Pentecostal believers were against such communication while the Catholics were in support of such communication with more caution about condoms and contraception discussions. This indicated that, religion is misconstrued by parents as the barrier to SRH communication while in the actual sense it is not against such communication rather it insists about abstinence (Motsomi et al. 2016; Bikila et al. 2021).

Parents' attitude and self-efficacy were also found to be important determinants of SRH communication between parents and adolescents. Usonwu, Ahmad and Curtis-Tyler (2021) in their qualitative review and thematic synthesis on parent-adolescent SRH communication in sub-Saharan Africa addressed parents' self-efficacy as the factor influencing SRH communication. The study found that lack of self-efficacy among parents was the main barrier to SRH communication. Likewise, Malango, Hegena and Assefa (2020) in their study on Parent-Adolescent Discussion on Sexual and Reproductive Health Issues and Its

Associated Factors Among Parents in Sawla Town, Gofa Zone, Ethiopia found that positive attitude towards SRH communication determined such discussion. This indicates that positive attitude on the importance of communicating SRH issues and positive perception on the ability to communicate SRH topics with adolescents are very important triggers of SRH communication between parents and adolescents. Nevertheless, their interaction effects on individual parents' and adolescents' characteristics are not well addressed hence creating the knowledge gap.

2.0   THEORETICAL LITERATURE REVIEW
2.1   Family Communication Pattern Theory (FCPT)
The FCPT was established in 2006 by Koerner & Fitzpatrick explaining how parents interact with their children to process information coming from the family's external environment. The theory has two predilections which are compliance and conversation. Under conversation predilection parents are committed to unlimited open and frequent discussions with their children on various SRH topics whereas in compliance predilection children are required to abide to family's common attitude, values and beliefs. However, in studying the effects of family communication pattern on family outcomes it is important to consider on both conversation and conformity predilections. This is because the family outcomes depend on the interaction of the two predilections which are protective (high compliance with low conversation), consensual (high compliance with high conversation), pluralistic (high conversation with low compliance) and laissez-fare (low compliance with low conversation families). This theory has been applied to classify different families' typology (Keating et al. 2013) as well as to measure family communication patterns and their effects on family members' behaviour (Mirzaei-Alavijeh1 et al. 2015; Mashalpoure, 2020; Ahmad & Turnip, 2019). The theory has some weaknesses for it just focuses on the actual communication rather than the outcomes of such communication. However, it is suitable for this study for it recognizes that there is neither universal ideal family type nor universal approach of communicating within families (Koerner & Fitzpatrick 2006).

2.2   Integrative Model of Behavioral Prediction (IMBP)
The model was compounded from the Theory of Reasoned Action (TRA), Socio-Cognitive Theory (SCT), Health Belief Model (HBM) and Theory of Planned Behaviour (TPB) (Fishbein & Ajzen, 2010). The model postulates that an individual's behaviour is determined by his/her intention to perform such behaviour which is influenced by cognitive variables (attitude, perceived social norms and perceived behavioural control). Attitude refers to an individual's evaluations on whether performing a certain behaviour is good or bad whereas perceived norms is based on the perception on whether important social networks (society, and peers) are in support of such behaviour. It also posits that individuals background variables like demographic, socio-economic, culture and media exposure can have influence on either those cognitive variables or that

behaviour directly (Fishbein & Ajzen, 2010). However, the model has been challenged for considering intention towards a behaviour as a moderating factor despite the truth that individual's intention to perform a certain behaviour can be interfered with external environment (Dai et al. 2017). Nonetheless, despite this weakness the model has been widely used to predict different behaviours in diverse population (Byers et al. 2017; Dai et al. 2017). Hence, its integrative nature gives the best conceptual framework to determine the factors influencing SRH communication and the interaction between those factors and parents' attitudes, perceived social norms and behavioural control in predicting SRH communication between parents and adolescents.

2.3 Conceptual Framework of the Study
The conceptual framework of this study is based on the IMBP by Fishbein & Ajzen (2010) as indicated in Figure 1.
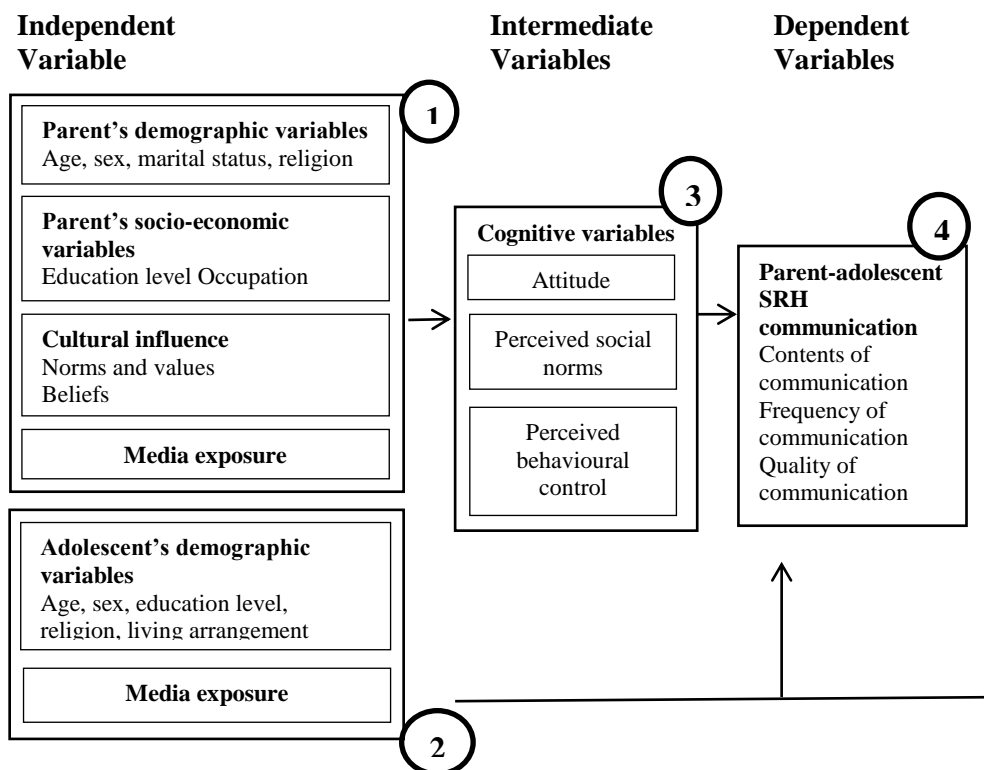
Figure 1: Conceptual framework on factors influencing parent-adolescent communication on SRH
Source: Adopted and Modified from Fishbein& Ajzen (2010)

The model shows how parent's behaviour in communicating SRH topics can be affected by their demographic characteristics and adolescents' demographic characteristics either directly or through interacting with their cognitive variables (attitude, perceived social norms and perceived behavioural control). The conceptual framework further indicates independent variables which are more

related to Parents' characteristics like age, sex, marital status, religion, level of education, occupation, religion, norms and beliefs and media exposure (Box 1). Likewise, adolescent characteristics include age, sex, education level, religion, living arrangement and media exposure (Box 2). It also indicates that the nature of parent-adolescent SRH communication (Box 3) is predetermined by both parents' and adolescents' characteristics which can have direct influence or through interaction with parents' attitude, perceived norms and perceived behavioural control towards SRH communication with adolescents (Box 4)

3.0 RESEARCH METHODOLOGY

The study employed an exploratory descriptive cross-sectional design. This design was used so as to get the current overall picture of the determinants and influence of parent-adolescent SRH communication on adolescent SRH behaviours by considering both parents and adolescents. Kumar, (2019) contends that cross-sectional design is useful in obtaining an overall picture of a phenomenon at the time of the study. A total of 384 households with a pair of one parent and one adolescent each were selected from Nzega Town Council and Nzega District Council. Whereby, one ward was selected from each Council. Both bivariate and multivariate analysis were carried out to determine the factors influencing SRH communication between parents and adolescents.

The factors associated with parents and adolescents SRH communication were examined based on adolescents' characteristics such as sex, age, attending school, level of education, person living with, tribe, religion, family type and media exposure. Parents' demographic, socio-economic and cognitive factors were also taken into consideration. The multivariate analysis was based on the logistic regression model transformed from the following logit model

$$Y_j = \ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_i x_i$$

Furthermore, the interaction effects of parents perceived behavioural control with parent's religion and family type in influencing SRH communication was also tested through separate regression model with interaction term as follows:

$$Y_j = \ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 X_n{}^* Parpercbehavcont$$

4.0 RESULTS AND DISCUSSION
4.1 Association between Adolescents' Characteristics and SRH Communication with Parents

The results in Table 1 indicate that adolescents' sex, religion and family type were the only adolescent characteristics which were statistically significant associated with general SRH communication with parents at 95% CI, (p-value < 0.05). A large proportion (77.6%) of female adolescents communicated with their parents compared to males (67.7%). This is because parents consider

female adolescents to be the most vulnerable to risky sexual behaviours which have more impacts on their reproductive health than males (Akida, 2018; Oyebuyi et al. 2019). On the other hand, adolescents' age, schooling status, level of education, person living with and adolescents' exposure to media were not statistically significant with communication concerning SRH issues.

This gender gap in SRH communication was also confirmed by a 52-year-old female parent at Mambali ward:

> "…*female adolescents are most prone to risky sexual behaviours and so they are affected more with the outcomes of such behaviours. Therefore, leaving them without telling them to take care of themselves is risky as they can lose their virginity and destroy the family's reputation and some effects are more adverse as they might lead to shame in the family especially when they get pregnancies and/or HIV"* (Female parents FGD-Mambali ward on 13/10/2021).

These results are similar with the studies of Kamangu (2017) and Byes et al. (2021) who found that SRH communication was more common among females. Therefore, close monitoring on adolescent girls intends to maintain their virginity until marriage and hence enhance family's prestige (Motsomi et al. 2016). The study further indicates that religion is an important indicator of SRH communication between parents and adolescents whereas more Muslim (78.4%) and Christian (72.9%) adolescents communicated with their parents concerning SRH issues while only (54%) of the adolescents with traditional religion communicated SRH with their parents especially on abstinence. This is confirmed by other studies (Motsomi et al. 2016; Bikila et al. 2021) who clearly established that religious stand on SRH communication depends on the topics of discussion as stated by religious leader:

> "... *Sexual relationship among unmarried people is not acceptable in Islamic religion. Therefore, the discussion between parents and adolescents should focus on insisting adolescents to abstain from sexual relationship before marriage because promiscuity is against Allah commandments"* (Muslim Religious Leader in Nzega Town West on 25/10/2021).

Equally, discussions concerning SRH seem to be high among adolescents in consensual (80.4%) and pluralistic (77.1%) families because these families are characterized by high levels of conversation with more interaction between parents and their children (Koerner & Fitzpatric, 2006). The results further show that less than three quarters of adolescents from protective (60.8%) and lasses-faire (60.7%) families communicated SRH topics with their parents. In these families, parents do not value frequent and open communication with their adolescent children due to low closeness between them hence low levels of SRH communication (Carver et al. 2016).

Table 1: Chi-square test between adolescents' characteristics and SRH communication

Adolescents' Characteristics	Had discussion		Chi-square test	
	Yes (n=297)	No (n=105)		
Sex			$\chi^2(1):4.7320$	*P-value*: 0.030[*]
Male	67.7	32.3		
Female	77.6	22.4		
Age			$\chi^2(2):2.9556$	*P-value*: 0.228
15-16	68.7	31.3		
17-18	74.4	25.6		
Above 18	78.9	21.1		
Currently attending school			$\chi^2(1):1.6459$	*P-value*: 0.200
Attending	70.0	30.0		
Not attending	75.9	24.1		
Religion			$\chi^2(2):8.2801$	*P-value*: 0.016[*]
Muslim	78.4	21.6		
Christian	72.9	27.1		
No religion	54.0	46.0		
Tribe			$\chi^2(2):0.6725$	*P-value*: 0.714
Nyamwezi	73.6	26.4		
Sukuma	72.9	27.1		
Others	66.3	33.7		
Person Living With			$\chi^2(2):4.6506$	*P-value*: 0.098
Single parent	74.0	26.0		
Both parents	74.7	25.3		
Others	60.0	40.0		
Media Exposure			$\chi^2(1):0.2020$	*P-value*: 0.653
Exposed	73.9	26.1		
Not exposed	71.8	28.2		
Family Type			$\chi^2(3):15.2040$	P-*value*:0.002[**]
Consensual	80.4	19.6		
Pluralistic	77.1	22.9		
Protective	60.8	39.2		
Laisses-fairs	60.7	39.3		

[*]The test indicates a significant association at 95% level of confidence
Source: Field Survey, 2022

4.2 Association between Parents' Demographic Characteristics and SRH Communication

The results in Table 2 show slight differentials in SRH communication whereby the majority (74.9%) of female parents communicated with their adolescent children concerning SRH compared to male parents (69.9%). The results are similar to the study of Sagnia et al. (2020) in Gambia which showed that SRH communication role was mostly played by mothers than fathers. This is due to cultural settings of African societies whereby the role of child rearing and grooming is mostly put on mothers' hands (Mbachu et al, 2020; Yibrew & Mbwele, 2020). The chi-square test indicates that there was no statistically significant association between parents' demographic characteristics (sex, age, religion, tribe and marital status) and general communication on sexual and reproductive health issues between parents and adolescents (p-value > 0.05).

Table 2: Chi-square test between parents' demographic characteristics and SRH communication

Parents' demographic characteristics	Had discussion		Chi-square test	
	Yes (n=279)	No (n=105)		
Sex			$\chi^2(1):1.1673$	*P-value*: 0.280
Male	69.9	30.1		
Female	74.9	25.1		
Age (years)			$\chi^2(3):1.0756$	*P-value*: 0.783
30-39	74.3	25.7		
40-49	69.9	30.1		
50-59	75.6	24.4		
60 and above	71.7	28.3		
Tribe				
Nyamwezi	75.9	24.1	$\chi^2(2): 1.5789$	*P-value*: 0.454
Sukuma	69.9	30.1		
Others	71.0	29.0		
Religion			$\chi^2(2): 1.2152$	*P-value*: 0.545
Muslim	75.2	24.8		
Christian	72.5	27.5		
No religion	65.7	34.3		
Marital status				
Never married/Separated	65.2	34.8	$\chi^2(2): 1.6092$	*P-value*: 0.447
Married/cohabiting	73.3	26.7		
Widow/widower	76.2	23.8		

*The test indicates a significant association at 95% level of confidence
Source: Field Survey, 2022

4.3 Association between Parents' Socio-economic Characteristics and SRH Communication

The results in Table 3 indicate that mothers' education level was an important predictor of SRH communication between parents and adolescents (p-value = 0.006). Adolescents whose mothers had no formal education and primary education (72.3%) and (78.2%) respectively had high levels of SRH communication compared to those with secondary education and above (57.1%). These results contradict with those by Ojebuyi et al. (2019) in Nigeria and Abdissa and Sileshi, (2021) in Ethiopia who found that SRH communication with adolescents was higher among parents with primary education and above. However, the differentials observed can be justified by parents' consideration of communication about SRH issues as the normal parental responsibility which does not need them to have higher levels of education for such communication to be carried out. It was also observed by Malango et al. (2020) that parents' ability to read and write was adequate for parents to communicate SRH issues with adolescents. Likewise, parents' occupations were among important predictors of SRH communication for more adolescents with fathers and mothers in agricultural occupation (78.3%) and (77.8%) respectively reported having SRH communication with parents. Nonetheless, adolescents from families whose parents were in business had low levels of communication because only (58.9%) and (53.2%) of mothers and fathers in business had communicated with their adolescents on SRH issues within six-months prior to the survey. These results are similar to what was found by the study of Bikila et al. (2021) in Ethiopia.

Table 3: Chi-square test on the association between parents' socio-economic characteristics and SRH communication between parents and adolescents

Parents' demographic characteristics	Had discussion		Chi-square test		
	Yes	**No**			
Fathers' education	**(n=239)**	**(n=91)**	$\chi^2(2)$:3.7048	*P-value*: 0.157	
None formal	65.3	34.7			
Primary	76.1	23.9			
Secondary and above	67.1	32.9			
Father's occupation			$\chi^2(2)$:14.8577	*P-value*: 0.001**	
Agriculturalists	77.8	22.2			
Business persons	53.2	46.8			
Others	70.6	29.4			
Mothers' education	**(n=271)**	**(n=97)**	$\chi^2(2)$: 0.006**	10.3463	*P-value*:
None formal	72.3	27.7			
Primary	78.2	21.8			
Secondary and above	57.1	42.9			
Mothers' occupation			$\chi^2(2)$: 0.002**	12.0615	*P-value*:
Agriculturalists	78.3	21.7			
Business persons	58.9	41.1			
Others	65.2	34.8			

*The test indicates a significant association at 95% level of confidence
Source: Field Survey, 2022

4.4 Association between Parents' Cognitive Variables and SRH Communication

The results in Table 4 indicate that more than three quarters (77%) of adolescents whose parents had positive attitudes towards SRH communication discussed at least any SRH topic with their parents within six-months prior to the survey compared to those whose parents had negative attitudes (65.8%). Likewise, the level of SRH communication was higher among adolescents whose parents had positive perceived behavioural control (77.3%) than negative counterparts (56.5%). Parents' attitude and perceived behavioural control were statistically significant (p-value < 0.05) predictors of SRH communication between parents and adolescents. However, parents' perceived norms had no significant association (p-value > 0.05) with SRH communication. These results concur with the study by Byers et al. (2018) in Canadian Province which found mothers' attitude and perceived behavioural control to be among important predictors of mother-adolescent sexual communication while perceived social norms were not significant. This indicates that having positive evaluation on the importance of SRH communication with adolescents is very important for parents to have such communication. Moreover, parents' self-confidence on communicating SRH topics with adolescents is required in promoting such communication. Hence, parents' knowledge on SRH issues should be enhanced through continuous mass media campaigns so that their can increase confidence on communication SRH topics with adolescents. This should not be taken into granted due to its significance in the future healthy generation.

Table 4: Chi-square test on the association between parents' cognitive variables and SRH communication between parents and adolescents

Parents cognitive variables	Had discussion		Chi-square test
	Yes (n=279)	No (n=105)	
Attitude			$\chi^2(1)$: 5.8084 P-*value*: 0.016*
Positive	77.0	23.0	
Negative	65.8	34.2	
Perceived norms			$\chi^2(1)$: 0.4770 P-*value*: 0.490
Positive	74.0	26.0	
Negative	70.8	29.2	
Behavioral control			$\chi^2(1)$: 14.3949 P-*value*: 0.000***
Positive	77.3	22.7	
Negative	56.5	43.5	

*The test indicates a significant association at 95% level of confidence
Source: Field Survey, 2022

4.5 Logistic Regression Results on SRH Communication between Parents and Adolescents

The logistic regression model was significant at 95% CI, $\chi^2 = 53.74$, p < 0.000 and it explained 14.3% (Pseudo R^2) the variation of SRH communication. Furthermore, the results in Table 5 indicate that religion specifically being Christian or in other group, being from laissez-faire families, business occupation among fathers and parents' positive behavioural control were significant factors influencing SRH communication between parents and adolescents (p-value < 0.05). It is clearly observed in the table that Christian adolescents were 0.5 times likely to communicate SRH issues with parents compared to Muslims counterparts (OR:0.50; 95% CI: 0.26-0.97). Nonetheless, adolescents who were neither Christians nor Muslims were more less likely to communicate such topics with their parents (OR:0.12; 95% CI: 0.05-0.34). This indicates that Muslim parents communicate more with their adolescents concerning SRH issues compared to other religions. However, the low levels of SRH communication practices among adolescents who were neither Muslims nor Christians portray the message that families with traditional religion are much bounded to cultural norms and traditional beliefs which regard such communication as taboos (Kamangu, 2017). These results are also supported by the findings of Motsomi et al. (2016) who found that parents consider SRH communication with adolescents as culturally unacceptable. Equally, adolescents from lasses-faire families were less likely (OR:0.37; 95% CI:0.17-0.80) to communicate SRH topics with their parents as compared to consensual families. The low odds of SRH communication with parents among adolescents from these families can be explained by low levels of conversation and conformity communication patterns.

With regards to fathers' occupation, fathers in business occupation were less likely (OR:0.34; 95% CI:0.16-0.74) to communicate with their adolescents concerning SRH compared to fathers in agricultural occupation. This situation is propagated by busy schedules of fathers in business occupation unlike

agricultural activities which are seasonal hence provide ample time for parents to have talks with their adolescents. These results concur with the observation made by Bikila et al. (2021) in Ambo Town Omora State in Ethiopia where business was among the hindrances of communication concerning SRH topics. It was also confirmed during parents' FGDs in Nzega Town ward where a 42-year-old male parent said:

> *"... Sometimes the nature of occupation determines how free a parent can be to have time to talk to adolescents about SRH topics. For example, we male parents in business occupation when we wake up in the morning we just think about business. We think on how the day will end by focusing on how much we will generate. So usually our minds are too busy thinking about our businesses and we usually come home late so we find ourselves with limited time to talk to adolescents concerning SRH issues"* (Male Parents FGD – Nzega Town Ward on 20/10/2021).

Table 5: Logistic regression results on the factors influencing SRH communication between parents and adolescents

Independent Variables	Odds Ratio	S.E	Z	P>|z|	[95% Conf. Interval]	
Sex						
Female	1.251	0.364	0.77	0.441	0.707	2.213
Religion						
Christian	0.505	0.174	-1.98	0.048*	0.256	0.993
Others	0.119	0.061	-4.13	0.000**	0.043	0.327
Family type						
Pluralistic	0.878	0.329	-0.35	0.728	0.422	1.829
Protective	0.531	0.204	-1.65	0.100	0.249	1.128
Laissez-faire	0.367	0.146	-2.51	0.012*	0.168	0.802
Father's occupation						
Business person	0.336	0.136	-2.70	0.007**	0.153	0.741
Others	0.679	0.322	-0.82	0.413	0.268	1.718
Mother's education						
Primary	1.308	0.461	0.76	0.447	0.655	2.612
Secondary and above	0.874	0.442	-0.27	0.790	0.324	2.355
Mother's occupation						
Business person	0.718	0.325	-0.73	0.464	0.296	1.742
Others	0.782	0.433	-0.44	0.657	0.264	2.318
1.Parentattitude	1.072	0.323	0.23	0.818	0.594	1.935
1.Parbehavcont	2.233	0.704	2.55	0.011*	1.204	4.140
_cons	4.597	2.546	2.75	0.006**	1.553	13.613

*The test indicates a significant association at 95% level of confidence
Source: Field Survey, 2022

4.6 Impact of Interaction of Parents' Perceived Behavioral Control on Predicting SRH Communication

According to Mize, (2019), many relationships of variables of the interests in social sciences are interactive hence necessitating testing for the interaction effects between variables to have sound conclusion. Therefore, the study tested the interaction effects between parents' and adolescents' characteristic and parents' behavioral control which emerged significant predictors of SRH communication between parents and adolescents in the logistic regression model. In order to test for the interaction effects, marginal effects were estimated

in order to enhance correct interpretation of the results (Williams, 2012). Therefore, the margins plots were used for easy visualization and interpretation of the observed interaction. It can be observed in Figure 1that with regard to the main effect of the model, parents with negative perception on their ability to communicate SRH topics were in general less likely to communicate SRH compared to those who were confident that they can communicate. Whereas, negative perception on the capacity to communicate SRH issues with adolescents has more effect among laissez-faire families which are high in conformity and low in conversation predilection. This is justified by the study of Hemati et al. (2020) in Iran who found the direct correlation between self-efficacy and conversation predilection and vice versa. Hence, parent-child closeness is very important in child growth especially when communication concerning confidential messages is required.

Figure 1: Interaction effects of parents' perceived behavioral control on family type in predicting parent-adolescent SRH communication

Source: Field Survey, 2022

Likewise, the study revealed significant interaction between adolescent religion and parents perceived behavioral control as indicated in Figure 2. The results show that negative parents' perception on the ability to communicate SRH topics with adolescents had more interaction effects with traditional religion than Muslims and Christians. The likelihood of SRH communication was lower among adolescents in traditional religions whose parents had negative perception on their ability to communicate SRH topics with adolescents. This implies that lower communication among adolescents in traditional religious is driven by negative parents' perception on their ability to communicate the topics. This situation reflects the effect of lack of exposure to religious teachings among both parents and adolescents on their confidence to communicate SRH topics. Hence, they abide themselves to traditional norms and beliefs that communication concerning those topics is a taboo (Mekonen et al. 2018; Adam et al. 2020;

Malango et al. 2021; Bekele et al. 2021). On contrary, religious teachings gives parents a starting point to share with adolescents important SRH messages as they advocate abstinence (Svodziwa, Kurete and Ndlovu, 2016). Therefore, during those discussions, parents get chances to discuss with their children issues concerning the effects of premarital sex like unplanned pregnancies and STIs including HIV/AIDS.
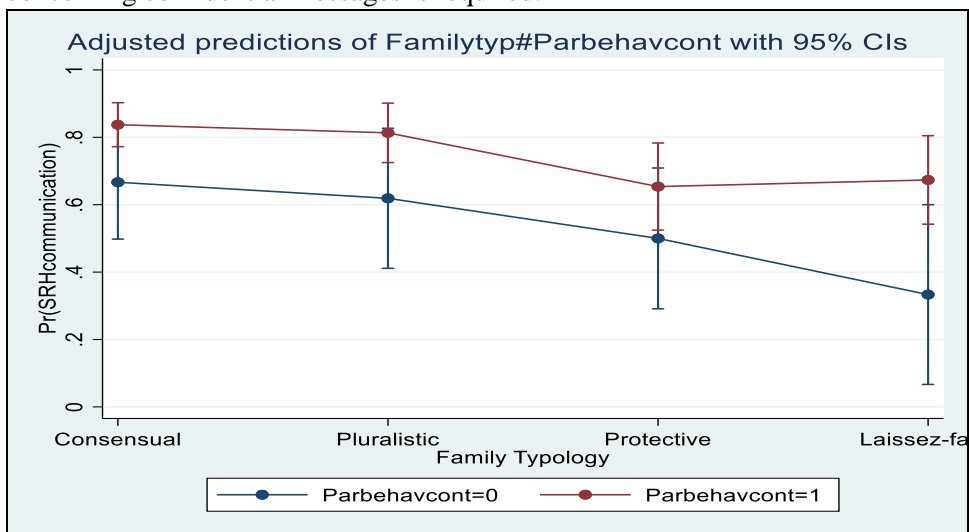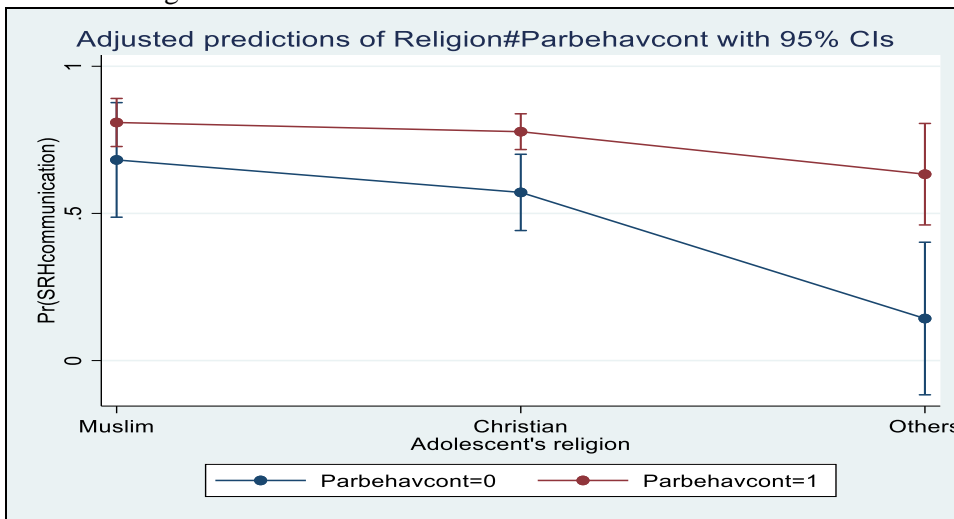

Figure1: Interaction effects of parents' perceived behavioral control on parents' religion in predicting parent-adolescent SRH communication
Source: Field Survey, 2022

5.0 CONCLUSION AND RECOMMENDATIONS

Regarding the assessment of factors influencing SRH communication between parents and adolescents it was observed that it was gender sensitive with more communication between female adolescents and mothers leaving male adolescents with low levels of communication with both parents. This was the result of gender gap in children grooming which attach a big role to mothers than fathers. Unfortunately, mothers feel more comfortable to discuss such topics with female adolescents than male counterparts. On the other hand, fathers find themselves with limited time to share confidential messages concerning SRH issue with their sons. Meanwhile business occupation was among the hindrances of SRH communication between parents and adolescents due to busy schedules associated with it. Apart from that religion was also found to be an important factor of SRH communication between parents and adolescents. However, unlike previous studies which revealed negative influence of religion on SRH communication this study showed that high levels of communication between parents and adolescents were more common among Muslims and Christians. Though, it should be noted that abstinence was the main topic which was promoted by both Islamic and Christian religions which are against condoms and/or other contraceptives use communication. Therefore, more emphasis was put on avoiding premarital sex as to maintain holy lives.

