Connectedness to Water as a Predictor of Household Participation in Water Resources Conservation in Singida Municipality, Tanzania

Lunango Gabriel Muwelu[1]
Christina Mwivei Shitima[2]
Harold Martin Utouh[3]

[1]lunango.muwelu@mustudent.ac.tz
[2]cshitima@mzumbe.ac.tz
[3]hutouh@mzumbe.ac.tz (+255 784515607)*

[3]https://orcid.org/0000-0002-9355-4349

*Corresponding author

[1,2,3]Mzumbe University, Economics Department, P.O Box 5, Mzumbe – Tanzania

ABSTRACT

A low level of household participation in conserving water resources threatens the future of human survival because water is a unique substance with no substitutes. In addition, despite diverse discussions regarding water accessibility and the need for conservation, the literature is even scarce on the linkage between these two important constructs. Therefore, this paper examines connectedness to water and its influence on household participation in water resources conservation in Singida Municipality, Tanzania. Using a quantitative study approach with a cross-sectional survey, primary data were collected from 391 households in Singida Municipality to investigate water accessibility, considering the aspects of physical access, economic access, and cultural acceptability, as well as the number of water conservation practices households engages in. The Structural Equation Model (SEM) analysis reveals a positive relationship between water accessibility and participation in water conservation practices (WCPs) at 1% ($Z=7.34$, $p<0.01$). The study recommends that policymakers, agencies, and water sector stakeholders need to enhance their efforts to provide clean and safe water services to all community members to uphold the right to water for everyone and increase the level of participation in water resource conservation.

Keywords: Households, Singida Municipality, Structural Equation Modelling, Water accessibility, Water Resources Conservation

I. INTRODUCTION

Water is an essential requirement for the survival of living organisms(Feitelson, 2012; Kılıç, 2020). There is no doubt that without water, there is no life, especially for human beings (Dinka, 2018; United Nations, 2016). The fact is clear, with the main reason being that the largest portion of the human body, approximately 75%, is water to control and maintain biological activities for the life continuum of living organisms (Bidaisee, 2018; Kılıç, 2020). The usefulness of water is not only linked to biological aspects but also to livelihood enhancement because water is considered an input or commodity for different social and economic activities, the least of which include hydropower generation, irrigation, cooking, washing, drinking, livestock keeping, and industrial manufacturing (Spellman, 2015).

The unique quality of this natural resource, confirmed by its many uses, justifies the resolution of water as a human right and a basic need(Gleick, 1998; Kumari & Singh, 2016). The right to water, as stipulated by the United Nations(UN)and the World Health Organization (WHO) in Fact Sheet No.35, attributing every individual to access clean and safe water, at a sufficient minimum amount, continuously, not far from residence, with acceptable quality, and at an affordable price. This scope of human right to water defines dimensions of efforts taken by all regions around the global to ensure every citizen has access to clean and safe water to minimize healthy risks and improve living standards among human beings in present and future generations(WHO/UNICEF, 2021).

The recent rapid population increase and urban development in different regions, including Tanzania, affect food demands and economic growth, causing overexploitation of natural resources, including water(Kimaro, 2019). The increasing demand stimulates competition -among water users, mainly in agriculture and industrial practises. In additions to the negative effects of climate change and environmental degradation, water scarcity is invertible

(Gavrilescu, 2021; Russell & Knoeri, 2020). The efforts to solve this identified challenge of water scarcity is highly required, yet the majority of households. The majority of households are unaware of or do not participate in the conservation of water resources,(Lameck et al.,2021).

Nature-based solutions or techniques to conserve water resources by reducing the amount of water use are of necessity to prevent water stress, which is already experienced by various regions, especially in developing countries(Araya et al., 2019; Boretti & Rosa, 2019). The need to regulate demography and economy by policy makers and promoting households to participate in different interventions such as rainwater harvesting, afforestation, water reuse, use of dry toilets with provisions for decomposition of wastes, treating wastewater, and proper disposal are among the techniques to preserve the existing water resources to save water and ensure water security (Gavrilescu, 2021; Koop et al., 2019; Rasoulkhani et al., 2018). Water resource conservation is very important because the quantity of fresh water is very limited, only 2.7% of the global water, and it is very expensive to restore if lost (Dinka, 2018; Kumari & Singh, 2016; Manríquez-Betanzos et al., 2016).