Similarly, family type influenced SRH communication between parents and adolescents. Adolescents in laissez-faire families reported low communication compared to adolescents in consensual families. This is based on the reality that laissez-faire families are basically characterized by low levels of conversation and conformity predilections. Hence, they end up in limited openness and free communication between parents and adolescents due to low parent-child interconnectedness.

Parents' attitude on the importance of SRH communication and their perceived ability to communicate SRH with adolescents also predicted the levels of communication concerning the SRH topics. Positive parents' attitudes and perceptions were associated with high levels of SRH communication. Meanwhile, parents' perceptions on their ability to communicate were also a significant factor in influencing SRH communication between parents and adolescents. Moreover, adolescent religion, family type (laissez-faire) and occupation (business) were important factors in influencing SRH communication between parents and adolescents. Moreover, the low levels of communication in adolescents of other religions and laissez-faire families the evaluation showed their low ability to communicate SRH topics with adolescents. These results justify that parent-child closeness and religion are important factors to in enhancing parents' self-efficacy in communicating SRH topics with adolescents. Hence it also important for parents to have time to monitor their adolescents on SRH regardless their occupations. The study recommends that sexual reproductive health education should be introduced at community level as well as in all levels of education. Furthermore, the st5udy concludes that SRH is essential in order to reduce child birth and maternal mortality.

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Assessment of Quality of Water Resource from Great Ruaha River and Allied Water Sources Serving Domestic Purposes at Pawaga Division

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Abstract

This study intended to assess water quality from Ruaha River and allied water sources serving domestic purpose in Pawaga division. By using standard methods triplicate samples from sixteen (16) different sites were collected and analyzed for physicochemical parameters and bacteriological values. The conductivity of analysed samples ranged between 1 – 286 µS/cm which is lower than the TBS threshold 2,500 µS/cm. The TDS ranges between 107 – 2235.8 mg/L during the wet season and 49.0 – 2,616.3 mg/L during the dry season. The level of Na+ ranges between 0.2 – 104.4 mg/L during rainy season and 0.8 -119 mg/L during dry season. Nitrate levels ranges between 0.4 – 101.4 mg/L during rainy season and 0.3 – 107.9 mg/L during dry season. This may be contamination from fertilizers, municipal wastewaters, feedlots, septic systems in river water. Sulphate concentration ranges between 0.3 – 93.0 mg/L during rainy season and 3.7 – 98.9 during dry season. Sulphate can also be produced by bacterial or oxidizing action as in the oxidation of organo-sulphur compounds and the more common sinks are pyrite, gypsum, and sulphate reduction. The study concluded that, water supplied by Pawaga water supply must be treated to eliminate microbial, physical and chemical pollution prior to domestic water supplies. It recommended that Government should strengthen water intervention management and carry out intervention measures to improve water quality and reduce water pollution's impact on human health. The control of water pollution can be done by increasing monitoring of wastewater disposal into rivers, carrying out an inventory and identifying water pollution sources.

Keywords: *Water Treatment, Rural Water Supply, Public Health, Pawaga*

1.0 INTRODUCTION

Water resource, next to energy, is the second of human top ten problems in the next 50 years (Kumar et al., 2014). Its challenges are quality and quantity based, where different specialized professionals work on it; however, it is also unofficial or traditionally realised by unskilled but experienced water users. Water quality challenges are mainly invisible which is chemicals and microbial pollution. Anyone can analyse physical water pollution, such as unpleasant colour, odour, taste and turbidity, but chemical and microbial pollutions become

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ascertained by qualified professional scientists in the water quality laboratory fields (Mihale, 2015). It is important for water utilities to provide esthetically acceptable drinking water to the public, because our consumers always initial judge the quality of the tap water by its color, taste, and odor (Zhou, et al., 2017). In this case, clean and safe drinking water is vital for the health and wellbeing of all domestic water user populations. Water is abstracted from the surface and groundwater sources, and if it is of poor quality, it must be treated to comply with drinking water standards before domestic supply (Bhuvana and Ramesh, 2012). Such conforming water is later delivered to concerned users under an established supply network through the drinking water distribution system (DWDS). As water moves through the DWDS, water quality is likely to change and may deteriorate if supply infrastructures are poor, resulting in (i) microbiological growth, (ii) chemical reactions, (iii) interactions with deteriorating and ageing infrastructure (McClain et al., 2013). The visibility of water quantity constraints makes it a prioritised area compared to quality issues, and engineer's trade-off for the majority to have at least some water rather than missing it out. The danger of this paradigm centers on foregone concepts that without first-hand knowledge of water source quality may lead to a poor (e.g., wastewater) distribution for communities where unknowingly supply of contaminants can cause diseases occurrence (Mahmud, et al., 2019). The effects can thus reach an epidemic level, and more to children and already sick people with limited immunity. A similar reason can justify the establishment of the United Nations (UN) Sustainable Development Goal (SDG) number 6 for clean water and sanitation; and the Water Action Decade 2018-2028 (Liu, *et al.,* 2012).

The DWDS issues include the formation of biofilms which are among the ignored sources of unpleasant taste and odour in piped water supplies (Zhou et al., 2017; Perrin et al., 2019), and where the mechanism to eliminate them is a challenging task. Growth of biofilms that pose insignificant reduced pipe size, i.e., less than 1% (Kithiia, 2011), can be retarded through increased flow rates and disinfection practices, but this procedure, when realised with chloramines, yields another nitrification water quality issue (Cruz et al., 2020; Shi et al., 2020). Besides biofilm-based microbe releases, DWDS leakages, repairs, and maintenance can assimilate microbes into the supply network. Fontanazza et al., (2015) found that contaminants intrusion in DWDS occurs at pipe crack and is mainly driven by low or negative water pressures. Thus, in addition to microbial contaminations, which also have a particular case of survival means through biofilms, other pollutants of physicochemical characteristics are also introduced in the DWDS in the same way.

Water infrastructures in the Pawaga study area are not well developed; no proper water treatment, and still people are sharing the water sites with animals. Large-scale agricultural production in the Usangu basin is one of the largest consumers of water, and as a result, has the most significant influence on water stress,

especially during the dry season to the users, especially in the Pawaga division (Lufingo, 2019). Pastoralists in the highlands of the Great Ruaha river have been feeding their animals along the river. Livestock has increased in the division, migrating from neighbouring regions such as Mbeya, Singida and Dodoma. This makes the number of livestocks more than 35,000 in the division, and this destructs the river banks and threatens water quality (IUCN, 2010).

This work aims at assessing the water quality of drinking water at Pawaga division. The research has considered all water sources used by the same piped water users and others during different occasions or localities, such as prolonged and distant farming sessions where piped water users switch to unpiped sources such as shallow wells, deep wells, rivers, rain, streams, or swamp water uses. The overall implication of water safety was analysed in terms of reported supply status and the influence of official or unofficial alternative sources on the general water quality status, which is weighed as per concerned DWDS.

2.0 MATERIALS AND METHODS
2.1 Study Area
The study covered the Pawaga division, the area graphically situated downstream of Ruaha Rivers and is one of the six divisions in the Iringa district Council in the Iringa region, Tanzania. The site is well shown in Figure 1. The division has the smallest land area, about 684.3 square kilometres (3.3%) of the total district land area. It has a total of 12 villages and 60 hamlets. The main economic activities in this division are agriculture and pastoralism. The climate of the Pawaga division is semi-arid to arid, with bi-modal rainfall patterns (Coppolilo et al., 2011). The amount of rainfall increases along the northeast-southwest gradient of the division, with more precipitation in the southern villages creating a wetter environment than in the northern towns (Coppolilo et al., 2011).
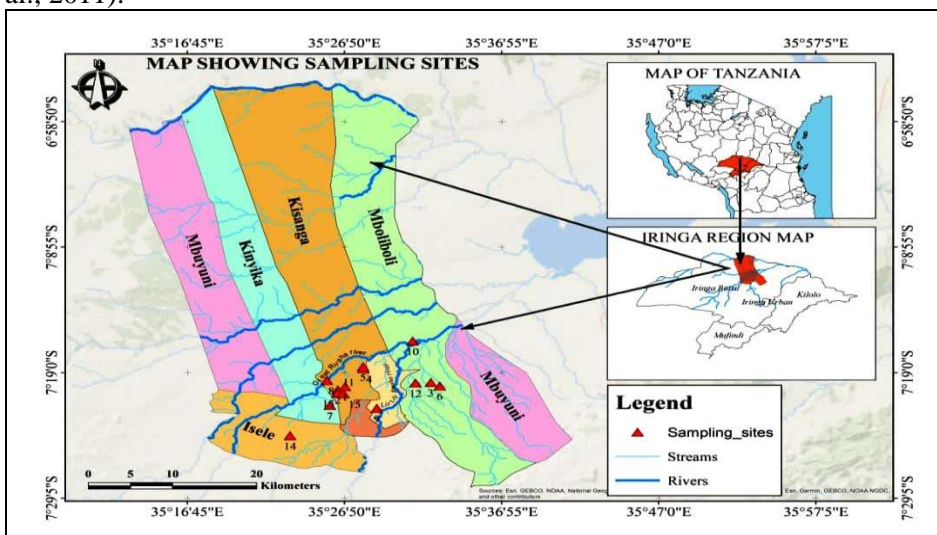

Figure 1: Map of Pawaga Division Showing Sampling Sites (reference)

2.2 Water Sampling Site and Plan

The selection of sampling sites was based on water scarcity and availability of newly developed water supply projects under several funders was the reason selection of the study sites. Furthermore, most localized water projects (at community level) at Pawaga division account for its exclusive study area suitability that reflects future implications on clean and safe water provision for all.

Table 1: The description of sampling sites

ID	Source	Sampling Point	Village
S01	Little Ruaha River	Irrigation Scheme Canal	Kinyika
S02	Shallow Dug Well	Direct	Kinyika
S03	Shallow Dug Well	Direct	Mboliboli
S04	Shallow Dug Well	Direct	Kisanga
S05	Little Ruaha River	Tap Water	Kisanga
S06	Little Ruaha River	Tap Water	Mboliboli
S07	Shallow Dug Well	Direct	Mboliboli
S08	Little Ruaha River	Tap Water	Isele
S09	Great Ruaha River	Near village	Kisanga-Kilala
S10	Swamp Water	Pawaga Sec	Pawaga
S11	Great Ruaha River	Near village	Mboliboli-Mbugani
S12	Borehole	Direct	Kinyika
S13	Rainwater	Roof Collected Water	Mboliboli
S14	Rainwater	Roof Collected Water	Kinyika
S15	Rainwater	Roof Collected Water	Isele
S16	Rainwater	Roof Collected Water	Kisanga

Water sampling followed the standard method for the examination of water and wastewater (APHA, 2017). The 1000 ml plastic bottles were washed thoroughly with distilled water and rinsed with the sample to be taken. After grab sampling (S01, S05, S06, S08, S09 and S011) near the centre of the river, proper sealing and labelling followed before storing in the cool box (around $4^{O}C$) and transported to Iringa water quality laboratory for analysis. A similar procedure for river water sampling was employed, except for tap water required water flushing for about five minutes before taking a grab sample. A triplicate sample from three different locations of Great Ruaha River, three different tap water and three different wells were sampled for physical-chemical and bacteriological analysis. Well water sample was treated the same as river water except for the sampling procedure, which involved flushing water from the well for about ten minutes before obtaining a grab sample. River water sampling for microbial analysis followed method described earlier (Dobrowsky et al., 2014), where the sterilized sampling bottles were fully inverted and submerging to a depth of 0.3 m below the water surface, so as to avoid surface scums and debris.

Well water and Tap water involved pre-sterilisation of sampling insitu through the application of 99.9% ethanol followed by the flame, which lasted for about two minutes and allowed to cool after ten minutes before obtaining grab sample in sterile microbial glass bottles.

2.3 Water Quality Analysis

During fieldwork, there was an immediate analysis of water quality parameters with a limited maximum holding time, i.e. even if preserved (e.g. less than 24 hours). They comprised pH, Turbidity (Turb, NTU), Electric Conductivity (EC, µS/cm), Temperature (Temp, ^0C), Ammonia (NH_3, mg/L); Nitrate (NO_3, mg/L), Nitrite (NO_2, mg/L), Ortho-phosphate (PO_4, mg/L), Sulphate (SO_4^{2-}, mg/L) and *Escherichia* Coliform (E. Coli, Cfu/100 ml) enumeration.

The following physical-chemical parameters were included in the study: conductivity, temperature, pH and turbidity. These were selected due to their ubiquity as water quality assessment parameters globally and their ease of measurement in the field under rough conditions. Physical parameters were all measured in-situ using portable multiparameter (HANNA HI-9828, USA). The following nutrients: Nitrate-N (NO_3^-–N) and Phosphate-P (PO_4^3–P) were selected as they are typically the most common nutrients of concern in aquatic and wetland ecosystems. Specifically, they are important when present in excess amounts, as they tend to result to water pollution and ecosystem impartment. For nutrients, surface water samples were collected at the mid-channel at approximately 0.5 m depth in hydrochloric acid washed polythene bottles. Samples were preserved in a cool box at about ≤4 °C before being transported for laboratory nutrient analysis.

In the laboratory, NO_3^-–N, and PO_4^3–P were analysed using standard spectrophotometric methods described in APHA (2012). The NO_3^-–N was determined using the cadmium reduction method followed by diazotization with sulphanilamide and coupling with N-(1-naphthyl)-ethylene-diamine to form a highly coloured azo dye that measured spectrophotometrically at 545 nm wavelength. whereby PO_4^3–P was analyzed using themolybdate ascorbic acid method which results in a formation of intense blue colour measured at a wavelength of 880 nm. The quality of analytical data was assured by analysis of blanks and replicates samples with according to laboratory analytical procedure. Calibrated Multi-parameterprobes (SevenGo pro probe and SevenGo Duo pro probe, Mettler Toledo AG, Switzerland) were used to measure electrical conductivity (EC), TDS, and pH in situ. Bicarbonate (titration using 0.02 N HCl) and chloride ions (argentometric method using 0.0141 N AgNO3) were analyzed on-site by using unfiltered samples (APHA, 1998). Meanwhile, the filtered samples were separated into two polyethylene bottles, one for the analysis of sulphate (SurfaVer 4 HACH method) and nitrate (NitraVer 5 HACH method) and the others to determine cations which were analyzed using flame atomic absorption spectrometry (FAAS, Shimadzu AA6800).

2.4 Statistical Analysis and Validity of Results

Field and laboratory quality assurance of results were employed through calibration and verification of used equipment, standardization of traceable chemicals and reagents used, proper sampling and sub-sampling practices, use of

quality control samples, and employment of triplicate samples analysis. Data accuracy check for charge balance utilising major ions using Aquachem 9. The information obtained from the microbial, physico-chemical, and metal analysis of the collected samples was evaluated by using the statistical software package SPSS version 23.0 (IBM Corp, 2013; Armonk, NY, USA). Several linear and multiple regressions were performed between the concentration of *E. coli* and total coliforms physical-chemical parameters, and major elements. In all the hypothesis tests, a significance level of 5% was used as the standard. In all tests, a *p*-value < 0.05 was considered to be statistically significant.

3.0 RESULTS AND DISCUSSION
3.1 Results of Physicochemical Parameters
Water quality findings presented in Table 2 corresponds to field and laboratory works as per the wet season (March 2021). Table 3 corresponds to data collected during dry season November 2021. Table 4 summarises maximum and minimum statistics for all tested parameters; their values acquire a further comparison to TBS (2018) and WHO (2017) limits for natural potable (Untreated) water.

Table 2: Physicochemical Results - Wet Season

Sample code	E.Coli	Turb	pH	Temp	EC	TDS	HCO_3^-	Cl^-	Hardness	PO_4^{3-}	SO_4^{2-}	NO_3^+	Na^+	K^+
S01	88	93.5	6.89	25.3	348	236.6	167	9.3	171.01	2.1	18	5.9	1.8	0.1
S02	3	69.2	7.01	24.1	573.3	389.8	204.5	43.05	204.75	1.18	27.3	5.9	32.3	6.51
S03	11	72.1	6.65	25.2	456.3	310.3	171.6	20.54	162.97	0.61	22.1	24.1	28.6	3.12
S04	7	55.4	7.66	24.7	593.5	403.6	210	25	214.28	0.26	27.5	44	33.7	5.95
S05	2	48.2	7.11	23.1	169.7	115.4	65	8.89	62.93	0.1	8.06	6	9.1	1.33
S06	1	42.4	7.63	24	310.4	211.1	177.4	5.84	119.4	0.14	9.78	0.6	16.1	1.9
S07	6	62	7.55	26	678.9	461.6	431.9	4.33	266.22	0.34	12.19	1.9	28.1	8.37
S08	12	33.7	7.32	22.7	166.2	113	49.2	13	77.38	0.09	9.6	4.6	2.2	0.72
S09	124	211	7.09	24.1	176.6	120.1	51.7	11.86	76.72	0.09	13.57	4.3	5.1	0.66
S10	13	69.3	7.62	28.3	514.8	350.1	199.1	31.9	192.52	0.75	19.8	14.3	25.3	5.5
S11	111	286	7.93	25.1	158.4	107.7	49	11.6	55.76	0.13	10.2	3.1	8	3.1
S12	0	1.02	6.88	22.1	3288	2235.8	1500	145.2	1309.32	2.8	93	101.4	104.4	59.4
S13	0	2.03	7.77	22.5	22.1	15	8.2	1.58	5.77	0.02	0.29	1.2	2.3	0.24
S14	0	1.1	7.87	23.1	15.7	10.7	8.9	0.12	7.01	0.01	0.49	0.4	0.4	0.2
S15	0	3.03	7.9	24.2	18.9	12.8	8.6	0.66	8.98	0.01	0.43	1	0.2	0.04
S16	0	5.09	7.99	24.6	19.5	13.3	10.7	0.2	6.82	0.07	0.8	0.4	1.2	0.17

Table 3: Physicochemical Results - Dry Season

Sample code	E.Coli	Turb	pH	Temp	EC	TDS	HCO_3^-	Cl^-	Hardness	$PO_4^{\#-}$	SO_4^{2-}	NO_3^-	Na^+	K^+
S01	51	49.73	6.89	26.8	158.2	107.6	75.9	4.23	77.925	0.71	8.18	2.7	0.8	0.05
S02	0	36.81	7.01	25.6	625.4	425.3	223.1	46.96	223.44	0.67	29.78	6.4	35.3	7.1
S03	0	38.35	6.65	26.7	497.8	338.5	187.2	22.41	177.845	0.34	24.11	26.2	31.2	3.4
S04	1	29.47	7.66	26.2	647.5	440.3	229.1	27.27	233.56	0.15	30	48	36.7	6.49
S05	6	25.64	7.11	24.6	77.1	52.5	29.5	4.04	28.6	0.09	3.66	2.7	4.1	0.61
S06	3	22.55	7.63	25.5	141.1	95.9	80.6	2.65	54.055	0.11	4.45	0.3	7.3	0.86
S07	1	32.98	7.55	27.5	709.7	482.6	451.5	4.53	278.41	0.18	12.74	2	29.4	8.75
S08	5	17.93	7.32	24.2	75.5	51.4	22.4	5.91	35.13	0.06	4.36	2.1	1	0.33
S09	67	112.23	7.09	25.6	80.3	54.6	23.5	5.39	35.095	0.08	6.17	1.9	2.3	0.3
S10	_	_	_	_	_	_	_	_	_	_	_	_	_	_
S11	88	152.13	7.93	26.6	72	49	22.3	5.27	25.46	0.1	4.64	1.4	3.6	1.41
S12	0	0.54	6.88	23.6	3495	2616.3	1595.3	154.4	1421.9	1.07	98.9	107.9	119	37.2

Table 4: Correlation Matrix

							Wet Season							
	E.Coli	**pH**	**Turb**	**EC**	**TDS**	**Temp**	**NO$_3^-$**	**SO$_4^{2-}$**	**Cl$^-$**	**HCO$_3^-$**	**PO$_4^{3-}$**	**Na$^+$**	**K$^+$**	**Hardness**
E.Coli	1													
pH	-0.1	1												
Turbidity	**0.9**	-0.1	1											
EC	-0.2	-0.4	-0.2	1										
TDS	-0.2	-0.4	-0.2	1.0	1									
Temp	0.2	0.1	0.3	-0.2	-0.2	1								
NO$_3^-$	-0.2	-0.4	-0.2	**0.9**	**0.9**	-0.2	1							
SO$_4^{2-}$	-0.1	**-0.5**	-0.1	**1.0**	**1.0**	-0.2	**0.9**	1						
Cl$^-$	-0.1	**-0.5**	-0.1	**1.0**	**1.0**	-0.2	**0.9**	**1.0**	1					
F$^-$	-0.2	-0.3	-0.1	**0.9**	**0.9**	0.1	0.8	**0.9**	**0.9**					
HCO$_3^-$	-0.2	-0.4	-0.2	**1.0**	**1.0**	-0.2	**0.9**	**0.9**	**0.9**	1				
PO$_4^{3-}$	0.1	**-0.6**	-0.1	0.8	0.8	0.0	0.7	0.8	0.8	0.8	1			
Na$^+$	-0.3	-0.4	-0.2	**1.0**	**1.0**	-0.1	**0.9**	**1.0**	**1.0**	**1.0**	0.7	1		
K$^+$	-0.2	-0.3	-0.2	**1.0**	**1.0**	-0.3	**0.9**	**0.9**	**1.0**	**1.0**	0.7	**0.9**	1	
Hardness	-0.1	**-0.5**	-0.2	**1.0**	**1.0**	-0.2	**0.9**	**1.0**	**0.9**	**1.0**	0.8	**1.0**	**1.0**	1

							Dry Season							
	E.Coli	**pH**	**Turb**	**EC**	**TDS**	**Temp**	**NO$_3^-$**	**SO$_4^{2-}$**	**Cl$^-$**	**HCO$_3^-$**	**PO$_4^{3-}$**	**Na$^+$**	**K$^+$**	**Hardness**
E.Coli	1													
pH	0.3	1												
Turbidity	**0.9**	0.4	1											
EC	-0.3	-0.3	-0.4	1										
TDS	-0.3	-0.3	-0.4	1.0	1									
Temp	0.3	0.2	0.4	-0.5	-0.5	1								
NO$_3^-$	-0.3	-0.3	-0.4	**0.9**	**0.9**	-0.4	1							
SO$_4^{2-}$	-0.4	-0.4	-0.4	**1.0**	**1.0**	-0.5	**1.0**	1						
Cl$^-$	-0.3	-0.4	-0.4	**1.0**	**1.0**	-0.5	**0.9**	**1.0**	1					
F$^-$	-0.3	-0.3	-0.4	**1.0**	**1.0**	-0.4	**0.9**	**1.0**	**1.0**					
HCO$_3^-$	-0.3	-0.3	-0.4	**1.0**	**1.0**	-0.4	**0.9**	**1.0**	**0.9**	1				
PO$_4^{3-}$	-0.2	**-0.6**	-0.4	0.8	0.8	-0.2	0.7	0.8	0.8	0.7	1			
Na$^+$	-0.4	-0.3	**-0.5**	**1.0**	**1.0**	-0.4	**0.9**	**1.0**	**1.0**	**1.0**	0.7	1		
K$^+$	-0.3	-0.3	-0.4	**1.0**	**1.0**	-0.4	**0.9**	**1.0**	**1.0**	**1.0**	0.7	**1.0**	1	
Hardness	-0.3	-0.3	-0.4	**1.0**	**1.0**	-0.4	**0.9**	**1.0**	**1.0**	**1.0**	0.8	**1.0**	**1.0**	1

3.1.1 Multivariate Cluster Analysis

Study samples related from one another during sampling as (i) shallow wells near or within co-sampled rivers and canals, as well as (ii) all water sources, experienced collective comparable natural and anthropic influences. Figure 4.8 shows a dendrogram that depicts the hierarchical relationship from clustered samples among 16 water sources of the wet season. The remarkable similarity (~100%) occurs on S02 and S03 samples, and they are all shallow wells from Kinyika, Mboliboli and Kisanga villages. These samples share the same seasonal water valley that becomes waterless during the dry season but continues to sustain these shallow wells at relative more depth. S06 and S07 correspond to little Great Ruaha river water and a shallow well close to it and shows a similarity of more than 99% to each other.
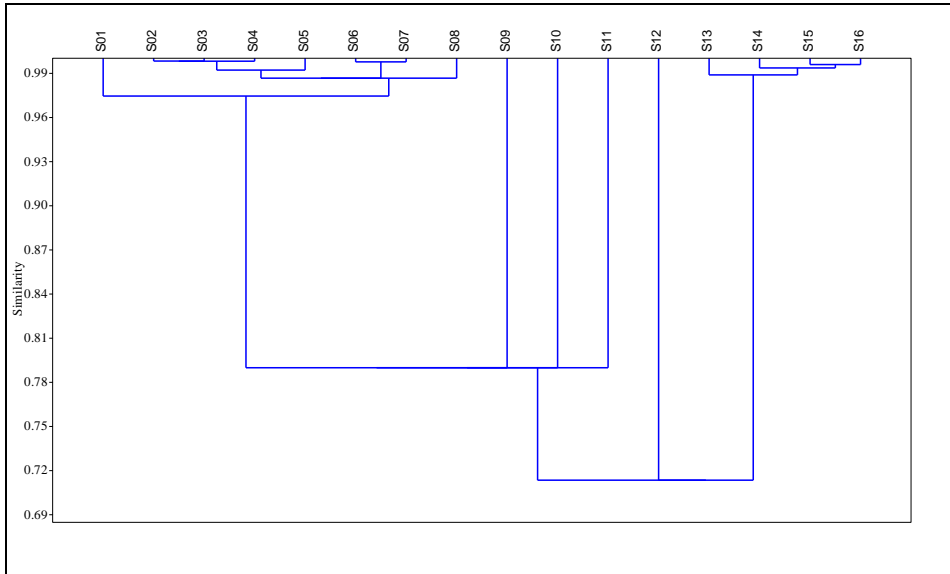
Figure 2: A dendrogram indicating wet season clustered samples

Rainwater samples S13, S14, S15 and S16 from different villages also showed variations. Contrary to S15 and S16 from Isele and Kisanga villages with a similarity of ~99%, S13 and S14 from Mboliboli and Kinyika villages had 98-99%. Another sample from the Little Ruaha river at Kisanga tap water (S05) showed a ~99% similarity to others, followed by the same tap river water at Isele (S8), which had a ~98% similarity. The irrigation water sample (S01) had a similarity of ~97% to all study samples. Water samples from the Great Ruaha River (S9 from Kisanga-Kilala village and S11 from Mboliboli-Mbugani village) and the swamp water (S10 from Pawaga division) altogether had a similarity of ~79% to others. The deep borehole sample (S12) from Kinyika village had a similarity of ~71% concerning all study samples. To summarise, the study area had excellent sample interrelations from shallow wells, tap water and the irrigation canal, except those from the Great Ruaha River, Swap and the deep borehole, which had their distinct characteristics.

3.2 Discussion
3.2.1 Water physical parameters
Most parameters' mean values and standard deviations were generally higher during the dry season than the wet season. The pH values of all tested sources in both seasons are within the acceptable standards TBS (2019) (5.5 – 9.5) and WHO (2017) (6.5 – 8.5) limits. These values are in line with those detected earlier (Jia et al., 2010), ranging between 7.01 and 8.21. Turbidity, which is also related to the content of diseases causing organisms in water, is the cloudiness of water caused by various dissolved particles. The values in both seasons, except rainwater, exceeded TBS (2018) (25 NTU) and WHO (2017) (1 NTU limits). The detected values are higher than those seen earlier (Rahmanian et al., 2015),

where the lowest turbidity values of 0.69 NTU and the highest value of 4.6 NTU were noted.

Electrical conductivity is the ability of any medium, water, in this case, to carry an electric current. The presence of dissolved metal or non-metal ions such as calcium, chloride, sulphate, magnesium, and many others in water samples carries the electric current through water. The analysed samples range between 1 – 286 µS/cm. These values correspond to values detected elsewhere (Rahmanian et al., 2015), where the conductivity of water samples ranges from 69.7 µS/cm to 269.3 µS/cm, and also the one detected at Mbinga (Kihampa and Ndunguru 2021), where the electrical conductivity ranges between 14.6 to121.1 µS/cm. According to Cidu et al., 2011, conductivity does not directly impact human health. It is determined for several purposes, such as determination of mineralisation rate and estimating the number of chemical reagents used to treat this water. High conductivity may lead to lowering the aesthetic value of the water by giving a mineral taste to the water. The DWDS in this study had inefficient clarification treatments and no disinfection treatments, hence EC serves as a relative real-time measure of water supply origin, chemical contamination changes and compared the quality of alternative used sources. The TDS ranges between 107 – 2235.8 mg/L with a mean of 319.2 mg/L during the wet season and 49.0 - 2616.3 mg/L with mean of 428.5 mg/L during the dry season. These values are below the permissible limits by TBS (1,500 mg/L) and WHO (1,000 mg/L).

3.2.2 Chemical parameters

Hardness Nitrate concentration is low in water samples but in the effluent of nitrifying biological treatment plants nitrate may be found in concentrations of up to 30 mg. In present study NO_3^- ranges between 0.4 – 101.4 mg/L during rainy season and 0.3 – 107.9 mg/L during dry season. The maximum levels are higher than previous study (Uddin, et al., 2014), which shows the concentration NO_3^- in water ranges from 78 to 98 ppm in dry season and 77 to 99 ppm in wet season, this is very high in respect to standard value. The higher amount contamination from fertilizers, municipal wastewaters, feedlots, septic systems in water which causes higher concentration of NO_3^-, it refers that the higher the deviation the lower the quality of water for fish and other aquatic life and for common uses (Ayers, and Westcot, 1976). Sulphate concentration ranges between 0.3 – 93.0 mg/L during rainy season and 3.7 – 98.9 during dry season. These values are lower than those detected earlier (Uddin, et al., 2014), ranged between 824 to 843 ppm in dry season and 712 to 743 ppm in wet season. According to Jailos, et al., (2021), sulphate can also be produced by bacterial or oxidizing action as in the oxidation of organo-sulphur compounds. The more common sinks are pyrite, gypsum, and sulphate reduction.

Chloride is an indication of salinity in water. Surface water containing significant amount of chloride ranges between 0.1 -145.2 mg/L during wet

season and 2.7 – 154.4 mg/L during dry season. These levels are higher than those determined earlier (Jailos, et al., 2021), ranged from 0.46 to 2.68 mg/L (wet season) and during the dry season ranged from 2.02 to 5.8 mg/L. The maximum value of PO_4^{3-} was 2.8 mg/L during rainy season and 1.1 mg/L during dry season. These levels were lower than those detected earlier in recent study (Jailos, et al., 2021), where phosphate levels ranged from 0.52 to 1.25 mg/L.

Figure 3 shows a piper diagram depicting major ions (anions and cations) in the wet and dry seasons. A vertical look at both seasonal figures shows less variation on position for their apexes, thereby suggesting that inherent comparable chemical composition exists and only varies in their magnitude due to seasonal effect.
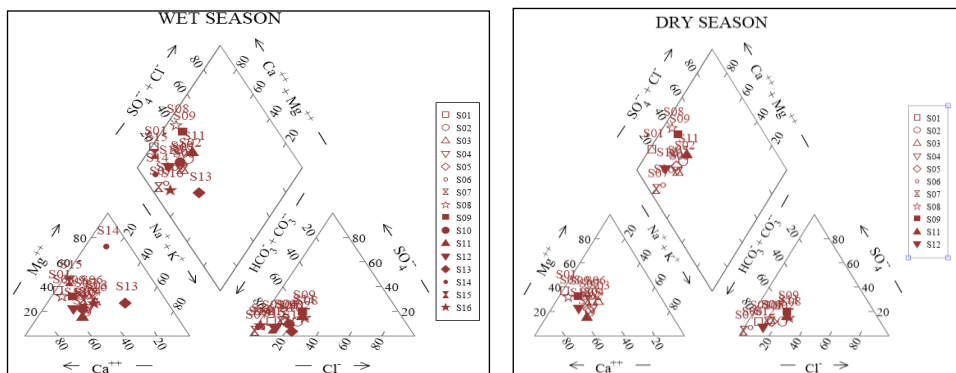
Figure 3: Piper Diagram for the Major ion Composition of Water Samples for the Wet and Dry seasons

The two ternary diagrams represented as triangles in both seasons shows plots for cations (Magnesium, Calcium, sodium and potassium) and anions (sulphate, chloride, carbonate and bicarbonate). Most samples in the cation triangle plots between 0 to 50 Ca^{2+} and Mg^{2+}, signifying a Ca^{2+} water type. Sample S14 (rainwater) plots between 0 to 50 values of $Na^+ + K^+$ and 50 to 100 values of Mg^{2+}, indicating Mg^{2+} water type. Sample S13 plots close to the centre of the cation triangle and depicts no dominant water type. Contrary, the anion triangle had all samples plotting between 0 to 50 values of Cl^- and HCO_3^- and CO_3^{2-} that portrayed HCO_3^- water type. Figure 3 shows the projection of the two ternaries (matrix transformation of cation and anion triangles) into a top diamond plot. All samples are plotting between 0 to 50 values of Na+ + K+, and $SO_4^{2-} + Cl^-$ on diamond plot facies, which depicts that Alkaline earth (Hardness, Ca^{2+} and Mg^{2+}) exceed alkalies ($Na^+ + K^+$) as well as weak acids (such as H_2CO_3) exceed strong acids (such as HCl). Weak acid dominance accounts for observed pH trends where minimum sample pH was acidic to slightly acidic but with values at least 6.7. Strong acid dominance would have presented more low pH values, i.e. ≤ 6.7, that could invalidate potable water use suitability at values less than 5.5 and 6.5.

Excellent correlation (r = 1.0) is presented in Table 4 to all major ions with Electrical conductivity (EC) and TDS. In this regard, EC and TDS have a close relationship, as portrayed in Figure 4 for both seasons. At low Values, TDS and EC plotted close to each other for both seasons and plotted relatively apart at higher values. Lwimbo et al. (2019) realised dry and wet season water quality studies on groundwater sources and observed a comparable EC vs TDS plot trend. The EC and TDS relationship is documented in the water chemistry (APHA, 2017) as TDS = EC*k (where "k" is the conversion factor). This study had a minimum factor of k = 0.68 and a maximum k = 0.75, averaging at k = 0.71. Possible extremes values of "k" range from 0.5 to 0.9, with 0.7 as an average (Walton., 1989); thus, the EC and TDS relationship in the current study was suitable irrespective of the gravimetric method used to evaluate TDS in all water samples. Since all major ions accounted for measured EC and TDS values, their uniform influence suggests a common relationship of mineral origin during dissolution and sampled sources interrelations. For instance, HCO_3 excellently correlated (r = 1.0) with all major cations, i.e. Na, K, hardness (Ca and Mg), suggesting the existence of sedimentary evaporite deposit as the area is characterised by extremely high temperatures (Tanzania C.A.R.E, 2019) that water content lost as evaporation can't be compensated by total rainwater and influx surface water (rivers and streams).
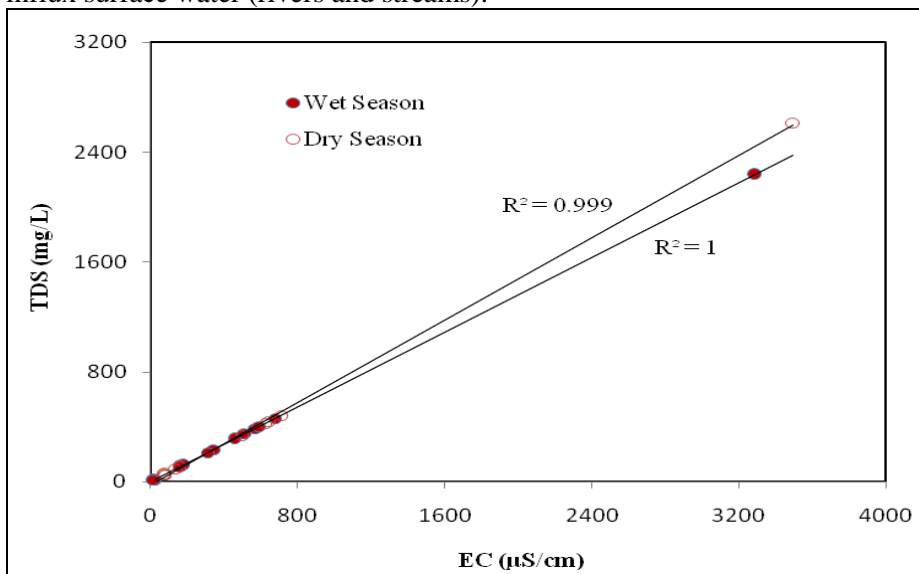

Figure 4: EC vs TDS Relationship for the dry and wet season

3.2.3 Microbial Pollution

Rainwater accounted for the wet season due to its availability and preference for domestic uses from most study area water users. Rainwater had no microbial contamination of E. coli, as portrayed on most shallow and deep wells during the dry season. All surface and groundwater sources, except a deep borehole (S12), had contaminations of E.coli. The contamination is low to absent on dry season

within the same sources. Maximum E.Coli contamination was 124 Cfu/100ml, and the minimum was 88 Cfu/100ml for all studied sites in both seasons.

The presence of E. Coli in drinking water samples indicated the highest risk of faecal pollution related to human pollution on such water sources (Ercumen et al., 217; Mahmud et al., 2019; Sasáková et al., 2021). E.Coli best correlated with turbidity (r = 0.9, for both seasons) in water samples. Since turbidity has no health effects, it usually interferes with disinfection activities and provides a medium for microbial growth. Thus, high turbidity values can indicate the presence of disease-causing organisms such as E.Coli (Smith et al., 2008), which can cause symptoms such as nausea, cramps, diarrhoea and associated headaches. Figure 5 shows that turbidity and E.Coli had a linear relationship with all samples plotting at R2 = 8 and 9. During the wet season, the association suggests that rain activities that collect terrestrial matters into water bodies and agricultural activities return used water to drinking water sources (Yu et al., 2016; Ghernaout and Ibn-Elkhattab., 2019), thereby contributing most of the high turbidity values. The dry season had a better association of E. Coli and Turbidity with relatively low values than a wet season, direct access of human to these water sources during their routine activities could be one of contaminaion route.
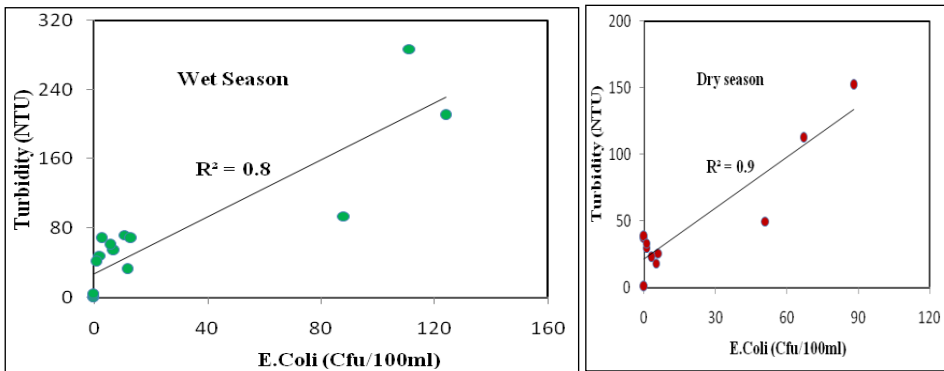

Figure 5: Behavior of E.Coli with Turbidity in Wet and Dry Seasons

4.0 CONCLUSIONS AND RECOMMENDATIONS

The levels of pollution in all water sources were severe during the wet season. The E.Coli contamination was detected in at least 68% of all wet season samples and portrays how acute diseases such as diarrhoea and typhoid are prominent to such water users during the wet season. Dry season microbial status is also not well as most samples also possess E. Coli. During the wet season, users preferred rainwater which was also confirmed free from microbial (E.Coli) contamination. While chemical pollution remained relatively uniform from the source and at distribution points, microbial contamination progressively decreased with an increase in supply network coverage. It can therefore be concluded that land-use practices largely influenced the quality of water in the

catchment. These results provide new insights into the environmental quality of the catchment. They also demonstrate that, even though most parameters were within the permissible limits of drinking water standards, there is a need to take appropriate measures of pollution control by the concerned authorities to keep the water quality within the permissible limits as the population and human activities in the area are increasing.

The same applies during the dry season that users near the intake have a relatively reliable water supply than those at distant networks. Turbidity represented poor physical water quality and was severe during the wet season. Since all studied domestic water sources had no treatment before use, turbidity was the first visible water quality parameter that all users realised an upfront rejection of such water when rainwater was available. Turbidity further sustained microbial survival and could interfere with most disinfection processes.

Chemical pollution noted in all water samples threatened users' health when many values exceeded the maximum limits set by Tanzania Bureau of Standards (TBS, 2008) and Word health Organization standards (WHO, 2011). A deep borehole is generally not suitable for domestic uses due to its high unbearable salt contents. Shallow wells that serve the remote area (with no piped water supply) as water sources also present inherent pollution from anthropic activities. Rainwater possessed considerable dissolved materials instead of its ideal composition due to the semi-arid climate zones of the study area, where there are high sunny activities than rain, and wind act as a carrier of particulates to roofing material even after several flushes. Nutrient content in water bodies served as evidence of poor water quality for potable water uses and ecological health; nutrients such as phosphate are portrayed as point source water pollution from agricultural activities. In the current practice where agriculture backs up more than 90% of villagers' economic activities, water pollution is inevitable as the same scarce water resource also serves potable uses. Farmers use raw water from streams and rivers for drinking during their farming activities distant from villages. Apart from prolonged chemical intoxication (that leads to chronic effects), the situation presents their vulnerability to typhoid and diarrhoea (acute effects) due to raw water consumption, which is polluted from anthropic activities.

Pastoralist presents a group of water users in areas where there is no piped water supply. Their activities force them to live in remote areas where public water supplies are not practical. This group suffers more when it comes to clean and safe water availability. Their survival mode relies on ponds and related surface water reservoirs, and to a certain extent, they need to spend more time searching for appropriate water from village centres. This research has further confirmed that surface water quality is extremely poor to microbial contamination. Physical pollution, and to a certain extent chemical pollution, are among other disqualifying features.

While the current study assessed the Pawaga drinking water distribution systems, it was observed that there are more out of formal piped water supplies, which could pose a potential public health threat, yet the blame is under the supply management authority. Future studies shall further ascertain the extent of contamination in Pawaga historical water supply pipes, including the biofilms.

ACKNOWLEDGMENTS

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Investigating Local Community Perception About Climate Change in Gatsibo and Nyagatare Districts, in Rwanda

Théogène Habakubaho[8], Emmanuel Patroba Mhache[9] and Josephat Saria[10]

Abstract

The main objective of this paper was to investigate the perception of local community about climate change in drought prone areas of Nyagatare and Gatsibo districts in Rwanda. This paper perceived changes of climate and their effects, causes of climate change and perception of adaptation measures. Understanding community perception on climate change issues is critical in designing community-based adaptation actions and programs. Data were collected using questionnaire administered to 480 households selected in six sectors. Data were analysed using SPSS Statistics 28.0.1. to generate descriptive results. 89% of responds perceived a decrease in amount of rainfall while 70% perceive changes in reduction of length of rain season. Reported causes of climate change are dominated by environmental degradation (85.6%), deforestation (57.2%). Perceived effects of climate change on community livelihoods include decline of annual households' income (88.3%), increased incidences of pests and diseases in crops (90.1%). The research results indicate that ongoing adaptation initiatives have failed to meet expected results. This is partly because local perception and knowledge are not considered. It is therefore, recommended to change the approach and adopt more community-based approach and considers local characteristics and local knowledge in designing adaptation actions. This will increase community resilience, ownership and address real community needs.

Keywords: Climate change, Adaptation, Perception, Community

1.0 INTRODUCTION

Historical and current projections provide evidences of climate change around the World. Projections under different scenario indicate that intensity and frequency of climate related hazards will increase. According to Intergovernmental Panel on climate change, predicted risks will not only increase, but also changes will bring climate related hazards (IPCC, 2014). In the same time, local communities that are mainly depending on natural resources are the most vulnerable to climate change effects due to their strong attachments to their territory and livelihoods (van Aalst *et al.,* 2008). Fortunately, it has been demonstrated that local communities are not passive and have traditionally adapted to variations in their environment. Different communities deployed a combination of local knowledge, perception and learning processes, their social structures, institutions, and internal communal arrangements to deal with climate

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change hardships (Boillat and Berkes, 2013). These communities are key actors in the management of environmental challenges (Armitage, 2005) such as climate change. Previous studies have demonstrated social relations may enhance the ability to cope with weather-related and environmental hazards and to address the impacts of climate change (Lorenzoni *et al.,* 2007; Wolf *et al.,* 2013).

It is, therefore, essential to comprehend the perceptions of people within the communities and to include them from the start when developing and designing climate change adaptation strategies (UNPFII, 2008) in a way that translates their capabilities into effective adaptation practices. Understanding how community members perceive and understand environmental and climate changes, these changes mean for them, and how perceptions on climate change differ in each community, it is important in climate change. It has been documented that adaptation is effective only when local communities have sufficient knowledge about climate change and are empowered to effectively participate in proposed adaptative initiatives and actions (Adger *et al.,* 2014). Perceptions about climate change, its causes, impacts, and the necessary response mechanisms to cope with climate calamities are important for any population in a given community (Hannah *et al.,* 2010).

It is understood, that the level of awareness determines the scope of implementation that needs to be taken to tackle the problem. Community knowledge and perception on social and earth systems interact, is significantly becoming key source for comprehending climate change and creating adaptation strategies (Mafongoya and Ajayi, 2017). Thus, community knowledge is an essential and active resource for the survival of agro-pastoralists and other local people. This knowledge is also a cornerstone of social, cultural, political, economic, scientific, and technical identity (Magni, 2017; Ayal *et al.,* 2015), which can help achieve sustainable development goals (Tengo *et al.,* 2014).

Therefore, the objective of this research is to assess the perception and knowledge of local communities and how local knowledge and perspective can be considered in designing adaptation actions especially at community level. The understanding and consideration of perception would reduce issues encountered in the implementation of proposed actions including lack of ownership and linkage between proposed actions and local characteristics.

2.0 MATERIALS AND METHODS
2.1 Study area description
This study was conducted in Nyagatare and Gatsibo Districts, formerly Umutara Region (between 1°17'04.7"S 30°31'57.6"E and 1°38'20.9"S 30°30'52.8"E). Administratively, the two districts are located in the Eastern Province of Rwanda towards the Tanzania and Uganda borders (Figure 1). A big part of these districts used to be part of Akagera national park and was opened to human

settlement in 1996 to accommodate returning refugees from after 1994 genocide. Since then, both districts have experienced a major influx of returning refugees and their livestock from neighbouring countries and migrants from other provinces in Rwanda.
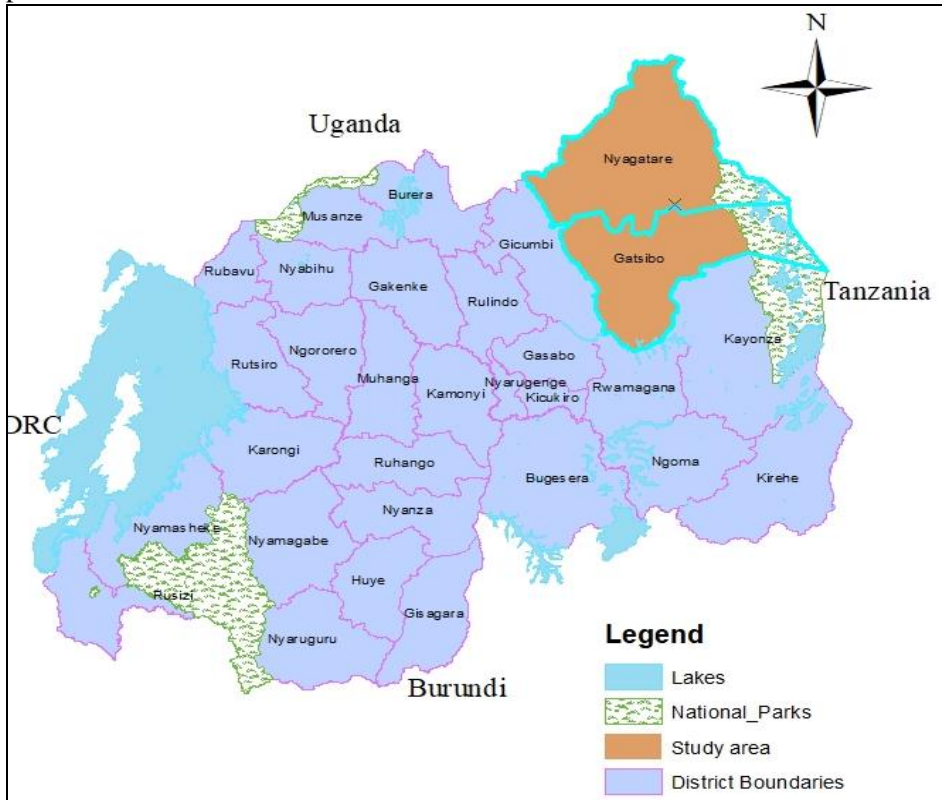

Figure 1: Location of study area on the administrative map of Rwanda
Source: Prepared by author-based National base map, 2022

In terms of climatic conditions, the study area is located in eastern drought-prone region in Rwanda and has been facing rainfall deficits for the past 30 years. According to meteorological services data, the study area receives an annual rainfall of between 700 mm and 1,100 mm, with mean annual temperature oscillating between 20°C and 22°C. Historical observations made between 1961 and 2018, indicate that the years 1991 to 2000 were the driest since 1961. According to these measurements, rainfall was significantly deficient in 1992, 1993, 1996, 1999, and 2000, while there were excesses in 1998 and 2001 (MIDMAR, 2018). The two districts are experiencing very high drought susceptibility (Figure 2), characterized by a substantial number of dry spells, late rainfall onsets, early rainfall cessations, and frequent rainfall deficits (MINAGRI, 2020).
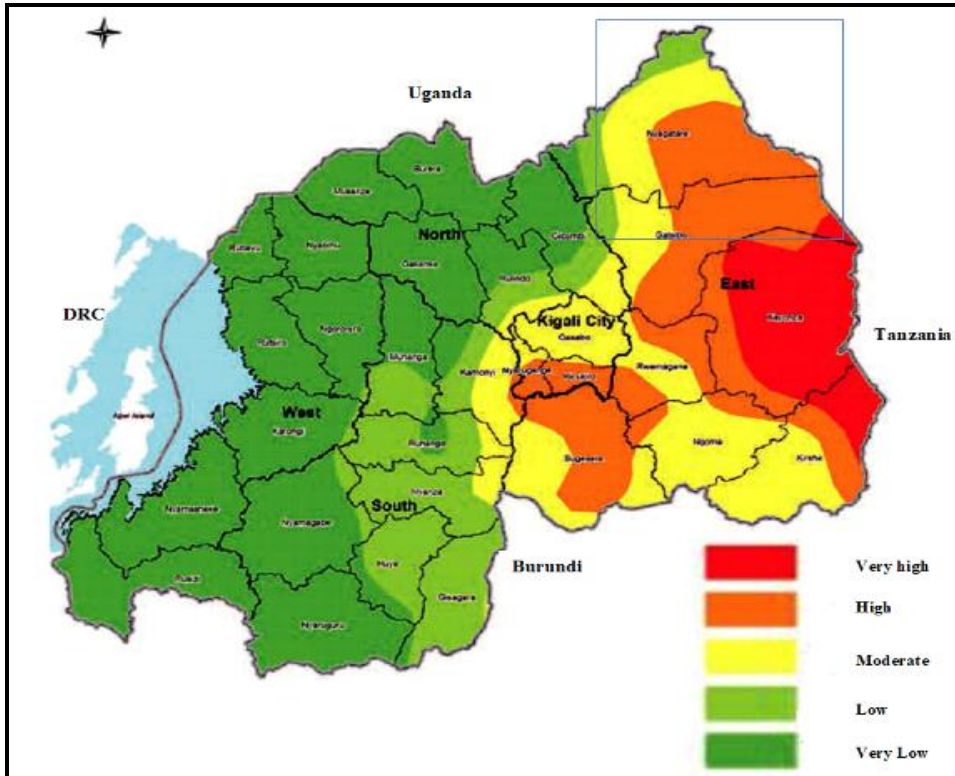
Figure 2: Location of the study area in drought susceptibility in Rwanda
Source: National disaster atlas, MIDMAR, 2018

From figure 2 it can be observed that the eastern part of Rwanda is located in very high drought susceptibility compared to central and western region. Prolonged drought and deficit in rain, has caused famine, food shortages, a decline in plant and animal species. Frequenty migration of people in search of food and pasture are results of these prolonged droughts. This has also impacted natural resources whereby drought has forced herders to move their herds from their pastures closer to or into the Akagera National Park during the dry season (MIDMAR, 2018).

2.2   Research Design and research approaches
2.2.1 Research design
The researcher opted for a descriptive research design for the current investigation. This design was chosen because of its high representative and made it simple for the researcher to get the participants' thoughts (Polit and Beck, 2004). Additionally, descriptive research is used to characterize what is there in terms of variables or conditions in a situation and to learn more about the status of the phenomenon (Ticharwa, 2014).

This study used both qualitative and quantitative research approaches. Interviews with professionals, community leaders, chosen elders, and well-

known members of the neighbourhood were performed under the auspices of the qualitative approach. Quantitative data were gathered via household questionnaires given to agro-pastoralists in the study area as part of the quantitative research approach.