Water scarcity challenges and inadequate or no participation in water conservation resources raise an intriguing topic about the interconnectedness of water, which is considered a crucial concept for examining the relationship between these two constructs. A brief literature survey indicate that there are insufficient shreds of evidence on the relationship between water accessibility and household participation in water resource conservation; however, a theoretical relationship is said to exist (Warner & Diaz, 2021). The knowledge contribution on the positive influence of water scarcity -on household water conservation behaviour by Gilbertson et al., (2011), Hannibal et al., (2018), Rodriguez-Sanchez & Sarabia-Sanchez, (2020), Manríquez-Betanzos et al., (2016), and Garcia-Cuerva et al., (2016), provides a good foundation for the discussion on the linkage between water accessibility and households' participation in water conservation practices (WCPs).

Thus, by studying the relationship between water accessibility and water resource conservation among households in Singida Municipality, this paper seeks to fill a void in the literature that has not been adequately addressed and thus contribute significantly to the body of knowledge.

The study is organized as follows: introduction, literature review capturing theories and empirical evidence, methodology indicating research design, study area, and analysis model. Finally, the study presents results, discussions, and a conclusion with recommended policy implications.

II. LITERATURE REVIEW

2.1 Connectedness to Nature (Water)

This paper derives its theoretical grounds from the theory of connectedness to nature (CTN). The CTN theory was introduced by Aldo Leopold (1887-1948) in the field of Wildlife ecology to explain the relationship between the changing environmental behaviours of households and the role of connectedness to nature, including water. The assumption drawn from CTN describes that, through cognitive abilities and consciousness, human beings preserve love and respect, which create internal moral responsibility with strong gratitude and perfection, to protect things (nature)that, in one way or another, are connected to their existence (Leopold, 1949). Different social studies appreciated the application of this theory to explore the link between human behaviours and nature, for example, the study of connectedness as a core concern of conservation behaviour by Zylstra et al., (2014) and the study of the impact of connectedness to nature on sustainable behaviour by Barrera-Hernández et al., (2020).

In this study, the connectedness to nature (CTN) paradigm is modified to connectedness to water (CTW) to include water as part of nature to model individuals' connectedness to and/or accessibility to water and their participation in water conservation practices(Warner & Diaz, 2021). The basic assumption of CTW is similar to CTN in the sense that, provided individuals have access to adequate water to meet their demands at an affordable price, with good quality, and near their residence, they will be more willing and aggressive to protect and conserve it for their survival. The CTW paradigm is applicable to this study because it indicates the link, or rather the connection, between water and different activities and interventions adopted by the community and individuals on protecting and conserving water resources (Garcia-Cuerva et al., 2016; Zylstra et al., 2014).Figure 1 below summarizes the CTW paradigm with water conservation behaviour.