2.2.2 Source of data and data collection methods
Data used in this research were drawn from primary and secondary sources. First, the researcher collected primary data from households in Nyagatare and Gatsibo districts. These data were collected using a questionnaire distributed to 480 heads of sampled households. Additional primary data were obtained from interviews conducted with key informants selected in various ministries, agencies, and research institutions at the central government level.

Secondary data were obtained from documents and reports held by various institutions such as the Rwanda Meteorological Agency, the National Institute of Statistics of Rwanda, the Ministry of Environment, the Rwanda Environment Management Authority, the Ministry of Agriculture and the Ministry of Disaster and Risk Management.

2.2.3 Targeted Population
This research targeted agro-pastoralists in Nyagatare and Gatsibo District (Table1). Agro-pastoralists in the area were obtained from National Institute of Statists in Rwanda. According to available data, the target population was 65,402 households, including 33,717 households in Nyagatare District and 30,822 households in Gatsibo District (NISR,2012). The population appears to be large, so the researcher has used sampling methods and techniques to get a small population size (Table 1).

Table 1: Target Population

Category of targeted Population	Size of the Population		National Level	Total
	Nyagatare	**Gatsibo**		
Total Households	33,717	30,822	n/a	64,539
Grand Total	**33,832**	**30,933**	**653**	**65,402**

 Source: NISR, 2022

2.2.4 Sampling Procedures
A sample is a group of comparatively fewer persons picked from a population for the purposes of research (Alvi, 2016). It is also the choosing of a portion of an aggregate or total based on a conclusion or inference (Bernard, 2006). In other words, it is the process of acquiring knowledge about an entire population by analysing a small sample. This study included two sampling methods: systematic random sampling and purposive sampling.

Systematic random sampling was used to sample villages where households were sampled from Nyagatare and Gatsibo District. In total, 40 villages were sampled from 1,230 villages by using an interval of

31((N/n=1,230/40=30.75≈31). Thus, on a list sorted A-Z district by district, 40 villages were selected, starting from randomly selected villages and skipping 31 to choose the next village and so on, up to a total of 40 villages. Each village was represented by total sampled households divided by 40 villages (480/40) to get 12 households per sampled village. Once villages were known, households were selected with simple random selection whereby all households in the village were listed, and 12 households were selected randomly applying the same interval.

Purposive sampling aimed at selecting population of interest able to answer research questions. Given that this research aimed to collect information related to climate change in agro-pastoralism area, only agro-pastoralists were purposively targeted. To determine the sample size for all levels, the researcher relay on the Slovin formula of sample calculation taken from the study of Williams (2013) where: $n=N/(1+(N*(e)^2)$. Where "n" is the sample size, "N" is the total population, and "e" is the level of significance or margin error. The Slovin's sample calculation formula is flexible, so the researcher diversified the margin error from one given population category to another. This was made with a focus on the weight a certain population category has in the entire study. The main target population for the study is the agro-pastoral households in six sectors of Gatsibo and Nyagatare Districts.

Table 2: Sample distribution and selection for sectors in Gatsibo and Nyagatare districts

Sectors	Total targeted population	Sample Size
Sectors	**28**	$n=28/(1+(28*(0.3618730)^2)=6$
Rwimiyaga	3,499	$n=3,499/(1+(3,499*(0.\ 106499)^2)=86$
Nyagatare	3,396	$n=3,396/(1+(3,396*(0.0.109090)^2)=82$
Karangazi	3,390	$n=3,390/(1+(3,390*(0.111917579)^2)=78$
Kabarore	3,046	$n=3,046/(1+(3,046*(0.11047641323)^2)=80$
Matimba	2,317	$n=2,317/(1+(2,317*(0.1182820840)^2)=70$
Rwimbogo	2,247	$n=2,247/(1+(2,247*(0.10774874680)^2)=84$
Total	**17,895**	**480**

Source: NISR and researcher calculations, 2012

Reference made to Table 2, the sample calculation was made from 28 sectors of the former Umutara region (14 sectors from Gatsibo District and 14 sectors in Nyagatare District). Thus, the researcher got 6 sectors to be evaluated as a sample size from 28 sectors. Using systematic sampling, the sample was taken from total agro-pastoralists in selected sectors using data available at the sector level. To select sectors 6 sectors from 28 sectors in the two districts, systematic sampling was also used. Thus, six sectors were selected, including Rwimiyaga, Nyagatare, Karangazi, Kabarore, Matimba and Rwimbogo. For each sampled sector, a sample size was calculated based on a total sample of 480 households for two districts. Thus, from Rwimbogo, only 86 households were assessed, 82 from the Nyagatare sector, 78 from the Karangazi sector, 80 from Kabarore sector, 70 from Matimba sector and 84 from Rwimbogo sector.

2.2.5 Data analysis and data presentation

Analysis, interpretation, and presentation of data are crucial research tasks. The objective of data analysis is to obtain information that is usable and valuable. Whether the data is qualitative or quantitative, the analysis describes and summarizes the data, identifies links between variables, compares variables, and distinguishes between variables and predicted outcomes (Bruscia, 2005). Qualitative and quantitative data were analysed, interpreted, and presented in this research. Typically, qualitative data consists of words, audio or visual recordings, and observations, rather than statistics (Fisher, 2010). All recorded interviews were transcribed, translated, and entered into Microsoft Word documents. Responses from local communities were confirmed or complemented by results of interviews held government officials.

In this study, questionnaire-derived quantitative data were analysed using the Statistical Package for Social Science database (SPSS Statistics 28.0.1.). This software was useful for generating straightforward descriptive statistics, such as frequencies, percentages, and cross-tabulations. The results were then displayed using tables, bar charts, and pie charts, with interpretations based on frequencies and percentages. Results were discussed and compared to other research conducted in other regions.

3.0 RESULTS AND DISCUSSION

This section presents and discusses findings of research including socio-economic characteristics of respondents, key effects of climate change in the area, perceived causes of climate and perception of local community on proposed adaptation actions.

3.1 Socio-Demographic Characteristics of the Respondents
3.1.1 Age of the respondents

Table 3 indicates that most respondents, 62.9%, were between 36-65 years of age, followed by 65 years and above with 22.3%. The 18-35 represents only 14.8% of the respondents. Two factors can explain the presence of a small percentage of young people. One is that the selection criteria considered people above 18 years. The second reason is reported migration of young people to urban areas, especially in Kigali leaving agro-pastoralism managed by older adults.

Table 3: Age of respondents in the six sectors covered under this research

Age of respondent	Kabarore (n=80)		Karangazi (n=78)		Matimba (n=70)		Nyagatare (n=82)		Rwimbogo (n=84)		Rwimiyaga (n=86)		Grand Total (n=480)	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%
18-35	12	15.0	13	16.7	11	15.7	15	18.3	6	7.1	14	16.3	71	14.8
36-65	51	63.8	40	51.3	48	68.6	55	67.1	59	70.2	49	57.0	302	62.9
65+	17	21.3	25	32.1	11	15.7	12	14.6	19	22.6	23	26.7	107	22.3
Grand Total	**80**	**100**	**78**	**100**	**70**		**82**	**100**	**84**	**100**	**86**	**100**	**480**	**100**

Source: Questionnaire results, 2022

3.1.2 Sex of respondents

As presented in Figure 3, males were the majority, 59.2% of all respondents, while women represented 40.8%. This is opposite to the general distribution of the population in Rwanda where females slightly outnumber males, with 111 females per 100 males (NISR, 2012). This higher proportion of males can be justified by the survey methodology that targeted agro-pastoralism mainly done by Rwanda males.
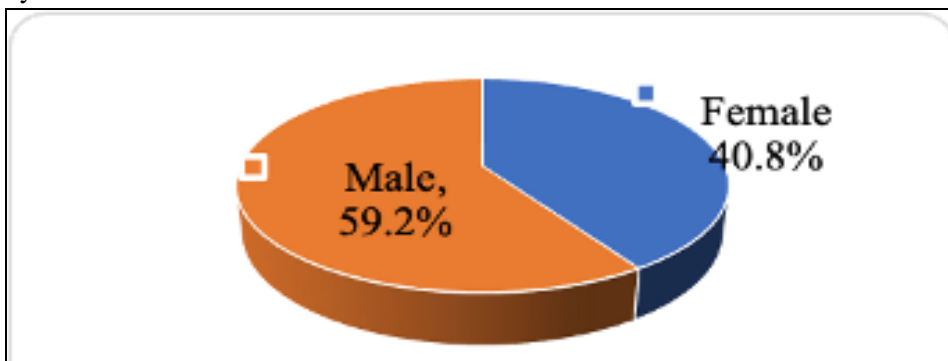

Figure 3:Distribution of respondents by sex
Source: Questionnaire results, 2022

3.1.3 The main source of income of respondents

As presented in Table 4, cattle rearing largely outnumbers other activities, with 59.4% of all respondents. The situation is similar across all six sectors because of the location of the study area in the agro-pastoralism region, where livestock is the main activity. Growing crops and small businesses come second, with 14.8% of the respondents.

Table 4: Main source of income among respondents per sector

Main Income Sources	Kabarore n=80	%	Karangazi n=78	%	Matimba n=70	%	Nyagatare n=82	%	Rwimbogo n=84	%	Rwimiyaga n=86	%	Total n=480	%
Full-time job	11	13.8	5	6.4	6	8.6	7	8.5	17	20.2	7	8.1	53	11.0
Growing Crops	11	13.8	17	21.8	10	14.3	11	13.4	8	9.5	14	16.3	71	14.8
Small Business	13	16.3	12	15.4	11	15.7	10	12.2	15	17.9	10	11.6	71	14.8
Sub-Total	**35**	**43.8**	**34**	**43.6**	**27**	**38.6**	**28**	**34.1**	**40**	**47.6**	**31**	**36.0**	**195**	**40.6**
Cattle keeping	45	56.3	44	56.4	43	61.4	54	65.9	44	52.4	55	64.0	285	59.4
Grand Total	**80**	**100**	**78**	**100**	**70**	**100**	**82**	**100**	**84**	**100**	**86**	**100**	**480**	**100**

Source: Questionnaire results, 2022

This was also observed earlier by Delgado (2005) that livestock rearing or animal husbandry is one of the fastest-growing agricultural subsectors in Rwanda. Animal husbandry in Rwanda has a big share in agricultural Gross Domestic Product (GDP), about 33%, and is rapidly increasing (Delgado, 2005). According to Rosegrant *et al., (*2009), this growth of animal husbandry in Rwanda is driven by the rapidly demand for livestock products, which is driven

by population growth, urbanization and rising incomes but also government policy such as "Girinka program"[11]. program.

3.1.4 Highest level of education attainment

Survey results (Table 5) indicate that most respondents in the study area (40.8%) have completed only primary schools, followed by secondary school and vocational training schools with 11% and 3.8%, respectively. The proportion of women who attained primary school is slightly lower than that of men in the area, with 48% and 52%, respectively. At the secondary education level, the percentages are 37% for women and 63%. Those with no formal education represent 18.5 %, while those who have completed university represent 7.3%.

Table 5: The highest level of education attained

Level of education	Kabarore (n=80)		Karangazi (n=78)		Matimba (n=70)		Nyagatare (n=82)		Rwimbogo (nN=84)		Rwimiya ga (n=86)		Total (n=480)	
	f	%	f	%	F	%	f	%	f	%	f	%	f	**%**
Complete University	7	8.8	6	7.7	4	5.7	1	1.2	13	15.5	4	4.7	**35**	**7.3**
Incomplete Primary	14	17.5	17	21.8	13	18.6	17	20.7	12	14.3	16	18.6	**89**	**18.5**
No formal school	14	17.5	14	17.9	13	18.6	17	20.7	14	16.7	17	19.8	**89**	**18.5**
Primary	31	38.8	36	46.2	26	37.1	34	41.5	29	34.5	40	46.5	**196**	**40.8**
Secondary	10	12.5	3	3.8	11	15.7	12	14.6	10	11.9	7	8.1	**53**	**11.0**
Vocational	4	5.0	2	2.6	3	4.3	1	1.2	6	7.1	2	2.3	**18**	**3.8**
Grand Total	**80**	**100**	**78**	**100**	**70**	**100**	**82**	**100**	**84**	**100**	**86**	**100**	**480**	**100**

Source: Questionnaire results, 2022

In terms of education, Rwanda has achieved a lot in gender parity in access to primary school education since 2001 (in 2001, net enrolment for girls was 76.1% and for boys it was 74.4%). This is partly due to the effective Rwanda's Education Sector Strategic Plan (ESSP), 2018/2019 – 2023/2024 (Karareba *et al.,* 2019), which recognizes pre-primary education as foundation for future learning. The Government of Rwanda commits to expanding access to three years of early learning for children aged 3 to 6, with the national goal to increase access to 45% of children by 2023/2024 (Paxton, 2012). Hence, more graduates in primary education compared to other levels.

3.2 Community perception about climate change and its effects
3.2.1 Level of knowledge of local community about climate change and variability

Before understanding the perceived effects of climate change, it was important to understand the level of community knowledge on climate change (Figure 4).

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[11] Girinka program was established the president to facilitate poor family to own at least one cow. Each poor family is given a cow with initial feeds and medicines.
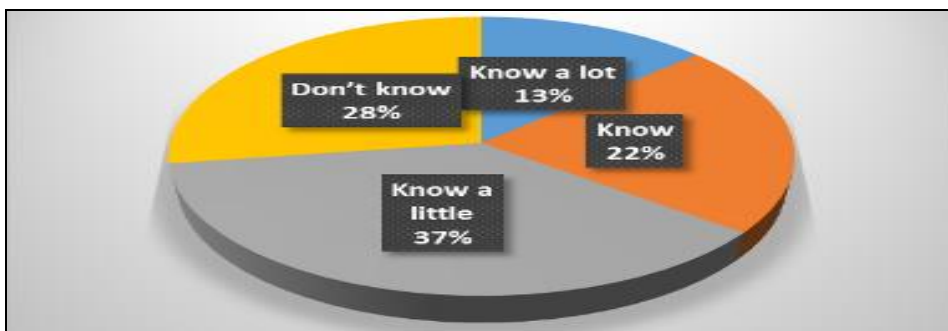
Figure 4: Knowledge of the local community about climate change and variability
Source: Questionnaire results, 2022

Figure 4 indicates that 37% of all respondents have little knowledge about climate change. The fraction of people who reported having sufficient knowledge about climate change and climate variability is equal to 22% while 13 % reported having a lot of information about climate change. Hamilton and Keim (2009) indicated earlier that in Africa and many parts of the World, anthropologic climate science denial persists among the public because individuals lack sufficient information, have a poor understanding of the matter, or associate climate science with conspiracy theories and the like. A recent survey from Africa suggests that only 56% of the continent's population has heard about climate change and about 20% believe that ordinary citizens can do nothing to stop climate change (Afro-barometer, 2019).

In an interview with an environmental specialist at Rwanda Management Authority, it was stated that

> "…. there *is ongoing training and awareness programme to educate people about climate change. However, due to lack of funds, these training are only provided to few people where climate change projects are being implemented".*

This was confirmed by agronomists at district and sector levels, who reported that

> "*...most people are aware of climate change because they are experiencing its effects. They provided different* examples*, including the length of the dry season, changes in planting time, and the amount of rain received during rainy seasons".*

3.2.2 Perceived changes in climate patterns
Understanding public perception of climate change risk and the factors that influence it has been established to be crucial in generating support for climate change response (Thomas, 2019). Several factors including the experience of extreme weather events have been identified in previous studies for having an influence on public opinions and concerns of climate change. To understand how local community perceived changes in climate patterns, the researcher asked respondents to list any change observed over the last 30 years. Table 6 portrays findings from this research is the six sectors covered by research.

Table 6: Local community's perception of climate change at the sector level

Local community's perception	Kabarore (n=80)		Karangazi (n=78)		Matimba (n=70)		Nyagatare (n=82)		Rwimbogo (n=84)		Rwimiyaga (n=86)		Total (n=480)	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Decreased amount of rainfall during the rainy season	71	88.8	69	88.5	62	88.6	73	89.0	75	89.3	77	89.5	427	89.0
Increased length of the dry season	74	92.5	72	92.3	65	92.9	76	92.7	78	92.9	80	93.0	444	92.5
Decreased length of the rain season	57	71.3	55	70.5	49	70.0	58	70.7	59	70.2	61	70.9	339	70.6
Late onset of rain days	48	60.0	46	59.0	42	60.0	49	59.8	50	59.5	51	59.3	286	59.6
Increase of strong winds events	68	85.0	66	84.6	60	85.7	70	85.4	71	84.5	73	84.9	408	85.0
Increasing temperature of the area	51	63.8	49	62.8	44	62.9	52	63.4	53	63.1	54	62.8	304	63.3
The decreasing temperature of the area	56	70.2	55	70.1	49	70.9	57	70.3	58	70.6	60	70.8	337	70.2
Total	**80**	**100**	**78**	**100**	**70**	**100**	**82**	**100**	**84**	**100**	**86**	**100**	**480**	**100**

Source: Questionnaire results, 2022

From Table 6, most respondents in all 6 sectors; 88.8% for Kabarore, 89.0% for Nyagatare, 88.5% for Karangazi, 88.6% for Matimba, 89.5% for Rwimiyaga and 89.3% for Rwimbogo reported that rainfall amount was decreasing. At the same time, survey data indicates that more than 70% of agro-pastoralists from six sectors, including 71.3% from Kabarore, 70.7 % from Nyagatare, 70.5% from Karangazi, 70.0%, from Matima,70.9% from Rwimiyaga and 70.2%) from Rwimbogo perceived that the rainy seasons are shorter compared to some years back.

In an interview with agro-meteorology specialists, these changes were confirmed. It was reported that available historical show a decrease in rainfall in the Eastern province over the last 30 years. Furthermore, the agro-meteorologist indicated that the rainy season has decreased while the dry seasons are becoming longer. This was also observed earlier (Lyon and DeWitt, 2012), who indicated that the rains have declined since 1985 in the African continent, with major consequences for livelihoods.

Historical and projected temperature and rainfall data presented in Figure 5 and Figure 6 indicates higher temperature where the extreme can go beyond 30°C in February and July-August. On the other hand, available data indicated that the study area has been experiencing rainfall deficits over the last 20 years.
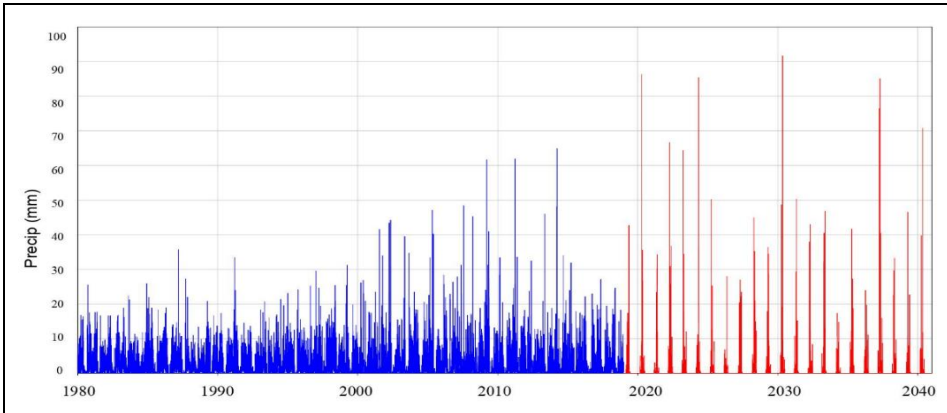
Figure 5: Historical and projected temperature in the study area
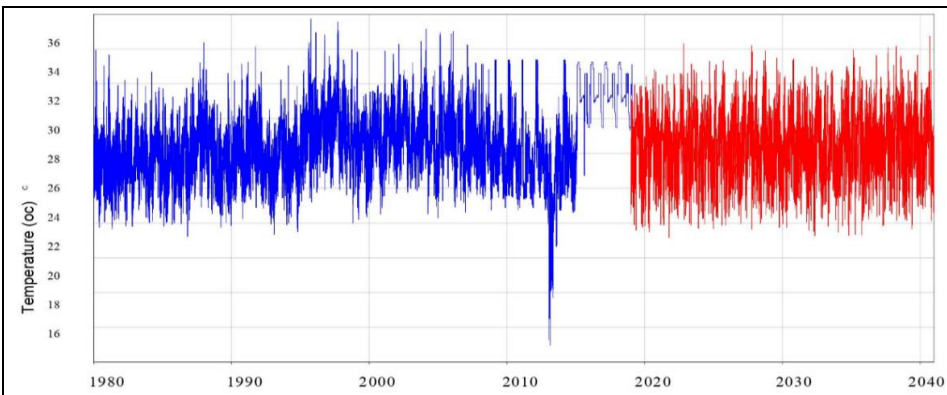**Source:** Data from meteorological service,2022

Figure 6: Historical and projected temperature in the study area
Source: Data from meteorological service, 2022

Some climate change literature was collected and analysed. Although the future scenarios are very variable, some findings are common to different studies. Awange *et al.* (2013, 2014, and 2016) points out that future climate change may lead to increases in average mean temperature, and changes in annual and seasonal rainfall. Henniger (2009) analysed air temperature at Kigali using 3 meteorological stations maintained by "Service Meteo du Rwanda" in the period from 1971 to 2008. Data indicated an increasing mean annual temperature of 2.60 C for a period of nearly 40 years. Haggag *et. al*. (2016) investigated past/present climate conditions and future climate projections in some potential hillside irrigation sites in Rwanda and stated that increases in mean air temperature, precipitation and potential evapotranspiration are projected under all models and all emissions scenarios. The increases in rainfalls are generally small relative to the inter-annual variability currently experienced in Rwanda. There is also a trend of precipitation increase of 1 to 29% corresponding to 2010-2019 and 2070-2099 duration and the range of warming varies from 0.75 to 4.50C.

3.2.3 Local perception about weather and meteorological information

Despite efforts made by national meteorological services to disseminate scientific weather and meteorological information, local communities are still relying on their own weather forecasting. This research attempted to understand traditional indicators used by community to understand weather behaviour in planning their agriculture activities. Table 7 presents traditional indicators reported by local communities in terms weather forecast.

Table 7: Reported traditional weather forecast indicators in community

Indicators	Kabarore (N=80)		Karangazi (N=78)		Matimba (N=70)		Nyagatare (N=82)		Rwimbogo (N=84)		Rwimiyaga (N=86)		Total (N=480)	
	fi	%	Fi	%	fi	%	fi	%	fi	%	fi	%	fi	%
Observation of clouds/sky colour and formation	66	82.5	59	75.6	58	82.9	66	80.5	69	82.1	69	80.2	**387**	**80.6**
Unexpected changes of temperature during the day	52	65.0	53	67.9	42	60.0	58	70.7	58	69.0	56	65.1	**319**	**66.5**
Direction and strength of winds,	47	58.8	42	53.8	44	62.9	49	59.8	51	60.7	49	57.0	**282**	**58.8**
Lightning and thunder,	35	43.8	38	48.7	33	47.1	37	45.1	37	44.0	42	48.8	**222**	**46.3**

Source: Primary data, 2022

Depicted from Table 7, the most reported local knowledge in terms of weather forecasting are the observation of cloud/sky colour (80.6%), change of temperature during the day (66.5%) direction and strength of winds (58.8%), followed by lightning and thunder with 46.3%. These results show that local community has developed their own knowledge and they can predict weather behaviour. For instance, unusual changes in temperature, the presence of heavy black clouds announces heavy rain while clear cloud and or presence of rainbow indicates that there is no rain. Though these indicators are not well documents and streamlined as scientific weather forecasting, they are almost the same as indicators used by meteorological services or scientist and weather forecasting.

The key difference is that traditional knowledge uses only observation and feelings while scientific weather forecasting uses sophisticated instruments to predicts and interpret climate data. Under scientific weather forecasting data collection are divided into two categories namely surface weather observations and upper-air weather observations. Weather observations can be taken manually by a weather observer or computer through automated weather station (Iseh and Woma, 2013). All in all, both knowledge has in common the observations atmospheric behaviour such as temperature, wind speed and direction, humidity, precipitations. Therefore, the two knowledge can complement each other especially when it comes to explain methodology used in weather forecast to ordinary farmers. Further, local communities can provide data and historical information when it comes to futures predications which rely heavily on past events (Iseh and Woma, 2013).

3.2.4 Perceived causes of climate change

Local communities have their own perception of causes of climate change which are at some extent linked with real causes of climate change. Table 8 summarizes causes of climate change as reported by local communities in the six sectors.

Table 8: Reported causes of climate change by sector

Perceived causes of climate change	Kabarore (N=80)		Karangazi (N=78)		Matimba (N=70)		Nyagatare (N=82)		Rwimbogo (N=84)		Rwimiyaga (N=86)		Grand Total (N=480)	
	fi	%	fi	%	fi	%	fi	%	fi	%	fi	%	fi	%
Environmental degradation	69	85.7	67	85.9	60	85.7	70	85.4	72	85.7	74	86.0	411	85.6
Air Pollution	43	53.75	42	53.8	37	52.9	44	53.7	45	53.6	46	53.5	257	53.5
Deforestation	46	57.5	48	61.5	41	58.6	47	57.3	48	57.1	49	57.0	274	57.1
Poor agriculture practices	28	35.2	27	34.6	24	34.3	28	34.1	29	34.5	30	34.9	165	34.4
Economic Development	11	13.75	10	12.8	9	12.9	11	13.4	11	13.1	11	12.8	63	13.1
Disrespecting ancestral	7	8.75	7	9.0	6	8.6	7	8.5	7	8.3	8	9.3	42	8.8

Source: Fieldwork, 2022

As presented in Table 8,85.7% of the respondents for Kabarore, 85.4% for Nyagatare, 85.9% for Karangazi, 85.7% for Matimba, 86.0%for Rwimiyaga and 85.4% for Rwimbogo perceived that environmental degradation was causing climate change risks. Another factor reported by most of respondents is deforestation reported by 57.5% for Kabarore, 61.5% for Karangazi, 58.6% for Matimba, 57.0% for Rwimiyaga and 57.1 for Rwimbogo. Other respondents attributed climate change to some government policies such as land consolidation, monoculture, fertilizer application and improved seeds. Some of the actions that contribute to environmental degradation were confirmed during site visits and are presented in Plate 1.

Plate 1: Mining activities on Muvumba River
Source: Fieldwork, 2022

Reported causes at some extent concur with causes documented in literature. Scientists have tried to divide the causes climate into two broad categories, natural and human causes. The natural causes are many including earth's orbital changes, solar variations, volcanic eruptions and ocean currents. The human causes include burning of fossil fuels, land-use and deforestation (Poehler, 2007).

For instance, Urbanization is believed to be a driving force of an economy which facilitates the transfer of surplus labour from the rural agricultural sector to the urban industrial sector and contributes to economic development (Muntasir and Syed, 2018). Urban expansion can enhance warming in cities and their surroundings especially during heat related events. Increased urbanization can also intensify extreme rainfall that may result in additional risks to the flood system (IPCC, 2020). On the other hand, when forests are burned or cleared for other uses such as cropland, pasture, infrastructure or urbanization, the net flow of carbon from the atmosphere into the forest ends (FAO, 2010). Deforestation also causes the release of the stock of carbon that has accumulated, both in the trees themselves and in the forest soil (David, 2018).

3.2.5 Source of climate change information

Climate change information is received from different sources including government officials, personnel experience, schools and training or neighbours or colleagues in working areas. The Figure 7 presents source of information in the study area.
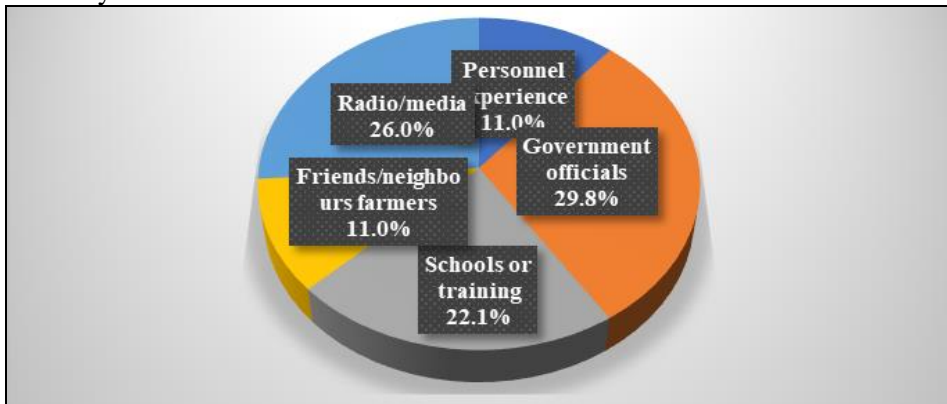
Figure 7: Source of climate change information
Source: Field work, 2021

The Figure7indicates that local community receive information from different sources. Most respondents, 29.8% have received information about climate change from government officials during meetings or when launching climate related projects. Another source of climate change related information is radio/media reported by 26.0%) of all respondents. Other respondents reported school training, personnel experience, or neighbours as the source of information about climate change.

These sources of information were reported by Naswem (2016) who indicated that personal observation/experience, Radio/television, and fellow farmers were the major sources of information. These findings also concur with Isife and Ofuoku (2008), who documented that radio, has the highest audience and has the strength of reaching a large population of farmers and other rural dwellers faster than other means of communication.

3.2.6 Perceived climate change effects on environmental and socio-economic systems

Findings from this research show that reported changes has affected communities' livelihoods but also local ecosystems a presented in Figure 8.
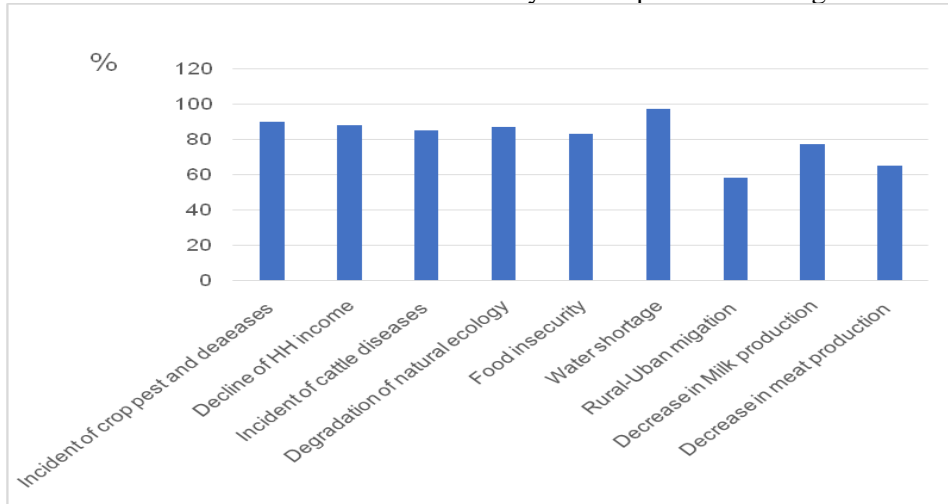
Figure 8: Perceived climate change effects on Socio-economic and environmental system
Source: Fieldwork, 2022

As portrayed in Figure 8, reported climate change effects on community livelihoods are decline of annual households' income (88.3%), increased incidences of pests and diseases in crops (90.1%) food insecurity (83.3%) and rural urban migration (with 58% of all respondents. Decreases in milk and meat production were reported by 77% and 55% of the respondents, respectively.

In terms of climate change effects on environmental and natural resources, respondents mentioned water shortages reported by 97% and degradation of natural ecology with 87.3% of all respondents. Discussion with agronomist at both Nyagatare and Gatsibo district revealed that reported that, in recent years the incidences of new diseases and pests have been a problem for crops and livestock production. Reported diseases the ones that affected Cassava and banana such as severe cassava mosaic (Kirabiranya) and banana bacterial wilt (Known as Kabore in Local language).

The most banana production losses were much observed since the occurrence of banana bacteria wilt which was first reported in 2005 and in 2012 has spread to two third of Rwanda's territory. The study on adverse impacts of banana bacterial wilt on farmers' livelihoods has estimated the banana production loss in Rwanda to be 433ha in 2007 with an economic loss of USD 638,675(Benjamin, 2016). Although the analysis of crop production loss in relation to weather variability is limited by insufficient climate data of the years where declines were observed, the World Bank report (World Bank, 2015) states that weather related risks including drought, erratic temperatures, floods, hailstorms, and

landslides have posed major damages on agricultural production in 1995- 2012. Further, The IPCC (2007) report has succinctly identified the most relevant impacts of climate change on human health as "changes in conditions, temperature, rainfall, humidity, and wind likely to alter the intensity and geographical distribution of extreme weather events, raise water levels in coastal regions, alter the distribution of vector insects and mammals, exacerbate health relevant air pollution, intensify the existing burden of malnutrition, and increase human exposure to toxic substances due to the deterioration of natural and man-made environment" (Graciano, 2010)

3.2.7 Perceived effects on livestock production and productivity
The Figure 8 presents perceived effects of climate change on livestock system in the community as reported by local community.
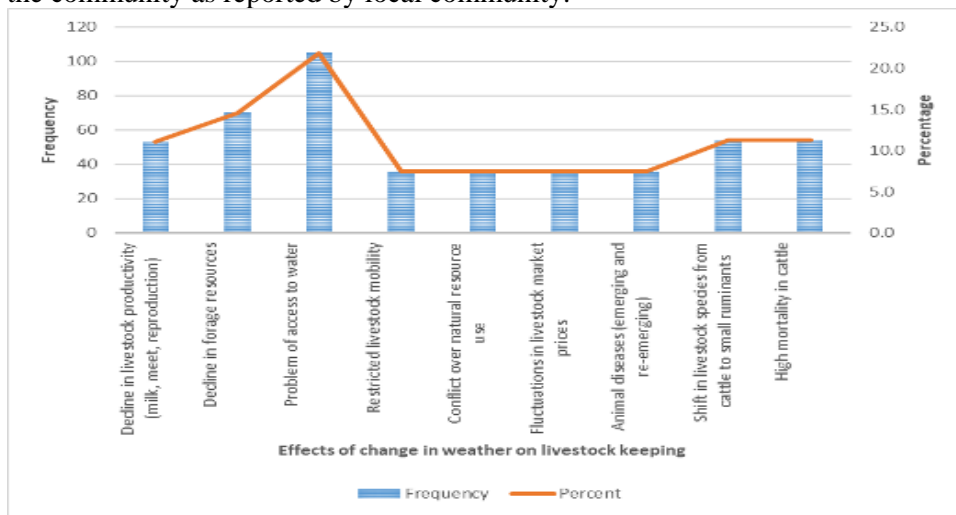
Figure 9: Perceived effects of climate change on livestock systems
Source: Field work, 2022

As illustrated in Figure 8, problem of access to water occupies the first place with 100% respondents mentioning it as measure effects of climate change on livestock systems. Other effects reported as consequence of climate change on livestock include decline in forage resources reported by 72.5% respondents, decline in livestock productivity (milk, meet, reproduction) reported by 56.6%, high mortality in cattle reported by 52.8% and shifts in livestock species (from cattle to small Ruminants) by 51.6% respondents.

It has been reported that climate change is expected to severely affect survival and production of livestock, and cattle in particular are reported to be more impacted than other livestock species due to their feeding behaviour and potential for heat stress (Nardone et al., 2010). Due to scarcity of pasture and water following recurrent drought periods in different countries, livestock have already succumbed to several climate-driven impacts including massive deaths

of livestock, loss of body condition and reduced productivity (Maleko and Koipapi,2015; Magita and Sangeda,2017).

3.2.8 Perception on proposed adaptation practices and actions

This section presents adaptation actions implemented in the study area. In addition to traditional adjustments developed by local communities, new practices observed or reported in the study area are funded by international funding agencies such as World Bank Group or the International Fund for Agriculture Development (IFADA). Figure 10, summarizes traditional knowledge applied by local communities do address climate change effects. Traditional knowledge is applied as part of agriculture practices used by local communities to enhance productivity and production (Benjamin, 2016). Western knowledge is either used as part of adaptation measures or as agriculture practices.
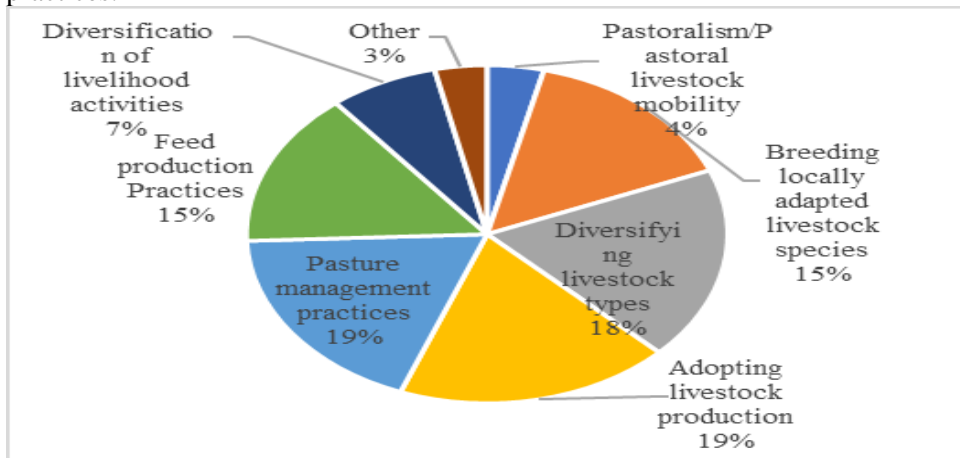
Figure 10: Traditional adjustments to address long-term shifts in livestock keeping
Source: Primary Data, 2022

As seen from Figure 10, the 3.8% reported livestock mobility as adjustment measures during prolonged drought. During this period cattle keepers moves to other areas with rainfall or keep their cattle along Akagera River.   15% of respondents has changed cattle species and opted for locally adapted livestock species, 18.5% diversifying livestock production by introducing small ruminants which does not consume a lot of fodders. These practices address not only the tolerance of livestock to heat, but also their ability to survive, grow and reproduce in conditions of poor nutrition, parasites and diseases (Hoffmann, 2008). If climate change is faster than natural selection, the risk to the survival and adaptation of the new breed is greater (Hoffmann, 2008). In Sahel region to cope with climate change effects on livestock, pastoralists use emergency fodder in times of droughts, multi-species composition of herds to survive climate extremes, and culling of weak livestock for food during periods of drought (Oba, 1997). Further, reduction of livestock numbers – a lower number of more

productive animals leads to more efficient production and lower GHG emissions from livestock production (Batima, 2006).

These traditional adjustments are complemented with western technologies implemented under government funded projects. Key adjustment practices reported by local communities are presented in Figure 11.
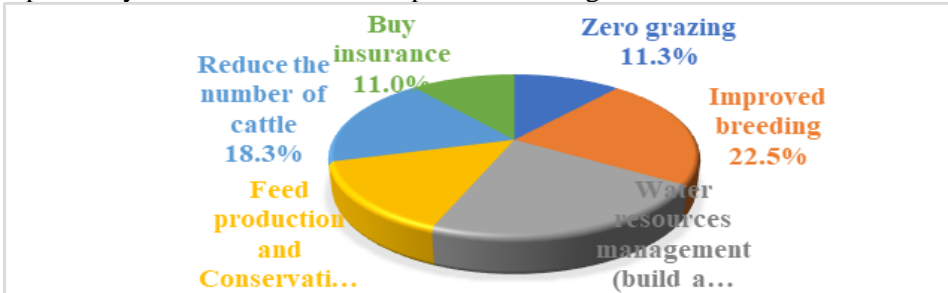

Figure 11: Western knowledge for climate change adaptation
Source: Primary Data, 2022

As seen from the above figure, people in study area have adopted or are implementing different activities against long-term shifts rainfall including improved breed with artificial insemination reported by 22% of all respondents. With these improved breeds, agro pastoralists can reduce the number of cattle and practice zero grazing. Other copying practices reported by local community include feed production and conservation technologies (14.6%) and cattle insurance (11%).

Plate 2: Feeds conservation and zero-grazing practice in the study area
Source: Primary Data, 2021

The left plate shows the fodder conservation piloted in the area while the right plate shows zero grazing practice where animals are kept in cowsheds. This practice is being promoted in entire country and even a law prohibiting extensive cattle keeping has been approved. Cattle keepers have either to keep cattle inside a fenced rangeland or construct sheds for cattle.

The Government of Rwanda (GoR) is promoting zero-grazing because it reduces over-grazing and environmental degradation. The main feed available for dairy

cattle under this system is Napier grass (Mutimura *et al., 2013*). Provision of concentrate feed and conservation of fodder for supplementary feeding in dry seasons remain exceptional in both systems. Insufficient quantities of feed especially during dry spells, and low-quality diets can only support low levels of milk production, and lead to low productivity and high seasonality of production (Lukuyu *et al.* 2013; Maina *et al.* 2020)**.**

In terms water management government is investing in small scale irrigation projects where farmers are supported up to 75% of irrigation facilities including dam sheets and irrigation technologies. Most of the technologies are implemented under on-going projects such as Sustainable Agriculture Intensification Project (SAIP), Land husbandry Water harvesting, and Hillside irrigation projects funded by World Bank and Kayonza Irrigation and integrated Watershed Management projects supported by International Fund for Agriculture (IFAD). This approach will not help reducing the cost involved but also will be used to increase awareness among local community. Some of these practices are presented in figure 12 and Plate 3.
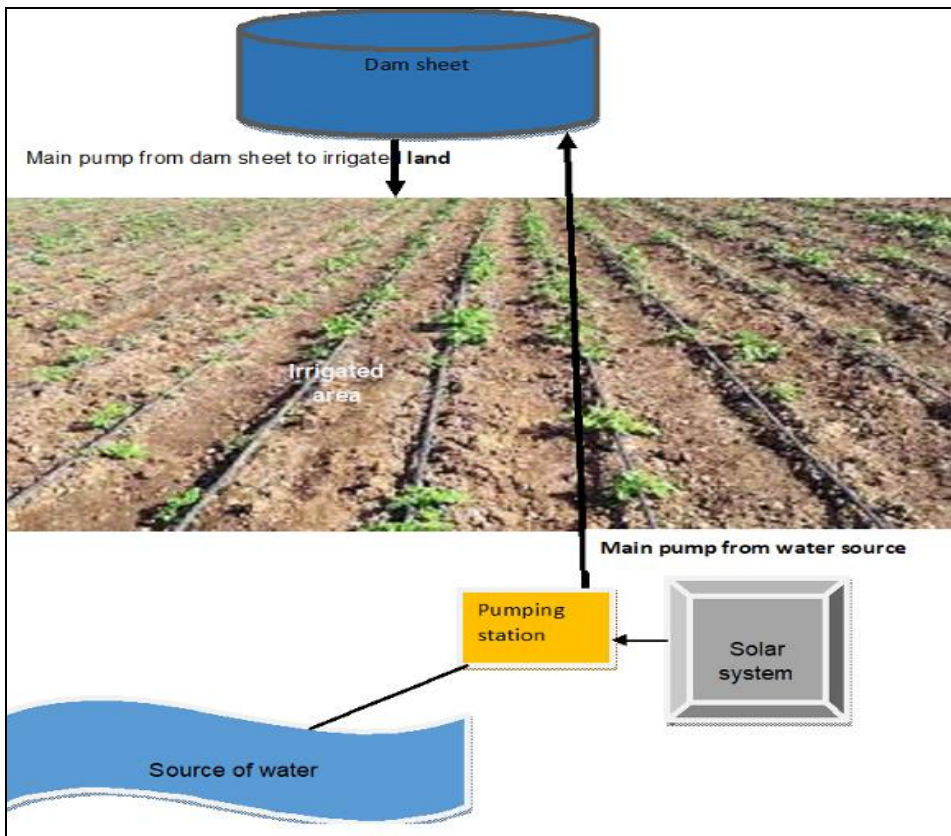
Figure 12: Small scale irrigation schemes
Source: MINAGRI. 2022

Plate 3: Small scale irrigation technology in study area and water harvesting dam sheet
Source: Field data, 2022.

It has been documented that effective adaptation to climate change adaptation in drought prone areas depends on water availability (Lukuyu *et al.* 2013; Maina *et al.* 2020). Under these conditions, improved and accessible irrigation technologies will become an important adaptation tool, especially in dry season, because irrigation practices the for dry area are water intensive. It is reported that climate change is expected to result in decreased fresh water availability (surface and groundwater) and reduced soil moisture during the dry season, while the crop water demand is expected to increase because of increased evapo-transpiration caused by climate change and the continuous introduction of high-yielding varieties and intensive agriculture (Selvaraju *et al.*, 2006).

Unfortunately, it was observed that local communities are not up taking some of the modern technologies and recommendations given by extensionist. For instance, 27.6% of respondents are using irrigation technologies while 43.3% farmers are not enthusiastic about using chemical fertilizer and herbicides or improved seeds. This is mainly due to the high cost but also their potential impacts on environment. In addition to that, communities are not well trained or sensitized on these imported technologies.

Local communities and scientists interviewed believe that the level of uptake and use of proposed adaptation measures would increase if its design considers what local community are already doing. This approach has been confirmed by other authors. For example, Chifamba (2013), reported that different projects failed because beneficiaries are not involved in the design which ultimately affects their level of ownership. It is therefore essential that state agencies and other stakeholders change that approach and establish clear, meaningful partnerships with local communities. This will help identify and address community needs and build on what is already undertaken by local communities. The local community stressed that consultation should be two ways of communication where their views are heard and considered rather than receiving instructions from authorities (Hyland-Wood, 2021). Further, Community engagement and consultation will lead to successful integration processes and could create an equitable, participatory approach, knowledge exchanges, and collaborative processes. It would also enhance the capacity building of all

stakeholders, public awareness, and a culture of continuity and sustainability (Karki *et al.,* 2013).

Recent studies and research on building community resilience, especially in rural sets up, highlighted the importance of transferring and integrating a range of information using a shared learning dialogue and including indigenous and modern scientific techniques into the local social, political, and cultural context (Dixit *et al.,* 2014).This learning puts actors with different views, information, knowledge, and experience on the same ground for conversation using a participatory and problem-solving approach. Such an approach can reinforce reciprocal learning between local communities and scientists. Furthermore, using different channels and platforms can simulate continual reflection that enhances the culture of exchanging specific knowledge and perspectives between custodians of local knowledge and external experts. In addition to that, a such approach may improve effectiveness in terms of decision-making in adaptation to climate and climate risk assessment (Benjamin, 2016).

4.0 CONCLSION AND RECOMMENDATION

The objective of this research was to assess community members' perceptions and understanding of the climate change. Results of this research indicate that local communities in study area have advanced knowledge about climate change and climate variability. Reported changes include the decreased amount of rainfall during rainy season, decreased length of rain season, late onset of rain days, increase of strong winds events and increased temperature. These perception and knowledge concur with data available in meteorological services. Further, the local community are aware of climate change induced effects including shortage of water and fodder and outbreak of climate related pest and diseases.

The research noted that, over time, agro-pastoralists have developed local practices to cope with ongoing climate and non-climate changes. Some of this knowledge are still applied by local communities, while others are disappearing. Despite huge knowledge held by local communities, research results indicate that these knowledges are not considered when designing adaptation strategy at local level.   Most of applied practices are brought western adaptation practices. This has cause failure of introduced adaptation measures, low level of uptake or ownership. This situation calls for changes in approaches when addressing local community challenges in terms climate change adaptation but also in other development programs.

It is important to focus on how local community perceive local challenges and what they are already coping with these challenges. This approach will help to understand how existing local knowledge and context can be incorporated into modern knowledge to design adaptation programs. With this approach, designed actions will reduce community vulnerability and enhance adaptive capacity and

community resilience. It is the view of the author, that successfully adaptation to climate change will depend on a close relationship between scientific knowledge and indigenous knowledge. This should be emphasized, especially in developing local action plans where the level of education and technical knowledge remain low. This will increase the level of uptake but also ownership of local communities. Further, introduced adaptation programs should consider local characteristics but also be affordable to local communities.

Therefore, the researcher recommends that:
 i) Local community knowledge and perception should be assessed and incorporated in designing adaptation actions especially at community and local level.
 ii) Local communities should be empowered and trained to facilitate the adoption and integration of local knowledge into modern adaptation practices through simplified training and awareness, such as the Farmers Field School approach and formal training.
 iii) The consideration of indigenous knowledge should be on how the local community can be involved in the adaptation process and how existing local knowledge and context can be incorporated into modern knowledge to design programs and actions to reduce community vulnerability, enhance adaptive capacity and community resilience.

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Impact of Ungulates on Vegetation Composition Around Waterholes in the Western Part of Etosha National Park, Namibia

Joseph Tashiya[12], Emmanuel Patroba Mhache[13] and Tendai Nzuma[14]

Abstract
Etosha National Park (ENP) is one of the largest conservation areas located in the semi-arid regions of Namibia. Artificial waterholes (boreholes) are the main sources of water for game in the park. Water availability has been largely viewed as a major factor driving ungulate's impact on vegetation composition around waterholes. A nested-intensity sampling design was adopted to collect data from fifty-four (54) quadrats (25m x 25m) on six transects (two at each waterhole) measuring 1 800m from Renostervlei, Dolomietpunt and Olifantsrus waterholes. Results showed that there was no significant difference in species composition with increasing distance away from the waterholes. Herbivory, soil trampling, playing and fighting of ungulates among vegetation before and after drinking has impacted vegetation composition around waterholes. The impacts imposed on vegetation around waterholes by ungulates cannot be completely avoided but be reduced. To reduce the ungulate's impacts on vegetation composition around waterholes, adaptive management measures such as controlled burning, closure of waterholes during rainy seasons, creation of new waterholes that will be evenly distributed within the park and destocking of ungulates is recommended to restore some of the plant species that may have been lost from within those localities.

Keywords: Ungulates, herbivory impacts, waterholes, vegetation composition, Etosha National Park

1.0 INTRODUCTION

Globally, large ungulates are known to have a major impact on vegetation dynamics in ecosystems, ultimately influencing ecological processes, species composition and distribution (Chamaillé-Jammes *et al*., 2007). Etosha National Park (ENP) is a semi-woodland savannah (Burke &Strohbach, 1997; Riddell *et al.,* 2016) that falls within a semi-arid climatic region found in the central part of Namibia (Wardell-Johnson, 2000). Water provision in semi-arid environments determines the distribution and abundance of ungulates at waterholes (Hagwet *et al*., 2014). De Klerk (2004) indicates that African savannahs are known to have a high level of evolutionary history of grazing and browsing in areas around

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waterholes. It has been noted that the distribution of water is a factor that significantly influences the congregation of wildlife around waterholes (Kamanda *et al*., 2008). Most artificial waterholes in protected areas around the world have been recognized as a common and essential source of water for ungulates, hence the prevalent and evident effects of ungulates on vegetation composition are those related to trampling by large herbivorous mammals, grazing and browsing (Harrington, 2002). Vegetation cover is crucial for a healthy ecosystem, especially in an arid country like Namibia (Riddell *et al*., 2016). As part of protected area management in Namibia, the prevention of vegetation destruction in places like ENP is prioritized to reduce negative impacts of vegetation and loss of ecological processes at the park level.

Elephants (*Loxodonta africana*) are known as ecosystem engineers and play an important role in changing vegetation composition and compositions of African savannahs (Valeix*et al*., 2007). Elephants' feeding behaviours of debarking stems, felling trees and breaking branches off trees subsequently transform woodlands into grassland areas leading to a significant influence on the dynamic of vegetation composition and distribution (Cook*et al.*, 2018). Furthermore, other ungulates such as plains zebra (*Equus burchelli*) which inhabits most of the African savannahs particularly the southern and eastern Africa are classified as bulk feeders and known to have a significant impact on vegetation cover around waterholes (Pedersen *et al.*, 2018; Zvidzai *et al.*, 2013). This has successively resulted in overgrazed areas around waterholes in various savannah ecosystems inhabited by zebras (Valeix *et al.*, 2012). Habitually, ungulates in the western part of ENP maintain prolonged stays around waterholes before and after drinking (resting, playing, mating, feeding and fighting), consequently inflicting impacts on vegetation composition thereof (Ben-Shahar, 1993; Brits*et al*., 2002) and in ungulates concentrating more on areas close to waterholes (Owen-Smith, 2008).

In the ENP, waterholes are randomly placed but fairly distributed within the park to supply sufficient water for wildlife throughout the year. Water availability has been largely considered as a major factor driving interaction within herbivore communities, particularly in habitats dominated by seasonal water sources (Zvidzai *et al.*, 2013). Importantly, Auer (1997) stated that water is a key factor in semi-arid environments such as the ENP, influencing regular visits to waterholes by ungulates coupled with destruction and excessive utilization of vegetation around waterholes (Ben-Shahar, 1993; Brits *et al*., 2002). Thus, due to water scarcity, surface watersways the congregation of ungulates around waterholes, particularly in dry seasons. Besides dry seasons, the moisture content in forage material becomes low and when rainwater in puddles has dried up, ungulates congregate around waterholes and the drinking frequency to meet their daily water requirements increases (Chamaillé-Jammes *et al*., 2007; Epaphras *et al*., 2008). Nevertheless, irregular visits are expected in wet seasons

due to surface water abundance virtually everywhere in puddles and ample moisture content in forage materials (Epaphras *et al.*, 2008).

In Waterberg Plateau Park (WPP), it has been observed that areas around waterholes are usually in a degraded state during dry seasons, the results of ungulate's impact on vegetation and soil type around these areas (Mukaru *et al*., 2012). Hagwet *et al.* (2014) carried out a study on the impacts of grazing ungulates on vegetation and soils in areas closer to waterholes in Serengeti plains and discovered that during dry seasons, animals spend more time utilizing vegetation in areas close to waterholes. The situation stimulates habitat over-utilization and soil degradation by trampling, leading to vegetation loss by ungulates which will eventually expand the biosphere area around waterholes (Harrington, 2002). Contrary, Pedersen *et al.* (2018) stated that certain shrubs, herbs and grass species are disturbance-dependents thus coppice and flourish well after the first rain when they have undergone serious disturbances. In terms of community recruitment, pioneer grass species will primarily colonize the disturbed habitats around waterholes (Du Plessis, 1994; Huston, 2014). It is further recorded that, large ungulates often change vegetation compositions, particularly in areas close to waterholes (Ben-Shahar, 1993; Brits *et al.*, 2002) when mating, resting, feeding, fighting and/or playing. Over time, the concentration of animals in the vicinity of waterholes will have a significant negative impact on vegetation around waterholes.

This article assessed vegetation structure and composition at waterholes in the western part of ENP and establish factors that affect vegetation composition at different zones with distance away from waterholes.

2.0 METHODOLOGY
2.1 Study Area
The study was conducted in the western part of ENP in Namibia. ENP is the first protected area to be proclaimed in 1907 and one of the largest conservation areas in Namibia with a surface area of 22 700 km² (Cloudsley-Thompson, 1990; Wardell-Johnson, 2000;Brand, 2007; Riddell *et al.*, 2016). According to Oliver & Oliver (1993), ENP is home to 114 mammals and various bird species (of which the majority are migratory) and various tree species. The park inhabits fifteen (15) ungulates species namely: elephant (*Loxodanta africana)*, black rhino (*Diceros bicornis*), white rhino *(Ceratotherium simum)*, eland (*Taurotragus oryx)*, giraffe (*Giraffe cameloparddalis)*, oryx (*Oryx gazella*), plain zebra (*Equus burchelli*) and mountain zebra (*Equus zebra hartmannae*) blue wildebeest (*Connochaetes taurinus)*, kudu (*Tragelaphus strepsiceros*), black-faced impala (*Aepyceros melampuspetersi)*, common impala (*Aepyceros melampus*), ostrich (*Struthio camelus*), springbok (*Antidorcas marsupialis*) and warthog (*Phacochoreus africanus*) which carries a significant effect on vegetation composition around waterholes.