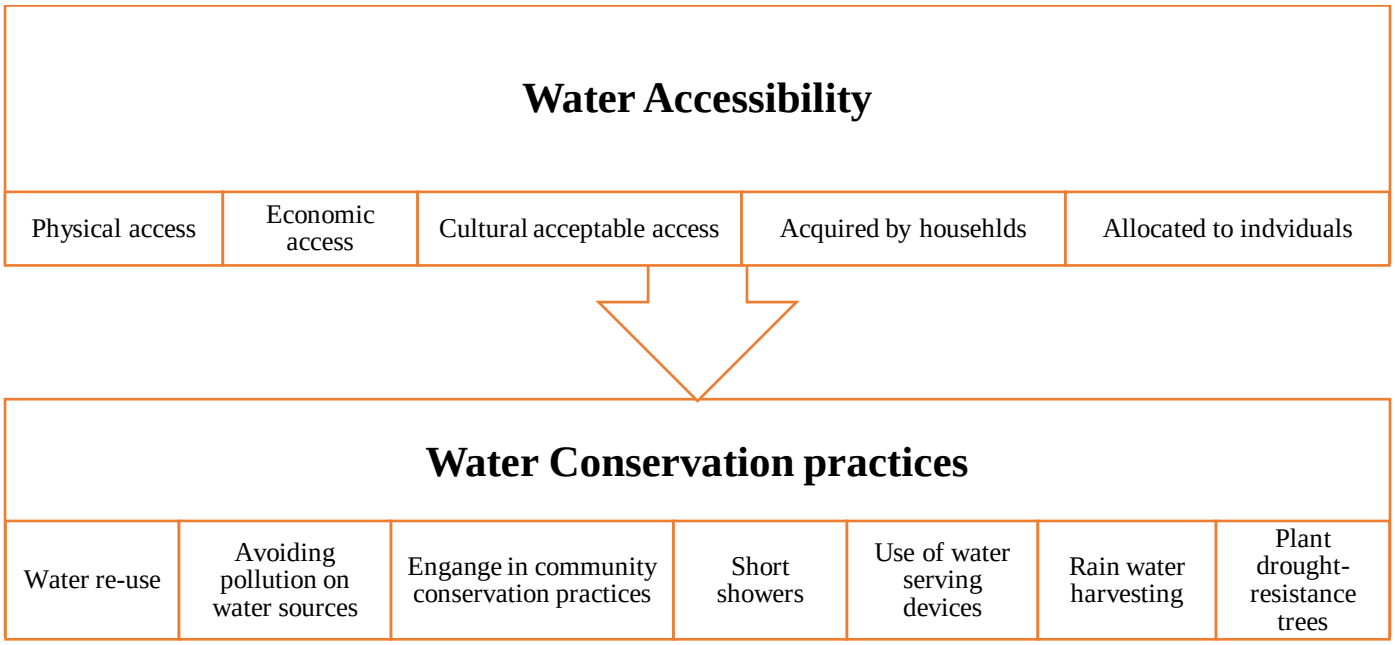

Figure 1
The Linkage between Water Accessibility and Water Conservation Practices

2.2 Theory of Planned Behaviour (TPB)

The behaviour of a person is linked to psychology and consciousness responses embedded in oneself, and to some extent, positive or negative actions taken are influenced by self-intentions. According to Ajzen, (1991) in the Theory of Planned Behaviour (TPB), it is assumed that individual intentions to act on certain behaviours are a function of attitude, subjective norms, and perceived behavioural control.

Prior to the incorporation of perceived behaviour control, which combines control beliefs and perceived power, Fishbein and Ajzen introduced the Theory of Planned Behaviour (TPB), also referred to as the Theory of Reasoned Actions (TRA), in 1975. Its purpose was to provide a model for predicting individuals' behaviour based on intentions generated by attitudes stemming from beliefs (Rutter & Bunce, 1989; Trafimow, 2009).

People think differently depending on the circumstances surrounding the person who has to make a decision to act on certain behaviour. According to Bosnjak et al., (2020) the subjective assessment by an individual of expected outcomes, whether desirable or undesirable, derives the attitude on whether to act or not. Therefore, if an individual believes conserving water will ensure water security for his/her family, he/she will be willing to understand and engage in different interventions of water resource conservation.

Subjective norms determine valued opinions projected to self–beliefs after observing the actions of the surrounding community or individuals with close relationships(Iftikhar et al., 2021).However it is urged that not always others beliefs pass personal judgement to act on them, but only if the desirable outcomes are evident. Warner & Diaz,(2021)argue that subjective norms are significant in shaping individual behaviour upon witnessing the benefits from others due to participation in a certain activity, but also that the feeling of doing a similar activity creates self-confidence in getting support to ensure success. The applicable assumption in this study is that if friends, family members, co-workers, and neighbours engage in water conservation practises (WCPs), an individual close to these groups will also be driven to participate.

Perceived behavioural control is subject to self-perception on the ability and capability to succeed or fail to accomplish a desired conduct (Ajzen, 2020). Water conservation, being part of the big agenda of water resources management, might be confusing and misleading to the individual's potential to feel able and capable of participating in conservation practices. According to Bosnjak et al.,(2020) different circumstances in life based on situations alter individual perceptions to take different actions. In other words, this dimension involves the individual's opinion and ability to overcome challenges and achieve a desirable and accepted degree of success if he or she takes the risk and decides to participate in water conservation practices (Iftikhar et al., 2021).

2.3 Water accessibility

Despite the decreasing quantity and quality of fresh water (Rasoulkhani et al., 2018),there is a population group for whom the sound of access to clean and safe water is very strange to them(Demie et al., 2016). Different countries provide impressive statistics on water accessibility based on the general definition, which considers the percentage of people accessing different types of water sources such as piped water, public taps, protected dug wells, springs, and rainwater (Aiga & Umenai, 2003).It is urged that the standard definition of access to clean and safe water in line with a satisfied living standard capture three main elements, which are physical access, economic access, and cultural access (Rosinger & Young, 2020; Young, 2021).

In reality, a household is said to have access to clean and safe water when the water source is reliable, in close proximity to the residences, affordable, readily available when required in sufficient quantities to meet minimum domestic needs with acceptable quality, and above all, devoid of contaminants such as faeces and hazardous elements (Dinka, 2018; Smiley, 2017; UN, 2016).