Namibia is a semi-arid country located in the south-western region of Southern Africa along the Atlantic Ocean (Wardell-Johnson, 2000). The western side of Namibia is dominated by an escarpment that serves as a transition between the narrow coastal desert and the flat inland plateau (Wardell-Johnson, 2000). ENP is situated in Northern-Central Namibia (Figure 1).
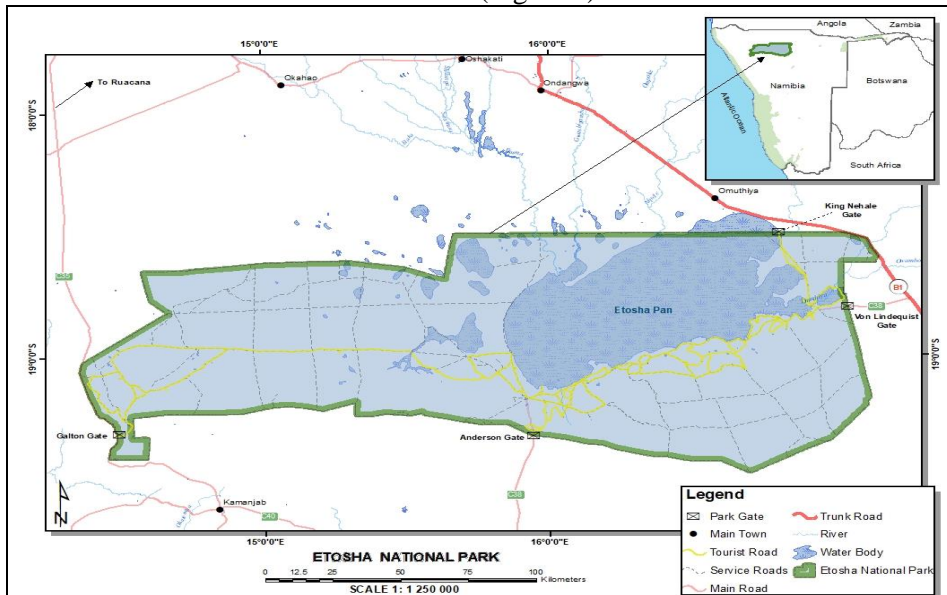

Figure 1: Map of Etosha National Park
Source: https://www.etoshanationalpark.org

ENP comprises a biologically diverse semi-arid woodland savannah ecosystem (Burke & Strohbach, 2000; Riddell *et al.,* 2016). In terms of vegetation composition, the western part of Etosha comprises *Colophospermum mopane* which is the prominent woody plant, while shrubs such as *Leucosphaera-bainesii, Sedderasujjruticosa, Rhigoziumbrevispinosum* and *Commiphoraango-lensis* are often present and grasses include *Anthephorapubescens* and *Eragro-stisdinteri* (Burke & Strohbach, 2000).

The western part of ENP was selected for this study based on the following three key reasons: (i) it has high vegetation and ungulate distribution (Hipondoka *et al.,* 2013) (ii) year-round water provision for wildlife from artificial waterholes unlike the central and eastern part of Etosha National Park with natural springs (Hipondoka *et al.,* 2013) and (iii) the fact that ungulate communities in western Etosha move in packs when going to waterholes and spend time around waterholes before and after drinking. This behaviour is different from other animals in other protected areas such as Waterberg Plateau Park, where ungulates such as Giraffe (*Giraffe cameloparddalis)*, Buffalo (*Syncerus caffer*), Eland (*Taurotragus oryx*), Kudu (*Tragelaphus strepsiceros*), Oryx (*Oryx gazella*) move alone to waterholes, drink and go back to the field shortly after drinking (Mukaru *et al*., 2012).

Three waterholes (Renostervlei waterhole, Dolomietpunt waterhole and the Olifantsrus waterhole) were identified as the study sites (Figure 2). These waterholes were selected because they are operational throughout the year with very minimal problems such as pipeline blockage, cylinder failure and therefore supply sufficient water for wildlife year-round.
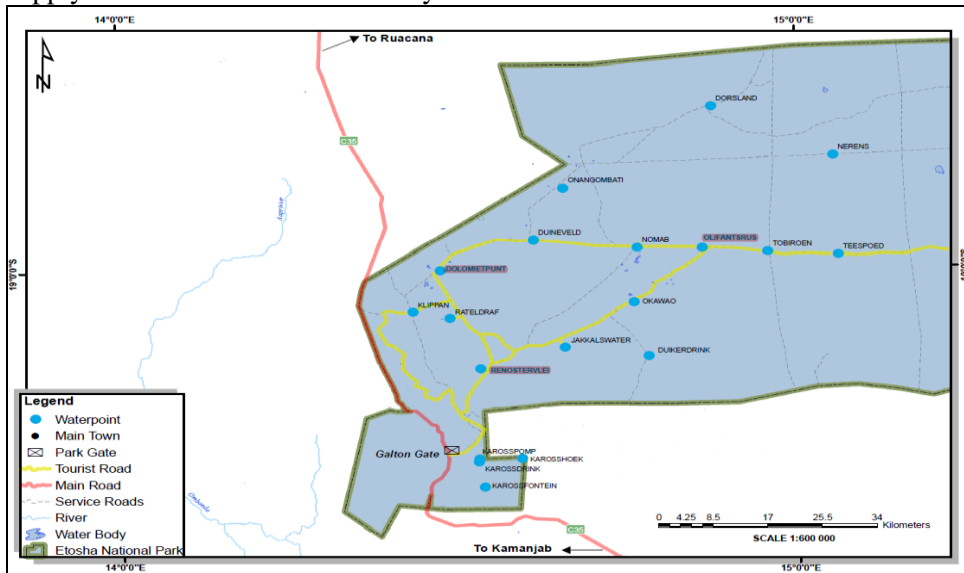
Figure 2: Study sites in the western Etosha National Park
Source: https://www.etoshanationalpark.org

2.2 Methods

A plot-based spatial sampling design was adopted to gather data on the species composition of vegetation around the three selected waterholes. A nested-intensity sampling design was adopted to collect data from 54 quadrats (25m x 25m) on six transects (two at each waterhole) measuring 1800m from Renostervlei, Dolomietpunt and Olifantsrus waterholes. Moreover, a desktop review of the literature was undertaken to interrogate species composition with increasing distance from the waterholes.

The study was conducted during the early vegetation growing season (February to March 2021), while vegetation still has its in-flavescent to ensure easy identification. Two lines of transects were demarcated at each of the three waterholes, running in a cardinal direction. A Global Positioning System (GPS) was used to attest correct placement of transects in the north and south directions. Along each direction, a line of transects measuring 1800m was demarcated from the edge of the piosphere, stretching outwards. Along each transect, nine nested plots of 625 m^2 (25 m x 25 m) were demarcated starting on the edge of the piosphere, at 0 m, 200 m, 400 m, 600 m, 800 m, 1000 m, 1200 m, 1400 m and 1600 m. The 1 m x 1 m plots were nested within the 5 m x 5 m and the 5 m x 5 m were nested inside the 25 m x 25 m of each plot.

2.3 Data Collection

To determine plant species composition and diversity, data were collected from three waterholes in the western part of the ENP. Two line transects starting on the edge of the piosphere, radiating in opposite directions away from waterholes were set and surveyed. Data for plant species composition was gathered by recording names of all plant species that were found in the 54 surveyed quadrants along the two 1800 m line transects at the three waterholes. Grass and herbaceous plants were recorded in the 1 m x 1m plots. Recorded grass species were classified into ecological affinity groups (decreaser and increaser species) considering their response to grazing and disturbance. Shrubs including woody plants with a diameter less than 100 mm at breast height and shorter than 3 m were recorded in the 5 m x 5 m plots while trees woody plants with a diameter $\geq$ 100 mm at the breast height with the height $\geq$ 3 m were recorded in the entire 25 m x 25 m plots. Trees could be singular or double stems.

Tree species were identified using Le Roux and Muller's Field Guide to the trees and shrubs of Namibia. The abundance of each species (grass, herb, shrubs, and trees) was counted using the species composition method. Grass and herbaceous plants were counted in 1 m x 1m, shrubs in 5 m x 5 m and trees in 25 m x 25 m plots from all 54 quadrants. The collection of data started from the edge of the piosphere stretching out to the end of the transect.

2.4 Data Analysis

Following Zar (2010), the statistical methods used in this study were a combination of non-parametric Mann-Whitney U-test which was used for the species composition data, and parametric tests namely the Analysis of Variance (ANOVA) with Least Significant Difference (LSD) and the t-test which were used for the plant species diversity data. All probabilities were two-tailed, and the results were recorded as statistically significant when the p-value was less than 0.05. The abundance of plants was calculated as the total number of individuals recorded in the study at different distances and plot sizes. However, variations in site abundance and between the three waterholes was tested using a t-test for samples with normal distribution and Mann-Whitney U-test for samples that do not pass the normality test (Kent and Coker, 1992). In addition, Shannon-Weaver Index of Diversity, (H') was used to calculate the species diversity
(Kent and Coker, 1992), as follows:

$$H' = -\Sigma(pi \ ln* \ pi)$$

Where, H'= Diversity Index,
Pi =Proportion of the individuals of the ith species
ln = log base n
Species evenness was calculated using Shannon's evenness index E,
$$E = H'/H_{max},$$
Where, E = Evenness, H_{max} = ln S, S= Number of species in that plot, H' =Shannon's Diversity Index.

Variation in plant species diversity between the two seasons was tested using a t-test, and among the three zones was tested using Analysis of Variance (ANOVA) with Least Significant Difference (LSD) as a post-test. The Shannon indices were calculated using past software version 4.6 (Hammer*et al*., 2001), and conducted all other data analyses in the XLSTATS version 2015.4.01.22368 (Addinsoft, 2014). Data for plant species composition was gathered by recording names of all plant species that were found in the 54 surveyed quadrants along the two line transects of 1 800 m at the three waterholes. Grass and herbaceous plants were recorded in the 1 m x 1 m plots. Grass species were classified into ecological affinity groups (decreaser and increaser species) considering their response to grazing and disturbance.

3.0 FINDINGS AND DISCUSSION
3.1 Composition of Plant Communities at Waterholes

The abundance of plant species was calculated as the total number of individuals recorded in the study at different distances and plot sizes. Twenty-one (21) grasses, three (3) herbaceous and sixteen (16) woody species were recorded at the three waterholes as shown in Tables 1 and 2. *Enneapogonscaber* and *Schmidtiakalahoriensis* species are the most abundant grass species (Table 1). Mopane is the most abundant tree in the western part of the park, accounting for around 80% of all trees (Table 2). Vachellia and Terminalia trees dominate the sandveld sections of the study area. Thorn bush savanna grows on limestone and alkaline soils and is dominated by Vachellia species such as *Vachellia erioloba, Vachellia mucronata* and*Vachellia melliferra*. The park's grasslands are mostly concentrated around waterholes and open areas, where the soil is sandy.

Table 1: Grass and herbaceous plant species abundance

Species	Dolomietpunt	Olifantsrus	Renostervlei
Aristida congesta	0	0	2
Aristida stipitata	0	0	2
Enneapogoncenchroides	4	10	10
Enneapogondesvauxii	0	0	2
Enneapogonscaber	0	0	1
Eragrostisporosa	0	2	0
Eragrostis rotifer	3	0	2
Eragrostissuperba	0	0	3
Erogrostisnindensis	2	0	0
Erogrostisviscosa	2	0	0
Geigeriaornativa	6	0	1
Heteropogoncontortus	0	0	1
Schmidtiakalahoriensis	1	14	4
Schmidtiapappophroides	2	0	1
Stipagrosisciliata	0	6	3
Stipagrosisobtusa	0	4	0
Stipagrosisuniplumis	7	0	1
Tragus berteronianus	6	5	0
Tragus racemosus	5	0	5
Pechuel-Loescheluebnitziae	3	0	1
Sesamum capense	3	4	4

Tribulus terrestris	5	3	5

Source: Field survey, 2021

Table 2: Woody (shrubs and trees) plant species abundance

Species	Dolomietpunt	Olifantsrus	Renostervlei
Catophractesalexandri	12	9	13
Elephantorrhizaelephantina	9	14	11
Mundulea sericea	2	0	5
Rhigozumbrevispinosum	5	5	7
Sesamothamnusguerichii	0	0	2
Bosciaalbitrunca	0	3	2
Bosciaalbrinca	0	0	1
Colophorspermum mopane	17	17	12
Combretum imberbe	2	0	5
Dichrostachyscinerea	0	0	3
Moringa ovalifolia	1	0	0
Mundulea sericea	2	0	5
Terminalia prunoides	1	0	6
Vachelliaerioloba	0	0	1
Vachellianebrownii	7	0	0
Ziziphusmucronata	0	0	5

Source: Field survey, 2021

Generally, the study recorded twenty-one (21) grass, three (3) herbaceous and sixteen (16) tree/woody species around the three waterholes. The study found that there was no significant difference in plant species composition with distance from the waterholes. A study by Dwire *et al.* (2006), revealed that the microclimate of waterholes and their surrounding areas can be likened to riparian microclimates, adding that there is an influence of water availability and soil type on species composition of plant communities around waterholes. In addition, hydrologic conditions particularly the water-table dynamics associated with seasonal flooding can also influence riparian soils by controlling the areal extent and duration of saturation (Dwire *et al*., 2006). In saturated soils, for example, oxidation-reduction potential, or redox potential indicates the occurrence and intensity of anaerobic conditions and provides an integrative measure of physical and biological conditions in subsurface environments (Eiche *et al*., 2015; Eiche *et al*., 2019).

While soil texture and water availability play a role in shaping vegetation structure, herbivory by ungulates is inevitably one of the major factors that influence the composition of species in plant communities (Eiche *et al*., 2015; Eiche *et al*., 2019). Faison *et al*. (2016), stated that large herbivores are lead drivers of terrestrial plant composition and dynamics, and therefore important determinants of biodiversity and a host of ecosystem services. The consistently high presence and abundance of grass species throughout the transects at all waterholes suggests that these areas were dominated by increaser grass species. According to Magandana *et al*. (2020), indigenous grass species are often the most dominant plants because of their superior adaptation to stress and extreme conditions such as water stress and extensive grazing and thus preserve the

stability and productivity of the rangeland in semi-arid environments. Furthermore, such species include increaser II species that colonize areas when the rangeland is overgrazed while increaser I species colonize areas when the rangeland is under-grazed (Magandana *et al.*, 2020).

3.2 Composition of species at different distances from the waterhole

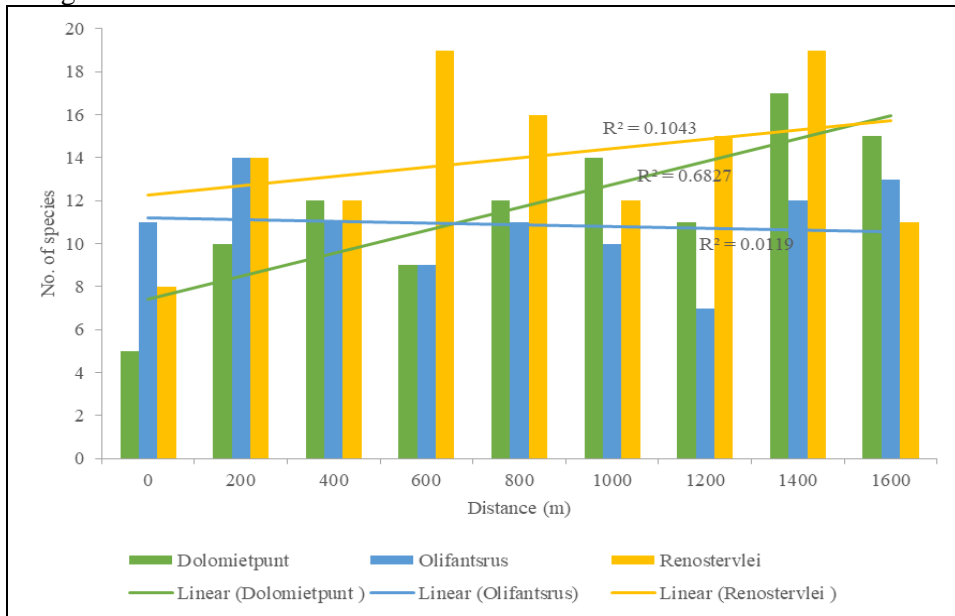The composition of vegetation in relation to waterholes and to distance is shown in Figure 3.

Figure 3: Distribution of plant species with respect to distance from the waterhole
Source: Field survey, 2021

Results from Olifantsrus waterhole show that vegetation species were evenly distributed throughout the transects. While species distribution increased with distance away from Renostervlei and Dolomite waterholes. The composition pattern of species in relation to distance from the waterhole shows varying correlations. For Dolomietpunt, there was a strong correlation between species observed and distance (r= 0.6827, p= 0.0045), i.e., there was an increase in the number of species of plants with reference to increased distance from the waterhole (Figure3). A similar trend was observed at Renostervlei (r= 0.1043, p= 0.211), whereby the number of species increased with distance. However, for Olifantsrus, species slightly declined with distance (r= -0.0119, p= 0.067).

The study further shows that the trend in the number of species was almost the same at all distances, except at 1200m - 1600m from the waterhole, where the number of species fluctuated (Figure 3). Overall, there was no significant variation between waterholes (Dolomietpunt, Olifantsrus, Renostervlei) in species composition in the study area (p =0.103, K = 4.54, df = 2).

This could then justify the relatively high abundance of grass and herb species near waterholes, where water was more abundant and soil texture was much finer compared to the rest of the transect where conditions may have only been more suitable for woody plant species (Mihailou & Massaro, 2021; Mpakairi, 2019; Šmilauer, et al., 2015). This is more apparent at the Dolomietpunt waterhole, where the area gets mountainous with distance away from the waterhole which justifies why there was a relatively higher abundance of grass and herb species near the waterhole and in the middle of the transect. Whereas, a higher abundance of tree species was found in the latter part of the transect which was characterized by a steep slope and rocky soil conditions compared to grasses and herbs.

3.3 Species abundance by plant type

Species abundances by plant type generally declined with increasing distance from water across the three waterholes as shown in Figure: 4. For grasses, the distance category of 0m to 100m had been significantly higher in abundance than the 200m to 600m distance category. However, it later picked up from 600 m toward the end of the transect.

The effective number of herbaceous species has been relatively high at the beginning of transects (first plot at 0 m) at all three waterholes. However, a general decline was revealed at all waterholes, with a persistent decrease from the distance category of 200m to 600m and a complete decline from 600m until the end of the transect at Olifantsrus waterhole. Herbaceous species abundance decreased from the distance category of 0 m to 200 m and an increase was observed at the distance category of 200 m to 400 m and 800 m at Dolomietpunt and Renostervlei waterholes respectively. It was further revealed that there was relatively very low herbaceous species at all three waterholes at the distance category of 800 m to 1 000 m along the transects. However, an increase was again observed from the distance of 1 000 m to 1 200 m before it decreased toward the end of the transect. At Dolomietpunt waterhole, herbaceous plant species remained on increase from the distance of 1 200 m till the end of the transect.

In contrast, there was a general increase in the effective number of shrub species with increasing distances from the waterholes. This increase was observed for the distance categories of 0 m to 600 m and that of 1200 m to 1600 m along the transects. Trees species abundance increased steadily from the distance category of 0 m up to 1400 m from waterholes. However, trees' abundance started decreasing at a distance beyond 1400 m along the transects at all three waterholes.
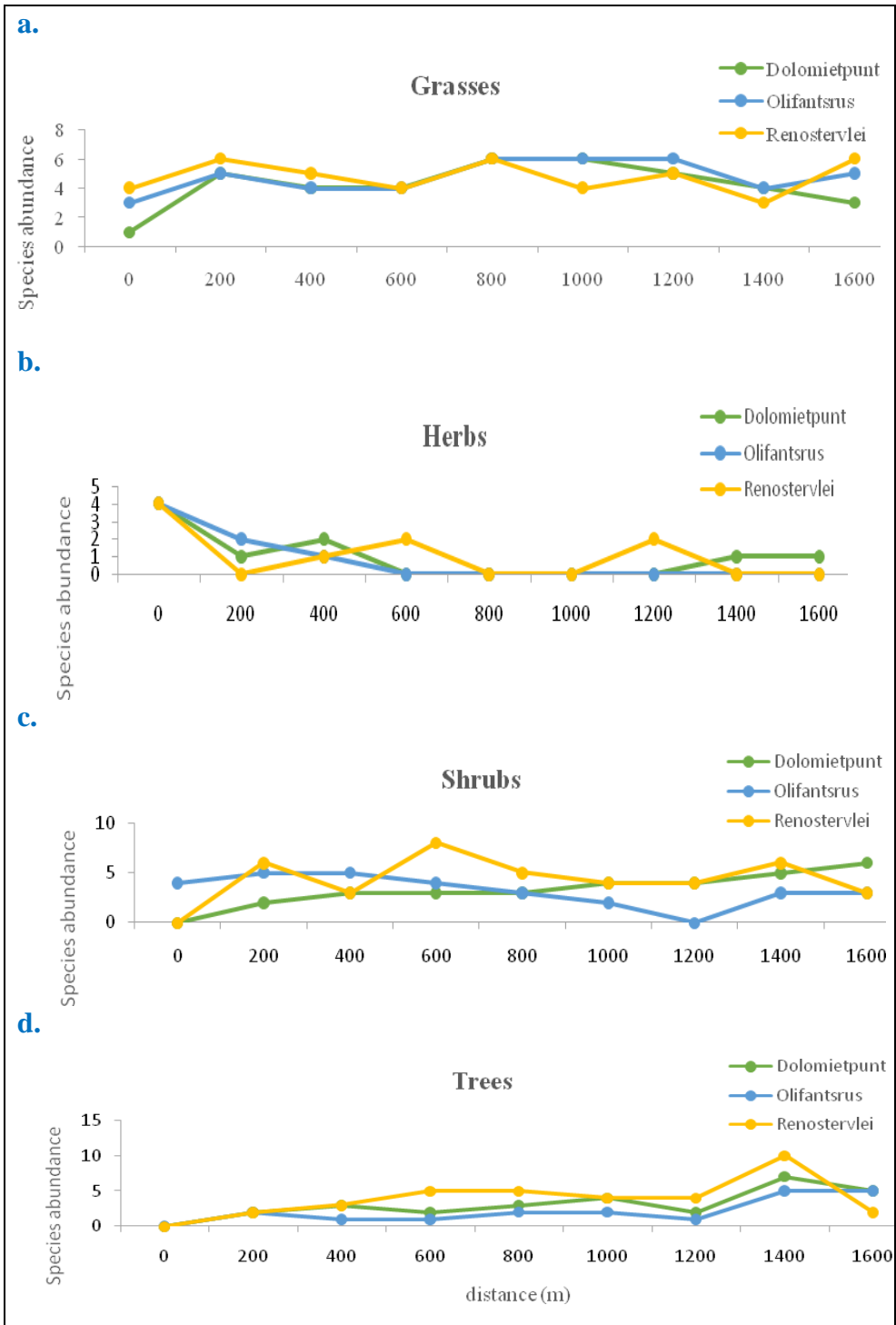
Figure 4: Species abundance of (a). grasses, (b). herbs, (c). shrubs, (d). trees, measured at different distances from the waterhole.

Source: Field survey, 2021

4.0 CONCLUSIONS AND RECOMMENDATIONS

The study concluded that there were no significant differences in species composition of similar vegetation type at the three waterholes. However, changes have been observed in vegetation type varying with distance away from waterholes. The abundance of trees, shrubs and grass species generally remained stable throughout transects at all waterholes. In contrast, herbaceous species significantly decreased with increasing distance away from waterholes. This implies that herbaceous species are increaser species thus dominated heavily disturbed areas (areas closer to waterholes) and decreases with increasing distance away from waterholes. While trees, shrubs and grass are generally decreaser species thus, increasing with increasing distance when the level of disturbance is decreasing with increasing distance away from waterholes.

The impacts of ungulates on vegetation composition around waterholes in the park cannot be completely avoided due to the interdependence of variables (water, vegetation and ungulates). Thus, the implementation of adaptive management measures is highly recommended. Such measures should include but are not limited to controlled burning, and closure of waterholes during rainy seasons when rainwater is plently available in water puddles to enable the recovery and restoration of some of the vegetation species that may have been lost from areas around waterholes. In addition to already existing waterholes, new waterholes should be created in already disturbed and/or open areas with low vegetation cover to avoid immersing vegetation during the construction process. Such waterholes should be evenly distributed within the park to calm accessibility, and avoid prolonged waits and congregation of ungulates and other game species at waterholes during drinking times, which will subsequently reduce ungulates' impact on vegetation around waterholes. Furthermore, such measures should be incorporated in the Etosha National Park's Management Plan (ENPMP) and other relevant framework documents for implementation while promoting ecosystem-based adaptation and resilience. To effectively implement adaptive management practices, the management team of the ENP should know and understand how ungulates are distributed in relation to vegetation and waterholes within the park.

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Influence of Traditional Medicine as Initiative for Rural Tourism and Poverty Reduction Strategy Tanzania: A Case of Kisarawe District

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Abstract

Despite recent scientific advancement and globalization, traditional medicines and complementary/alternative medicine are still primary sources of health care, livelihoods and income generation among local communities falling under Rural Tourism (RT). This study assessed the influence of traditional medicine initiative as a rural tourism strategy inter alia for poverty reduction in Kisarawe district in Tanzania. The main objective was to examine the local community perception on traditional medicine administered by traditional healers whether it has impact in promoting community health compared to modern medicines; but also, as eco-tourism strategy for poverty reduction; while sustaining environmental protection and conservation of various bio-diversities. The study employed mixed methods included structured questionnaires, key informants' interviews, application of Likert scale range from 1 to 7 in data collection from a sample size of 100 respondents. Other methods entailed direct field observation and reviews of relevant literature. SPSS software version 20 was used to analyze multivariate analysis. Results showed willingness of community members to undergo training on improvement of knowledge on traditional medicines supported by tourism programmes, government policies and regulations for sustainable RT, poverty reduction, environmental protection and conservation. The study concluded that, community perception on traditional medicine positively moderates the relationship between rural tourism development and poverty reduction; however, there was limited co-ordination of tourism activities; and insufficient collaboration between the public and private sector. It recommended that; future research should network with traditional healers in order to know more indigenous medicinal plant species in order to formalize their application in public health while promoting eco-tourism for social economic development of local communities in Kisarawe district.

Keywords: *Rural tourism, poverty reduction, perception, traditional medicine, Tanzania*

1.0 INTRODUCTION

Tourism is a social, cultural and economic phenomenon which entails the movement of people to countries or places outside their usual environment for personal or business/professional purposes. These people are called visitors

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they can be either tourists or excursionists; residents or non-residents and tourism has to do with their activities, some of which involve tourism expenditure.

The contemporary trend of moving from the concept of mass tourism to the individual forms of tourism opens to rural tourism the position in the world market of the 21th century. Rural tourism has no characteristics of massiveness; and it is compatible with the aspects of sustainable tourism (Lun dberg, 2017). Rural tourism in rural regions, tourism takes place as a business set up for the local community. The earliest study of rural tourism began in the 1950's, with farm tourism study by Ager (1958) (cited in Opermann, 1997) by emphasizing the importance of tourism in mountainous areas. Then, in the following decades, the study of rural tourism, particularly in regards to farmers, mostly focused on the economic contribution, problems faced by farmers and the social and psychological impacts of tourism to the farmers (Oppermann, 1996). Studies in rural tourism were more concentrated in wilderness areas or National Parks, rather than in the other attractions of the rural areas, such as farm tourism and non-farm tourism (Owens 1984, as cited in Oppermann 1996). Oppermann also supported this argument by classifying different types of tourism in rural areas in terms of the level of involvement by the community.

Globally, rural tourism dates back to the Romanticism movement era which began in the late eighteenth century. Romanticism developed as a counter to industrialism; it began in the natural world. The first creative tours in rural areas were based on the holiday concept, but modern rural tourism began after World War II (Lane, 2009). Additionally, this movement's influences on the development of rural tourism can be bilaterally thought of as the tourist side (demand) and the organizer side (supply). The needs of both sides revealed rural tourism. According to many tourism researchers, tourists seek wholeness in different things that they cannot see in their lives (Nilsson, 2002). People care about health and well-being more, they want to escape from their daily routines, preferring more personal and authentic experiences rather than the standard holidays provided by mass tourism, and realize their influence putting pressure on tour companies.

Traditional medicinal plants or so-called alternative medicine as the preferred form of health care are an important element of indigenous medical systems in Tanzania and the rest of the world. African Traditional Medicine has defined as the sum of all knowledge and practices, whether explicable or not, used in diagnosis, prevention and elimination of physical, mental, or societal imbalance, and relying exclusively on practical experience and observation handed down from generation to generation, whether verbally or in writing (WHO, 2002). Indigenous people have been using the unique approach of their traditional system of medicine for centuries and among the most renowned are the Chinese, Indian, African systems of medicine.

Kayombo (2012) argues that man learnt to distinguish edible plants from the poisonous ones by observing animals. Traditional medicinal plants are readily available and culturally acceptable. They offer an accessible and affordable health care regime and serve as an important source of livelihood for indigenous rural populations in Kisarawe district. Research on plant and use of traditional medicinal information has again received considerable interest. Indeed, herbal medicine is an integral part of any traditional system of medicine, and the present review becomes more significant from this viewpoint. The main objective of the present review is to explore the significance of traditional system of medicine, in particular traditional medicinal plants as a source of employment and primary health care modality in developing and resource-poor countries. It is also very important to identify the existing major values and the opportunities to preserve this valuable resource of nature to humankind in Kisarawe district.

World Tourism Organization (WTO) considers that there is an important potential market for rural tourism; however little research has been done to date into the size of this segment. It is estimated that 3% of all international tourists travel for rural tourism purposes and rural tourism is estimated to be growing at an annual rate of around 6%. African traditional medicine (ATM) is an important part of African culture that is recognized and accepted by Africans as tourist product despite conventional health practice. Scientific validation of the safety and efficacy of plant extracts derived from African medicinal plants based on African Indigenous Medical Knowledge has been facilitated by the use of WHO technical support tools.

African countries have embraced the sustainable development goals (SDGs) and of specific reference to health is SDG3—good health and well-being which has as one of its 13 targets: to achieve universal health coverage (UHC). UHC is defined as ensuring that all people have access to needed health services of sufficient quality to be effective, while ensuring that the use of these services does not expose the user to financial hardship. The current use of African traditional medicines (ATMs) and associated expenditures in seeking care from traditional health practitioners (THPs) implores the researcher to examine the influence of TM in contributing towards RTs in poverty reduction in Tanzania. UHC and SDG-3 can only be achieved with a stronger emphasis on primary healthcare (PHC). Since over 60% of people in sub-Saharan Africa (SSA) live in rural areas where conventional healthcare is scarce, exploring the role of ATM to achieve the goals of UHC becomes important. Given the economic reality and cultural beliefs, empowering THPs will enable more people to access quality healthcare, which is a critical component of UHC.

In principal, ATM is regarded as more accessible, affordable and acceptable to local populations and can therefore contribute to the attainment of UHC. For instance, the average ratios of THPs and medical doctors per population in SSA

are respectively 1:500 and 1:40 000 (Mhame *et al.,* 2010). Evidence shows significant use of ATM as high as 88% of respondents in a Zambian study expressing preference to visit a traditional healer when sick, for patients with AIDS symptoms in Malawi, South Africa, Uganda and Zimbabwe and as the main source of healthcare for mental illnesses in Uganda. Due to the high proportion of patients using herbal medicines (70% in Ghana), some health facilities have initiated the use of herbal medicines as a component of healthcare delivery. Significant out-of-pocket health expenditure on THP has been reported in the literature. For example, a study conducted by Semenya & Bapendi (2014) in Limpopo Province South Africa reported that out-of-pocket health expenditure on THP accounted for 10% of monthly expenditures among three-quarter of the poorest quantile.

Recognizing that Africans continue to patronize THPs and use ATMs, the WHO developed a set of tools and guidelines to support the scientific development of ATMs through the identification of their medicinal components and standardization of procedures for their use. The WHO African Regional Strategy on '*Enhancing the Role of Traditional Medicine in Health Systems*' provided the impetus and direction vis-à-vis promotion of ATM.

Promotion of traditional medicine on rural tourism development in this study refers to health practices, approaches, knowledge and beliefs incorporating plant, animal and mineral based medicines, spiritual therapies, manual techniques and exercises, applied singularly or in combination to treat, diagnose and prevent illnesses or maintain well-being as attractions for RTs development and employment on poverty reduction in Kisarawe district. The focus of the implantation strategies for the promotion of traditional medicine as initiative development and practice in Kisarawe require a number of factors to be considered. They include formulation of policy and regulation for the proper use of traditional medicine and its integration into areas health care systems for poverty reduction; establish a regulatory mechanism to control the safety and quality of products of traditional medicine practice. Other factors engross create awareness about safe and effective traditional medicine therapies among the public and consumers, cultivate and conserve medicinal plants to ensure their sustainable use. However, little research in the study area is known about the levels of return on this matter.

The Tanzania herbalist, often referred to as *'bwana mganga'* 'medicine man' or *daktarin wa miti shamba* 'doctor of plants', is normally passed on orally from one generation to the next (Runyoro, 2006). Despite the various research outputs of economists, anthropologists, sociologists, geographers and a range of development practitioners, there is little understanding and no consensus on what impact rural tourism has had from traditional medicine on poverty in the developing world (Lundberg, 2015). The World Tourism organization (WTO) and many European organizations agree that, rural tourism is "a form of tourism

that includes any tourist activity in rural areas organized and led by the local population, exploiting local tourism resources (natural, cultural-historical, human) and facilities, tourist structures, including hostels and agro-tourism farms." In light of this definition; it is obvious that there is still much untapped potential for rural tourism development in Tanzania bearing the diversity of the country's cultures; heritage, social structures and ecosystems provide the backdrop for unique visitor experiences that are unmatched anywhere else in the world. In the same vein, it can be argued further that the rural tourism development efforts in Tanzania and particularly in Kisarawe are not fully tapped for local community social economic development despite the efforts and interventions so far made by local communities, central government, non-governmental and other stakeholders since 1960s (URT, 2012).

There are many reasons to pursue rural tourism initiatives by using traditional medicine strategy. Rural tourism is considered by stakeholders as a viable strategy to assuage poverty (UNWTO, 2015). The main issue still facing many developing countries in Africa including Tanzania is the problem of poverty. Although the government has made great strides in the formulation of poverty reduction policy and strategies; the problem of poverty is still critical as the number of poor people is increasing (NBS, 2012).

Several studies have reported various rural tourism initiatives as potential opportunities for poverty reduction at the local community level (Kulcsar, 2009). Studies conducted in 2011 in South Africa show that (78%) of the local respondents perceived rural tourism development as a mechanism for economic development that needed to be implemented (Mthembu, 2011). Besides, a study done by Kibicho (2008) in Kenya also observed that, some demographic variables such as age, gender, and education among different groups of residents held different perceptions about rural tourism. In that study residents who had positive perceptions on the   impact of rural tourism to local community development included the youths, female, and of higher education achievers. It concluded that, rural tourism inter alia can serve as a panacea for reducing stresses of modern day living causing people unprecedented levels of strain and anxiety. A study which was conducted in Indonesia demonstrates that the perceived importance of community participation in rural tourism could influence perception towards sustainability by (Nazzura, 2016). From a demand side, the appeal of rural tourism is summed up as peace, solitude, nature, scenery, traditional people, recreation and adventure (UNWTO, 2015).

Runyoro *et al,* 2006 conducted a survey on an ethnomedical in Coast, Dar es Salaam, Morogoro and Tanga regions of Tanzania has resulted in the identification of 36 plant species belonging to 21 plant families that are used traditionally for the treatment of Candida infections. Twenty-one plants constituting 58.3% of all collected plants are used to treat oral candidiasis (*Utando in Kiswahili*) one of the symptoms of HIV/AIDS. The knowledge of

traditional healers for the treatment of Candida infections has been highly supported by literature; for 13 (36.1%) out of the 36 plants identified have been proven to be active against Candida albicans and/or other species of Candida. Some of the plants were reported to be active against other species of fungi including Cryptococcus neoformans which is among pathogenic fungi in HIV/AIDS. It can be seen that ethnomedical information from traditional healers provides guidance towards development of new drugs than sheer random screening. In fact, it simplifies to the screen task by obtaining extracts identified from indigenous knowledge and performs a bioassay and other medicinal processes. These data testify the importance of rural tourism industry in providing income opportunities to traditional healers through sales of medicinal plants to local communities for their social welfare and poverty reduction in Kisarawe district in general.

This study established that tourism sector in Kisarawe was evaluated as a pacemaker for globalization and locomotive for development. Rural tourism is viewed as an engine for economic growth rather than as a mechanism for poverty reduction; and that assumption has especially indebted developing nations in the 21st Century (Plüss and Backes, 2002). The development vision on tourism, as a development engine, still has reflections on multi-national agencies. The UN Conference on the Least Developed Countries (UN-LDC) adopted their first program of action on tourism, in which the LDCs were urged to promote a climate conducive to tourism (Plüss and Backes, 2002). However, rural tourism development thinking mostly emphasized on 'trickle-down' benefits. Trickle-down approach implies vertical flow from the rich to the poor that happens on its own accord. Benefits of economic growth go to the rich first, and then in the second round the poor begin to benefit when the rich start spending their gains. Thus, the poor benefit from economic growth only indirectly through a vertical flow from the rich (Kakwani and Ernesto, 2000).

It was important to first assess the effect of traditional medicine as a factor of rural tourism development on poverty reduction within the community's development perspective in their areas. Poverty still remains the confounding major obstacle to optimum utilization of tourism resources for both social and economic development of nations (Kudi, 2015). It will help not only in identifying gaps in the community's understanding of the concept, but also in developing tourism programmes and tourism policies for the community to better understand the process and importance of rural tourism development (Byrd et al. 2008). This knowledge gap made Cloke (2015) categorically state that, nothing is known about the long-term impact of traditional medicine for poverty reduction. Therefore, this study is intended to contribute towards narrowing this gap by providing some knowledge and exposing income opportunities that can be accrued from medicinal plants while promoting rural tourism.

2.0 MATERIALS AND METHODS

2.1 The Study Area

This study was conducted in Kisarawe District Tanzania. The District is one among 8 Districts in Coast Region; it is 25km on the outskirts of Dar es Salaam City towards the East North. Its headquarters is about 15 minutes' drive from Julius Nyerere International Airport. The district is endowed with abundant and unique natural resources to include reasonably fertile soil (heavy red loams on the rising ground of the foreland ridge and black soil in many valleys) together with miombo type and savannah natural vegetation in some parts especially in Chole and Mzenga Divisions. The natural forest reserves of Kazimzumbwi, Pugu and part of Selous Game Reserve in Vikumburu Ward are of special importance. Kisarawe is situated between latitude $6^0 50^0$ S, and 35^0 and between longitude 38^0 15^0E and 39^0 30^0E. It borders Mkuranga District in the East and Morogoro district in the West and Ilala Municipal of Dar es Salaam City to the Northeast, Kibaha District to the North and Rufiji District to the South. The district covers an area of 4,464 square kilometers and is 100 m above sea level with the total population of 101,598 males 50,631 and female 50,967 with the average growth rate of 2.1% and the average household size is 4 people (NBS, 2012.
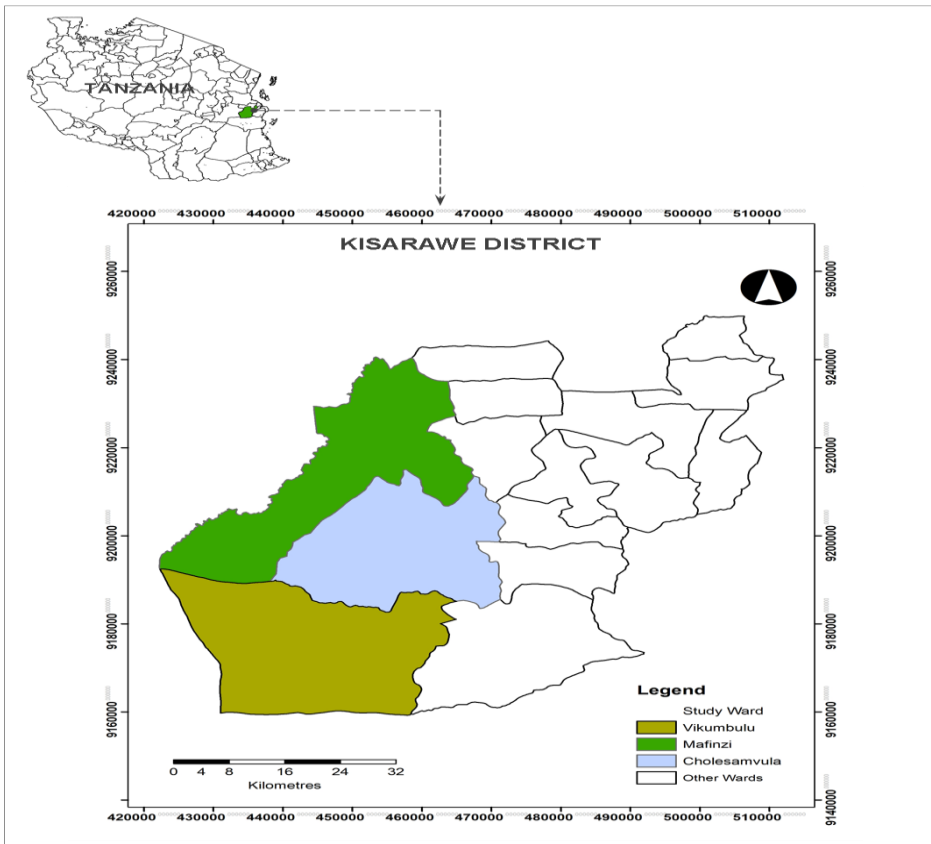
Figure 1: Locational map of the case study areas
Source: GIS Department Kisarawe

2.2 Data Collection Methods

The study used questionnaires, interviews, and direct field observation techniques to obtain information from respondents of different categories in Kisarawe district. Purposive sampling was employed by identifying respondents who were directly or indirectly linked to the influence of traditional medicine on RTs development for poverty reduction. Questionnaires were used to collect the quantitative information; and interviews were employed to collect qualitative information while field observation was used for preliminary identification and sample collection of the medicinal plants for discussion. Respondents ranged from local 13 government employees, 45 heads of departments, 34 traditional healers and their assistants from different wards, and 34 tourism entrepreneurs. Others include; a total of 8 experts selected from different institutions of higher learning namely, the College of African Wildlife Management (MWEKA), Muhimbili University of Health Allied Science, National College of Tourism (NCT), The Open University of Tanzania, and the University of Dar es salaam. The sample size for the study constituted 100 respondents. The justification for conducting interviews with respondents from different backgrounds was to triangulate information captured from different people. They were regarded to have varied perceptions and opinions on the influence of traditional medicine as a rural tourism component towards poverty reduction among rural communities.

Table 1: Respondents who participated in the study

Respondents	Category	Sample (n)
Local Government Employee 13 Heads of Dept.	Policymakers and supervisors	13
Tourism Entrepreneurs	Business practitioners	34
Local community	Traditional Healers	45
Representatives from Institutions of higher learning	Professionals and consultants	8
TOTAL (N)		100

Source: Field survey data (2021).

Descriptive methods were employed to analyze and present the results backed by resolutions reached in the workshop discussions, from the interview and from the field survey.

3.0 RESULTS AND DISCUSSION

A total of 100 questionnaires were administered to the respondents of Kisarawe district Table 1 above. The results are presented in the following sub-section. Generally, the results showed traditional medicine has significant effect on poverty reduction. The results correlated with those related studies previously reported by Karunamoorthi et al. (2012) and Runyoro, (2006).

3.1 Effect of Traditional Medicine on Poverty Reduction

The research revealed diverse beneficiaries of medicinal plants. In fact, medicinal plants were part and parcel of daily livelihood practices and cultural heritage of different societies in Kisarawe district. They covered economic growth, employments and environmental conservation in the district as 51% of

the respondents strongly agree with this contention that, traditional medicine had diverse positive impacts on RTs compared to only 10% respondents who disagreed with the same statement. The use of plants in the treatment of various diseases, as specific antidotes to witchcraft and for religious ceremonies has been an integral element of African society for centuries. Likewise, as commented previously by Cloke (2015); this study also established that, the long-term impact of traditional medicine for poverty reduction is not known due to various institutional factors. For traditional medicinal knowledge like a myriad of indigenous knowledge in many African traditions including Tanzania; the herbalist in Kiswahili it is known as *'bwana mganga'* (traditional 'medicine man'); or *'daktari wa miti shamba'* ('doctor of plants'), usually is the one who possesses the knowledge of medicinal plants and is not obliged to passed it on to the next generation through orally tradition. The same scenario was observed by Runyoro, (2006). If the possessor of such knowledge decides not to pass it to the next generation they die with and it becomes the thus the end of it.

Table 2: The effect of traditional medicine on poverty reduction

Statements	Strongly Disagree	Disagree	Slightly Disagree	Neither Agree Nor Disagree	Slightly Agree	Agree	Strongly Agree
Traditional Medicine increase Tourism Awareness of Local Community	4%	.3%	.0%	4%	17%	19%	53%
TMs Development Plays a Vital Role in Preserving Environment and expansion of Employment	1%	4%	3%	0%	16%	23%	53%
Promotion of Traditional Medicine Preserve Cultural and Natural Heritage	0%	0%	2%	1%	3%	10%	84%
Implementation of Herbal Medicine Generate Revenues to Community Income	0%	0%	1%	4%	7%	12%	76%
No Land Conflict Over the Use of Herbal Medicine	1.2%	1.3%	4%	6%	11%	31%	42%
TMs can influence Tourist of Special Interests	3%	9%	20%	0%	0%	36%	76%
Traditional medicine can have Diverse Impact on RTs	0%	10%	5%	3%	6%	25%	51%

Source: Researcher, 2021

These results largely focused on factors related to traditional medicine and rural tourism development they give an outcome on various effects of traditional medicine on poverty reduction in Kisarawe district. The study revealed that the role of government policies and regulations could reshape the perception and behaviour in solving the illegal activities among the society. The effects of rural tourism were therefore considered in terms of contribution to rural communities' livelihood needs and employment. The respondents were therefore asked to state the contribution of TMs on a variety of their livelihood outcome goals. Although

the study interviewed several traditional healers, it was discovered that the majority of the respondents did not use plant solely for healing purposes.

In another development, the study in Kisarawe revealed multivariate results somehow unique to globalization and modernization experience in that, a sizable fraction of the local community in the study area relied on the traditional medicines as their primary health care modality. This observation is envisaged to promote RT in future built on dependence on traditional medicinal plants. It may cultivate a health care system founded on viable culture of affordable plant medicines, nurtured amidst traditional beliefs in power of herbs, easy access to traditional cure compared to costly existing modern health care service as implied in Table 2.

3.1.1 Traditional provision of primary health care)

The study revealed plant- based remedies, commonly used in Kisarawe and other parts of Coast region; they included those which treat women complication such as infertility, early pregnancy complications, late labour pains. They were reported to be treated by a number of tree species including *Adansonia digitata* (mbuyu-kiswahili), *Pterocarpus angolensis* (mninga- mawe). Although they could not totally cure especially certain chronic diseases at least provide relief for such diseases. Other diseases curable by plant medicine include coughs, colds, flu, fevers, sore throats and African wormwood. Also, some medicinal plants can support immune system hence act as supplementary medication.

Even more importantly, it is a fact that most of the natural herbs have minimal or less side effects as compared to modern pharmaceutical drugs arising from industrial chemicals involved during manufacturing processes. Traditional medicines are usually safe for use by patients except for those who are allergic to certain herbs. Currently, traditional remedies are often used in conjunction with mainstream medicines as complementary treatments (Table 4).

3.1.2 The Influence of Traditional Medicine on Eco-Tourism

Eco-tourism refers to integrating conservation, communities and sustainable travel to ensure socio-economic, environmental benefits and empowerment of local communities while ensuring tourists' satisfaction. This study determined how these sectors were linked to conducting tourism value chain analysis, actor assessment, relationship and profit margins; and sustainable carrying capacity of the ecosystems. This concern was partly shared with in-depth views of respondents. It established the fact that, sustainability of the rural tourism depended on various factors basically inclusion of environmental protection and conservation. For: rural tourism could not stand alone without environmental protection and conservation against physical environment degradation factors such as improper solid waste disposal pollution, deforestation and erosion caused by irresponsible human activities; consequently, the drying of water sources due to encroachment of catchment area. These symptoms, though at

small scale, were observed to have started taking place in the study area. On the basis of this, the study probed the respondents to look for ways of achieving sustainable rural tourism and the quality environment which is the essence eco-tourism. Traditional medicine featured to be among the factors which influenced eco-tourism along with ideas of natural environment protection and conservation. To this effect, other factors included; change of communities' mindset, attitudes and behavior through awareness raising, application of ICT and promotion of service provision, business and market linkages.

3.1.3 Increase in Revenues
The study established that eco-tourism activities in Pugu and Kazimzumbwi forest reserves generated approximately Ths 65,926,650.00 million in July 2021 – May 2022 financial year (Table 3). These revenues were deposited into the Tanzania Forest Services (TFS) Fund for general use and distribution by the central government. During the pre-survey of this study which was partly conducted in some hotels in Kisarawe district showed that; occupancy rates ranged from 12% to 30% indicating that there was substantial capacity for expansion of rural tourism. It could be inferred that, there were diverse beneficiaries of eco-tourism including those engaged in one way or the other in traditional medicines. If a conducive socio-cultural and economic environment could be improved, it would most likely attract many tourists coming for rural tourism hence greatly contributes to the local economic development and the nation at large.

Table 3: Revenues from eco-tourist 2021-2022

Activity	Year	Total (Tsh)
Camping fee & government owned tents	2021/2022	7.547,150.00
Permit for vehicle in the forest reserve per day	2021/2022	4, 055,150.00
Royalties from tourism (entrance)	2021/2022	43,677,500.00
Sport fishing per day	2021/2022	80, 000.00
Day/night walk guide	2021/2022	6,622,000.00
Commercial photograph fee	2021/2022	645,000'00
Commercial filming fee	2021/2022	2,660,000.00
Kayaking per day	2021/2022	50,000.00
Sailing with government owned canoe	2021/2022	340, 000.00
Guide service per day		250,000.00
Total	**2021/2022**	**65,926,65o.00**

Source: TFS, Kisarawe 2021

3.2 Types of Medicinal Plant Species
A total of 24 plant species used in traditional medicine for the treatment of patient infections were identified (Table 4). Plant roots were frequently used followed by leaves, stems and entire herbs. Administration of the plant medicine depended on the type of infection; for some infections were treated using one of these parts of the plant whether applied directly or indirectly whatsoever but oral taking was common.

Table 4: Medicinal plants used by traditional healers in the study area

S/N	Local/vernacular names	Species	Affliction	Parts
1	Zigwa	*Uvaria pandensis*	Athma	Root
2	Kibayi cha nguku	*Vernonia - cinerea*	Eye problem	Leaf
3	Sasuwuyache	*Vernoniahildebrandii*	Headache	Leaf
4	Mkunungo	*Zanthoxylum chalybeum*	Stomach	Root
5	Muttumba	*Strychnos panganensis*	Stomach ache	Root
6	Mkuguni	*Terminalia boivinii*	Gonnorrhea	Root
7	Luwawa	*Tragia kirkians*	Haemorrhoids	Leaf
8	Musaka	*Tinnea aethiopica*	Flu	Leaf
9	Msango	*Ruellia patula*	Fever in children	Loot
10	Galagalasusuwi	*Solenostemon latifolus*	Fever	Leaf
11	Kibudubudu	*Polygala sphenoptera*	Skin disease	Leaf
12	Luvumbampuku	*Ocimum - americanum*	Eye irritation	Leaf
13	Sankwa	*Panicum - latticomum*	Bleeding	Leaf
14	Kisagati	*Mastuea brunonis*	Eye defects	Leaf
15	Mundi /mwegea/	*Kigelia africana*	Headache tooth ache sexual libido	Bark
16	Mkule	*Grewia holistii*	Breathlessness	Root
17	Mbalibali/mgunga	*Acacia drepanolobium*	Sore throats. A root decoction is mixed with milk or tea and given to women after childbirth as a diuretic	Bark & root
18	Mpingo	*Dalbergia melanoxylon*	Blood dysentery	Roots
19	Mnazi	*Cocos nucifera*	Food	Fruits
20	Mpapai	*Carica papaya*	ringworm infection and eczema psoriasis	Seeds and leaves
21	Luvumbampuku	*Ocimum sueve*	Eye irritation	Leaf
22	Kikulagembe (Zaramo)	*Dichrostachys cinerea*	Oral candidiasis	Leaves
23	Msipo (Zaramo)	*Abrutus precatorius*	Oral candidiasis	Leaves
24	Mninga mawe	*Pterocarpus angolensis*	Early pregnancy	Bark & roots

Source: Survey, 2021

Plate 1: Traditional preparations of herbal medicines as tourism product
Source: Survey, 2021

3.3 Effects of Traditional Medicine on Biodiversity Conservation
3.3.1 Ecosystem Conservation support

There are 25 globally recognized biodiversity hotspots including the Eastern Arc Mountain Forests and the Coastal forests of Tanzania. The country accounts for more than one-third of total plant species in Africa. All these attract attention of international community for rural tourism. Thus, any loss of biodiversity becomes a profound concern.

Tanzania is party to the Convention on Biological Diversity (CBD) with about 14,000 known plant and animal species; she is among top 12 countries with high biodiversity and among 15 countries with the highest number of endemic species. National Forest Policy Implementation Strategy (2021 – 2031) is advancing measures to enhance ecosystem stability with emphasis on conservation of forest biodiversity, water and soil fertility. Three specific areas of policy focus include forest biodiversity conservation, integration of wildlife in forest management, and adoption of environmental impact assessment (EIA) for investments in forest lands. In this case, establishment of new forest reserves and nature reserves in areas of high biodiversity value is essential to ensure forest biodiversity conservation.

Based on these study findings, 89.9% of respondents strongly agreed that the importance of TMs is manifold including conservation of the environment; and offer employment to traditional healers, seed collectors, forest guides, honey practitioners, and attract national and international researchers and research institutions. Examples of national institutions are TAFORI and TAWIRI; while international ones are AWF, WWF, and IUCN. The study further noted that, the country's Ministry of Natural Resources and Tourism involved various stakeholders in the management of watersheds. For example, the Project on Securing Water Services through Sustainable Land Management in Ruvu and Zigi Catchments (2015 – 2020) has involved local communities in the management of watershed. This is partly due to improved coordination between forest and wildlife authorities in Kisarawe district; for EIA is conducted prior to investments in the forest areas.

3.3.2 The Increase of Production of Quality of Indigenous Tree Seed

The study observed that production of quality tree seed and propagation of materials for plantation and community forestry has been increasing in Pugu and Kazimzumbwi forest reserves. The private sector has started to engage in commercial forest plantations and tree growing. It marked a milestone in the development of rural tourism in Kisarawe district. Also, this measure was taken in response to the national call to check the alarming rate of wood consumption estimated at 83.7 million cubic meters for domestic and commercial purposes at the detriment of the environment. To this effect, the Government of Tanzania introduced Participatory Forest Management (PFM) which is being promoted all over the country to improve management of forest resources spearheaded by two

approaches. That is, the Joint Forest Management (JFM) and Community-Based Forest Management (CBFM). JFM is applicable where reserved land is owned and managed by either the central or local government; or the private sector. In this approach, communities adjacent to a forest reserve enter into joint management agreements to share responsibilities, costs and benefits with the owner. Whereas; CBFM takes place where earmarked forest reserves occupy village lands. In this arrangement, the local communities have full mandates to own and manage forests.

While recognizing these efforts made by Kisarawe district authorities; forest ecosystems still faced several challenges. Local communities living adjacent forest reserves generally had low level of awareness on environmental and economic values of forest biodiversity and uncontrolled human activities that lead to deforestation and forest degradation. It was compounded by low baseline and updated data on forest biodiversity, destruction of water sources, created sedimentation and peak floods, spread of invasive and alien species. This study observed lack of and/or inadequate Fire preventive measures such as the placement and management of firebreaks. Similarly, like many places in the country, the study area generally experienced low prevention of pests and diseases. Also, there were no mechanisms to ensure that users of water contributed to the costs of conserving these forests. Moreover, collaboration among the related sectors was weak resulting in destruction or degradation of some catchment forests.

3.3.3 Increased Reliability in Traditional Medicine
The study established that, the use of traditional medicine was widespread among local communities in Kisarawe district especially those located in remote rural area where modern medicine was not available. Besides, a general belief prevailed among several members of local communities supported by various arguments. Some argued that, treatment using traditional medicine was preferred to modern drugs based on a belief that, traditional medicine cured patients more effectively and had fewer side effects compared to the modern one. Perhaps, such beliefs came out of experienced failure of modern treatment cure patients who resorted to traditional medicine and got cured. They may accord various negative factors to modern medicines in order to avoid such health facilities. These negative attitudes could range from perceiving modern medicine as expensive, unfriendly, dangerous, or ridden with corruption. Some respondents avoid modern drugs sold on the market as they believed that, they were counterfeit or ''fake'' drugs. Additionally, they believe that TMs are affordable; easy to obtain; free from prescription complexities; and they strengthen the overall immune system. Further, traditional medicine stabilizes hormones and metabolism, accessible in nature; easy to harvest and produce. On account of the above, they believe that TMs will continue to be relevant as they have numerous advantages over modern medicines especially in vulnerable communities.

However, there are controversial views regarding TMs reliability in disease prevention and cure which need to be cleared. The optimistic side viewed that, TMs knowledge has been practiced and passed on for generations with fruitful curability records. It has endured the test of time and proven worthwhile. Conversely, the pessimistic side considered TMs inefficient and ineffective due to various scientific reasons given. A neutral standpoint, seeks to consider the merits and demerits of both sides. The mainstream argument is that, TPM and modern medicine complement each other in various cases, a lot remained to be explored from both sides to foster effective and efficient curative practices in promotion of rural based eco-tourism and welfare of local communities at large.

3.4 Major Challenges and Opportunities in Developing Traditional Medicine

The pace of expansion and fortification of TMs globally to sustainable levels; is yet to be achieved. Records show that, only 25 out of 191 WHO member states have in place either policies and/or complementary statements on traditional medicine. This is due to various challenges facing them including the following as established by this study.

4.4.1 Lack of Standardization

Many industrialized nations agree that, herbal medicine is now a multibillion-dollar industry, and in developing countries; for around 80% of people rely on plant-based medicines. However, the identity, authenticity, and quality of crude plants are often uncertain and difficult to assess. The quality of manufactured products varies considerably worldwide, and regulations can be complex or inadequate. Standardization is possible for few herbs especially those with their active ingredients known to traditional healers. The problem arises when similar drugs have to undergo scientific analysis which is complex and costly increasingly making the drugs expensive hence unaffordable to the majority poor in developing nations.

3.4.1.1 Safety

In principle traditional procedure-based therapies are relatively safe, if they are performed properly by well-trained practitioners. But accidents occasionally occur incidentally; or can be caused isolated cases of untrained practitioners. It underscores the fact that, therapies ought to be performed by knowledgeable people and within accepted parameters or indicators. However, there were no supportive data obtained from the in-depth interviews to testify such cases. All he same, there is the need for future studied to evaluate adverse effects arising from mishandling of therapies in order to document the safety of TMs.

3.4.1.2 Efficacy

Traditional medicines are currently under scrutiny in sub-Saharan countries to evaluate their effectiveness and to monitor their adverse effect. Such analyses have often failed to confirm the efficacy of traditional remedies. Traditional and

complementary as well alternative medicine practices have developed within different cultures in different regions. So there has been no parallel development of standards and methods, either nationally or internationally, for evaluating them.

3.4.1.3 Quality
The study also observed that, although traditional medicines are locally and widely used, the efficacy of many herbal drugs is not yet proven. Moreover, many consumers misinterpret the natural origin of herbal medicines as a testimony of safety, without considering the fact that herbal ingredients can cause serious adverse effects. It calls the need that, herbal medicines should be assessed by randomized controlled trials. Majority of the respondents said that, they administered plant products in the form of decoction. However, none of them provided proper information on how such products could formerly be evaluated in order to ''standardize'' treatments. Since the general assessment of the quality of TM varied in terms of prescriptions from one area to another; it marked lack of feasible standardization and quality of traditional/ complementary and alternative medicine. This is compounded by the fact that in traditional system of medicine, some plant species are mixed with others to make them effective. It makes standardization; analysis, investigation, and monitor TMs become biologically even more complex. Therefore, there is the need to develop efficient quality control methods to attain standardized results.

3.4.2 Conservation of Medicinal Plants
The study findings showed that, medicinal plants were threatened by anthropogenic activities. It is partly due to the fact that, plants have multiple uses and applications including timber, fuel, and construction poles. It observed the need to initiate systematic cultivation of medicinal plants in order to conserve biodiversity and protect endangered species. In the pharmaceutical industry, where the active medicinal principle cannot be synthesized economically, the product must be obtained from the cultivation of plants.

4.0   CONCLUSION AND RECOMMENDATIONS
The study established various evidences to show the existence of traditional medicine as part of eco-tourism sourcing small scale income to locally disadvantaged communities as part of rural tourism in Kisarawe district. TMs plays a pivotal role in promotion of RT as it stimulates local employment opportunities through sales of medicinal plant products to local communities' members, internal and international tourists; and it promotes cultural tourism. The primary beneficiaries from this interface are members of the local communities and the local government through collection of overall revenue accrued. However, there are challenges which affect the efficiency and efficacy of TMs as an essential component of RT. They can be summed up as the existing mutual mistrust between the TMs and modern medical experts. They are busy in a wasteful competition of marketing their medicines through eco-tourism

transactions. On one side, the local herbalists claim that modern medical practitioners want to steal their traditional medicinal plant expertise and de-firm their reputation as healers of society. On the other side, modern medical practitioners look at TM herbs as neither efficient nor effective as they lack scientific evaluation and analysis hence harmful for human consumption. Yet, the two compromise in some instances; for patients who fail to get cured in modern medicines are quietly referred to traditional healers and recover or improve and vice versa. On this basis, TMs and scientific medical experts ought to work together as they complement each another in the treatment of various diseases affecting society.

There is the urgent need to scrutinize objectively and scientifically the two with a view of exploiting the advantages accrued from both sides for the purpose of promoting RT and improving the general health and economic development of the local communities in particular and the nation at large. Thus, medicinal plants, among others, are part of the cultural aspects which are instrumental in poverty reduction among residents of local communities in Kisarawe district through eco-tourism in RT. The study provides the following recommendations for improvement.

Future research should network with traditional healers and modern medical practitioners in order to know more about indigenous medicinal plant species in order to formalize them for application in public health while promoting eco-tourism for social economic development of local communities in Kisarawe district. Studies should be conducted to sort out the conflict between TMs and modern medicines for the common good of promoting RT in Kisarawe district particularly in improving the social economic condition of vulnerable local communities and the natural environment. Human safety is prime, it must be determined by conducting standardized scientific clinical trials to check whether contamination or overdosage exist in administering TMs by herbalists and other assertions and the likely solutions.

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Determinants of Collaborative Negotiation Style on Agribusiness Performance of High Value Food Crop Products in Tanzania: Evidence from Middlemen in Arusha

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Abstract

This paper explored the role of collaborative negotiation style in agribusiness food value addition in Tanzania with insights from Arusha city. The data were collected from a cross-sectional survey of 280 middlemen who trade on high value crops with perishable nature in Arusha main markets. A multiple regression analysis was conducted to determined main factors contributing to collaborative negotiation style but also on their disaggregated effect on agribusiness performance. The results showed that collaborative negotiation style through satisfaction, assertiveness, solution and communality had a positive effect on agribusiness performance on ($\rho < 0.05$). The model has high concern for self and high concern for others; this created a good environment for the perpetual transaction of the high value products since each of the negotiating part's interest has been considered. The high concern for others as well as high self-concern has been founded to add positive performance on high value products and made it to be one of the important negotiation models with positive impact on the agribusiness performance. The model found to be suitable on high value food crops. The perishable nature of high value food crops made collaborative negotiation style being suitable as the risk are reduced by middlemen involvement on the value chain process.

Keywords: *Collaborative negotiation style, agribusiness performance, high value food products, middlemen Tanzania*

1.0 INTRODUCTION

High value crops include crops like non-traditional food crops such as, fruits, houseplants, flowers, and foliage as well as condiments and spice vegetables Tegu *et al.* (2005). Msafiri *et al.* (2021) articulated some of the high value crops that are grown in Tanzania including Arusha, Kilimanjaro, Morogoro, Iringa, Mbeya, Tanga, Ruvuma, Manyara and Zanzibar region such are vegetable, fruits, flowers and spices. Some of these horticulture products include baby corns, baby carrots, onions, flower seeds, roses, potatoes, avocadoes, cabbages, tomatoes, oranges, pineapples, banana and jackfruits. These products are said to have higher value than traditional cereal grain due to its nature of demand and

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supply. In this category of the crops it was literarily argued that it improves the livelihood of the household Mangesho (2021).

Middlemen are important entrepreneurs who play an important role on the agribusiness sector performance. The social structure can affect negative entrepreneur's behavior and outcomes Adobor (2020), the obstacles behind its performance differ from town and in urban areas, Khan *et al.* (2022). Ume *et al.* (2020) assessed agribusiness performance in Nigeria basing on micro, small, medium and large enterprises by using five performance indicators, (real annual sales, annual labor productivity growth, capacity utilization, percent of firms fixed assets and annual employment growth) micro and large firms were having poor average performance by 0.506 in large firms and 0.448 in micro firms. Dossou *et al.* (2023) contend that in Benin business environment and market barriers led to negative performance of entrepreneurs. Some studies have revealed different obstacles behind its performance, Echessa (2020) argued lack of expertise on agribusiness firm as one of the causatives of its poor performance. The expertise are important key players in agribusiness chain from the primary stage of production to the tertiary level of consumption. Other important players are multinational cooperation Sekine *et al.* (2009) state corporations Ginting *et al* (2013), entrepreneurs Mohamed *et al* (2020), institutional development Azizah *et al.* (2020) agribusiness companies Piracón *et al.* (2022)

On the other hand, lack of collaboration with suppliers, increase in overall cost of searching for information, policing and searching for information, bargaining and decision making (Ngaruko 2022) along with lack of information sharing and not using technology, On the assessment of factors affecting agribusiness performance in Somali land, John (2022) found that; entrepreneurship training, use of mobile money transfer, prolonged drought, price fluctuation, greenhouse technology, capital and access to extension services were statistically significant at 5%.

On advocating the agribusiness performance some different scholars came up with findings on the area so as to improve the economic situation of the traders. According to Fani *et al.* (2021) measures like no collateral security should be given to young women in Cameroon, Incentives such as single-digit interest rates also should be provided with the intention to improve margin, improvement of variety of seed as well as advocating price control policy. Mwambungu (2019) assert on the importance of financial institution in providing credit to the SME's on agribusiness industry. Along with the provision of the financial services, Lekule (2019) added on the importance of the use of information technology on improving the agribusiness sector as far as the technological use is concerned.

On the same study conducted by John (2022) some factors were not statistically significant as impediments of agribusiness performance. These included education, land size, farm inputs, and availability of farmers' cooperative societies. Bajan *et al.* (2020) articulated differently from other scholars by looking the relation between carbon footprint environmental impacts with agribusiness performance. The case of global weather change in relation to economic activities contemporarily is a debatable global agenda. Marwa *et al* (2021) found that through irrigation farming youth are benefiting contractual farm on French beans, and increase yield by 17%. This increase of yield accounts the increase of household income by 34% and 37.5%. Apart from the factors above, Nsumilinda (2021) explored government structure and its influence on performance; it was found that; the existing functional governance structure did not favor sustainable supply chain performance.

In negotiation process each part has different interest seek to advance from the opponent so as to have a joint action. In this process different styles are employed by negotiators jointly so as to solve problem between them. According to Dual Concern theory (Blake & Mouton, 1964; Deutsch, 1949) conflict management styles can be categorized into: compromising, forcing, yielding, avoiding and problem solving. Interest and conflict are motivation tools which drives parties to the negotiation. In these conflict management styles, the level of concern for self and concern for other determine negotiation styles during negotiation process.

Collaborative negotiation style is the type of style which has the end result of win/win situation for the both sides. Coburn, (2015), in this negotiation style, both self-concern and concern for others are higher. When both self-concern and concern for other is higher for the both sides of negotiation, negotiators tend to divide the pie equally and satisfying on both sides. This is mostly desired negotiation style to be used by traders in the market however other factors may affect the choice. Hanek (2021) contended that; collaborative negotiation style has been linked with satisfaction. Satisfaction is the end result of negotiation, at the end if the side win it is obviously satisfaction reflected as the result of the negotiation process. According to McGuire *et al.* (2022) collaborative negotiation style maps the integrative negotiation style, the integrative here can be reflected on consideration posed by each other to one another.

Not only on the above but also Kersten *et al.* (2022) argued that rational motivation system has a significant direct effect on social motivation (Collaborating negotiation style, competing negotiation style and accommodating negotiation style). Rational motivation propel negotiator a reason logically for either to choose certain negotiation style. In rational motivation as argued above many factors affects the choice of either to compete, collaborate, avoiding, accommodating or compromise. It is mostly used in trade and commerce however it's not limited to that. Different negotiation styles are

employed in market during transaction cost. Each negotiation style opted by negotiators basing on the market environment.

Furthermore, middlemen in trade have been persisted from time to time however Sudrajat *et al.* (2021) argued that; socio-economic status defines the level of farmers to attach with them. In this scenario the prevailing social and economic status of the market determines whether farmers attach with middlemen or not. The availability of middlemen in the market in relation to the agribusiness performance has been articulated in different perspective.

Bett (2021) argued that, in order to increase fairness on pricing organization should eliminate middlemen in the production value chain. Nda *et al.* (2021) have the same idea of middlemen exploitation and suggest on provision of lower interest rates loans to the farmers and goods and services so that to alleviate them from middlemen exploitation. Muduli *et al.* (2022) and Kwesi *et al.* (2022) went contrary with Bett (2021), Nda *et al.* (2021) and Chouhan *et al.* (2022) by arguing that middlemen play a potential role of being a key distributor by distributing the poultry product by 50.5%, and are playing an important role in facilitating the trade. As far as this study is concerned the impact of middlemen's negotiation style on agribusiness performance will be studied and analyzed, each in relation to its impact.

Collaborative negotiation style has also been articulated on different perspective. Chang (2011) argue on collaborative negotiation style, social behavior and personality was centered in his study. The Taiwanese and Philippines Chinese were related to each other. On his finding it was found that; the significant relationship between the two groups in collaborative negotiation model existed. The study findings didn't go far from this study as collaborative also was found of great significant by .220 after linear regression model computation. In his study collaborative negotiation style was found that: the subcultural difference was insignificant ($t = -1.608$, $p > .05$). Gurieva, *et al* (2021) went contrary to that by founding that cooperation and competition have a negative significant relationship with conflict avoidance (r = -0.407 and r = -0.448, respectively).

Apart from that, Lowe (2020) on culture and business negotiation focusing on Chinese firms in Nigeria. He found that: Mixed style of compromise and collaborative was preferred and used by 51% of the total (120). The highest frequency use must be the results of trade performance. In negotiation model selection the negotiator uses the most performing style at the end of the negotiation. The less performing model of negotiation preferred less as it has negative impact in performance. Kang (2018) argue on purchasing portfolio management with sourcing negotiation styles. The results were that: Leverage items (low supply risk, high profit potential used 33% Strategic items (High supply risk and high profit potential) used 79% while Bottleneck items (High risk, Low profit) used 21%. This study founded medium use of collaboration

negotiation style. Kang *et al.* (2018) explored risk on supply and profit in variance of product. The researcher's focus was on general perishable products. Kang *et al.* (2018) didn't explain on the trade performance on the use of each negotiation style.

The general objective of this paper is to assess impact of middlemen negotiation styles on agribusiness performance in Tanzania. This paper specifically examined collaborative negotiation style on the agribusiness performance. In this study, the middlemen who trade on the supply nodes of high value products (Perishable goods) from farm to the market were interviewed. Arusha City being one of the most tourism destination and Kenya bordered region the circulation of high value crops it is of importance. The middlemen negotiation styles have potential impact on agribusiness performance as the end results of the process.

2.0 METHODOLOGY

In this study the researcher applied the cross-sectional survey, data were collected at a single point in time of study. Cost and time effectiveness were among the factors that attracted the application of cross-section survey. This study involved middlemen who trade on high value and perishable crops with shorter shelf life in which its circulation and its transaction needs an expert to spearhead to enhance quickly transaction such crops includes horticultural products. In this study five major vegetable markets in Arusha city council were involved in primary data collection. This study used simple random sampling technique to get the respondents from the selected sample size. A total number of 247 sample responded to the questionnares, in this study the sample size comprised of suppliers, producers and market vendors (traders). On testing the reliability, the researcher used Cronbach's Alpha (α) which is the most common internal consistency measure. Linear regression was used on predicting casual effects between the independent and dependent variable. The model is indicated in equation (1).

ATP = f (Collaboration)...1

Collaboration negotiation style was had four predictors as shown on the equation two below

CoLNS = f (Satisfaction, Goals, Solution, Communality.....................................2

The general equation for measuring impact of collaborative negotiation style on agribusiness performance was generated as the equation three below stipulates. This general equation was very essential on exploring the field results for analysis and interpretation.

***ATP** = Satscore +Goalscore +Solscore, Commscore*...3

Where
ATP   = Agribusiness Trade Performance
Satscore   = Satisfaction total score of collaborating negation style
Goalscore   = Goals total score of the collaborating negotiation style
Solscore   = Solution total score of collaborating negotiation style
Commscore = Communality total score of the collaborating negotiation style

The variables were measured on five-point Likert-type interval scale varying from "strongly disagree" to "strongly agree". Table 1 below stipulates frequency distribution of the collaborative predictors. The estimation parameters were important on relating the range of variable use with its effects on agribusiness performance. The percentage accumulations of strongly agreed and agreed were as follows; mutual solution had 74.1%, Communality had 74.5%, Both satisfactions had 78.6% and lastly Assertiveness had 73.7%. Literarily collaboration was highly used during negotiation process at the defined magnitude as table 1 below stipulated

Table 1: Collaboration negotiation style frequency

	Mutual Solution		Communality		Both Satisfaction		Assertiveness	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
Strongly Disagree	12	4.9	9	3.6	14	5.7	8	3.2
Disagree	26	10.5	27	10.9	16	6.5	32	13.0
Somehow	26	10.5	27	10.9	23	9.3	25	10.1
Agree	119	48.2	109	44.1	114	46.2	107	43.3
Strongly Agree	64	25.9	75	30.4	80	32.4	75	30.4
Total	**247**	**100.0**	**247**	**100.0**	**247**	**100.0**	**247**	**100.0**

Source: Researcher 2022

3.0 RESULTS AND DISCUSSION

Collaborating negotiation style was guided by four variables which include: satisfaction, assertiveness, mutual solution and communality. The findings are hereby presented as per the variables where respondents were asked specific questions based on their knowledge on the variables.

Collaboration is the unique negotiation style which characterized with both; high self-concern and high concern for others. It is one of the win/win situation results which occur after negotiation. This is one of the hardest negotiation style to be used however seemed to have better results on trade performance. Fu *et al* (2011), Coburn (2015), Bao *et al* (2019). The aforementioned independent variables were intended to speculate the degree of self-concern and concern for others on the collaboration model

Score Interpretation
The table below illustrates the adaptation of the collaborating negotiation style on the three-estimation range; low range, medium range and high range. The

scores projected the frequent use of the negotiation style on agribusiness which was compared on its performance in relation to the other negotiation styles. The same score range were adopted in this study.

Collaboration negotiation style found to have 15.4 mean, 16.0 median, 16.0 mode and uniformity of minimum of 4 and maximum of 20 like the other variables as stipulated in the table above. On the side of the Total score it was found to have 3814.00. This score can be interpreted as per the table above; collaboration to be used on medium level. Like other variables collaboration negotiation style will be analyzed also in relation to the agribusiness performance.

As stipulated on table 2, the contribution of both satisfactions was found that; a unit increase of both satisfaction lead to average increase of total collaborating by .225. In this notion the more both parties to the negotiation both satisfied during the negotiation process, the more the parties increased collaboration. The satisfaction of the both sides (middlemen and farmers) leads to increase of the collaboration on both sides as both sides win the negotiation as the end results of the agreement.

Another independent variable used was assertiveness; the assertiveness was intended to explore the attainment of what the negotiators needed at the end of the agreement. The table 2below illustrates that; a unit increase of assertiveness lead to average increase of total collaborating by .573. Assertiveness was the highly impacted independent variable which higher causal effect in the model. Assertiveness is one of the best strategies which might be first foresighted by the negotiators before entering into negotiations table. As far as the end results are oriented, it is easier for the negotiation side to focusing on the targeted end results.

Mutual solution was the third independent variable used on exploring the total collaborating negotiation style. Mutual solution was intended to explore both side attainment of the solution. In this course of negotiation, both sides were explored to have both solutions desired at the end of the negotiation. It was found that; a unit increase of mutual solution leads to average increase of total collaborating by .225. As both sides reached mutual solution on the negotiated interest, the total collaborative was increasing as both sides win the negotiation on the table. Total collaboration was also computed in relation to the agribusiness performance. The end results were essential in exploring it causal effect on the trade performance as it is the main objective of this study. The table below illustrates the above explanation in summary. The table has the roots from the regression model 2.

Table: 2 Total Collaborating Negotiation Style Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.62E-015	.035		.000	1.000
	Both Satisfaction	.345	.024	.225	39.888	.000
	Assertiveness	.678	.032	.573	16.835	.000
	Mutual Solution	.345	.021	.225	26.062	.000
	Communality	.340	.022	.223	25.220	.000

a. Dependent Variable: Total Collaborating

Source: Researcher 2021

The significant relationship between collaboration negotiation style and agribusiness performance was found. The percentage increase of total collaborative negotiation style led to the percentage increase of total agribusiness performance by .256. Collaboration negotiation style was found to be friendly on both middlemen and seller on the market. As far as stated earlier on collaboration negotiation style that; the model has higher level of self-concern and concern for others. In this notion the win/win environment were created on both middlemen and farmers.

Table 3: General Econometric Model from Equation 3

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	10.517	1.324		7.945	.000
	Total Collaborating	.221	.045	.256	4.963	.000

a. Dependent Variable: Total ATP

Source: Researcher 2021

4.0 CONCLUSION AND RECOMMENDATIONS

This style was used on the medium level in reference to it computed total score of 3814.00. Most of the traders/negotiators have no intention of win/win situation during the negotiation process rather than having a competitive bargaining and acquiring self-win. On this study it was found that; when middlemen and seller collaborated during negotiation process, the long standing and lasting relationships are created between the partners in trade. The established strong relationship creates more frequency of trade between the partners and more margin generation by the both parties as they both win at the end of the agreement.

Collaborating negotiation style has showed positive impact on trade performance. The model has distinction features in the following manners; collaboration negotiation style has higher level of self-consideration and higher level of consideration for other. In this notion the negotiation process tends to go smoothly as each part of the negotiation is highly considered for the other part.

The highest level of consideration for each other during the negotiation process creates more rooms for possible future transaction among the transacting partners. This model has win-win motives at the end of negotiation.

For the transaction or agreement to be executed both sides of the negotiation have to reach to the comfort zone of satisfaction (Smith, 2013; Eden, 2014; Cassell, 2018). In this zone of comfort, the mindset has to agree on the settled conflict during the negotiation. For the settlement of the conflict to be potential significant the knowledge has to be at equilibrium (Vanderschraaf, 1998). The equilibrium point of knowledge creates the gap for the accommodation of new variant. The knowledge gap creates the chance of acquiring the new knowledge as knowledge is found out of knowledge. The knowledge equilibrium in this context implies the psychological state of mind whereby the mind is at a great chance of accepting the new information during the negotiation process. The knowledge equilibrium is contrary to Nash equilibrium game theory whereby each party has to focused on his or her strategy while other maintain theirs (Vanderschraaf, 1998).

For the accommodation of new knowledge to be reached the will power/ determination ability has to be zero or freezing so as a new information/knowledge is accommodated. This procedure can be associated with a *Nature Theory of negotiation.* In any transaction so far each sides must win out of the negotiation when producer accept that he has to support the one from the sun as he has the water regardless of the magnitude of winning the knowledge gap has convinced him enough to accept the reality which was not there before. The same applies to the buyer/middlemen when he accepts the fact that his survive comes from the water side this will create the same environment of accommodation of the knowledge.

Collaborating negotiation style can be used on national, multinational and bilateral agreements. Collaboration negotiation style had good results whereby a unit the increase of the collaboration led to average increase agribusiness performance by .220. Collaborative negotiation style is highly recommended since it is the only model which has both high self-concern and high concern for others. This consideration environment creates a smooth atmosphere of agreement between transacting parties during negotiation process.

The application of this model saves time as well as benefiting both sides of the negotiation agreement. The application of this model does not gives/making negotiation process easier. The knowledge gap between the negotiating parties it is an important element to be founded earlier as possible for the agreement to be reached earlier. The knowledge gap is another important area of research which can be explored. The art of negotiation can be only the attainment of the knowledge gap. As long as the negotiation is the process of

convincing/persuading the attainment of knowledge gap could be an important area for the negotiators to understand when on the negotiating table.

In addition, collaborating negotiation style is favourable model of negotiation which can be used on perishable goods. The model provides the rooms for negotiation between parties to create environment for win/win situation. Furthermore, collaboration negotiation style can be favourable in conflict management, dispute settlement and in managing of diplomatic relations. As the model involves high self-concern and high concern for other it can be of the better result on leadership and management as well as on the interpersonal relationship.

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The African Resources Development Journal, Vol 6, No. 1, December 2022: 111-123

Determinants of Collaborative Negotiation Style on Agribusiness Performance of High Value Food Crop Products in Tanzania: Evidence from Middlemen in Arusha

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