However, due to the lack of similarity in country policies, the standard definition of water accessibility might be considered objectively and subjectively based on local context, experience, cultural beliefs, and knowledge (Angoua et al., 2018). In a Tanzanian setting, the standards in National Water Policy (NAWAPO) indicate the minimum water per capita consumption is 25litres, the acceptable maximum walking distance is 400m, and the water quality is monitored by the Tanzania Bureau of Standards (TZS 789:2018N-EAS 12:2018) in accordance with the National Guidelines for Drinking Water.

Water inaccessibility is a global crisis, explaining the presence of many studies in the field of the water sector relating to social and economic development setbacks. In Ethiopia, Demie et al., (2016) utilised a sample size of 197 to assess the impact of water accessibility for girls and women to participate in school and development and revealed that girls and women spent from 2.41hours to 8.05hours for a walking distance of 1.97km to 3.59 km to fetch water, which is not even clean and safe because it is being shared by livestock and other living things. Poor water accessibility and water-borne diseases influenced negatively the participation of girls and women in school and other development activities (ibid.). Smiley's (2013) study on the complexities of real access to safe and clean water in four districts of the Dar es Salaam region claims that in a development context, households near public water taps and protected dug wells are usually thought to have access to water. However, this is not the case; because of congestion and limited water supplies, most people have to get water that is not very good, from farther away, and for a higher price.

The cost of fetching water over long distances, especially for households with no piped connection within premises, is also reported by Sorenson et al., (2011) through the Multiple Indicator Cluster Survey (MICS) programme in 44 low-income countries, with the finding that water inaccessibility affects efforts towards poverty eradication. Also, Juma, et.al (2018) in studying the challenges facing peri-urban areas in Tanzania, found that there are different rates of reality on accessing clean and safe water, where the majority have a low reliability rate of more than 70%, which leads to spending more than 1hour to fetch clean and safe water. Not only that, water sources are very far, but they are also very costly, such that on average, households spend TZS 8,500 per day to TZS 225,000 per month to only get clean and safe water.

2.4 Household Participation in Conserving Water Resources

Preventing water pollution, efficient water use, water recycling or reuse, water supply, and demand management centralise the discussion of water conservation (MoW-URT, 2002).Though engineering-based solutions have been applied to optimise water supply and demand, recently, household and community participation has also been identified as a good approach to conserving this scarce resource(Kusena et al., 2016).

The level and extent of participation in water conservation by the community and households in different areas is positively and negatively affected by many factors. According to Diakite & Amadou, (2020)with the help of ANOVA, in a comparative study between gender bias in household water conservation and management using a sample size of 467 residents in Mali, males had low participation as compared to females in water conservation practices. The main reason for the good participation of females was to reduce water bills and for males, water scarcity was a big concern, but in general awareness, perception, and community involvement in decision-making were observed to be the determinants of water use control. Healthy problems related to water borne diseases were also identified as the reason for households to conserve water. This fact is confirmed by Thiam et al., (2021) when they studied the promotion of residential water conservation measures using latent class analysis and multinomial and conditional logit using a sample of 465 households in South Africa, which found that females were very sensitive to conserving water, stating that they are more vulnerable to diseases in poor hygiene environments as compared to

males. In Rawalpindi, Pakistan, a quantitative study on water conservation attitudes by Iftikhar et al., (2021), applied the theory of reasoned action and planned behaviour to a sample of 399 respondents using reliability analysis and revealed that, with high education, there is a positive relationship between attitudes and behaviour to conserve water resources.

Though technology has taken a step towards conserving water resources, the extent of its adoption is still in question. Using Agent-Based Modelling to understand the phenomena affecting the adoption of water conservation technology in Miami City, Rasoulkhani et al., (2018) found that low income growth and high water prices contribute to the low adoption of water conservation technology. A latent profile analysis by Addo et al., (2018) on assessing the barriers and drivers for households to conserve water also found that time constraints, lack of environmental knowledge to conserve water resources, and disincentives on water-saving devices had a big count on reluctant behaviours. Furthermore, the increase in household size was argued to increase water demand and household expenditure, and with limited income, water conservation is a necessity for survival (Araya et al., 2019).

2.5 Relationship between Water Accessibility and Conservation of Water Resources

The literature is too limited when speaking of the relationship between the two constructs, which are water accessibility and water resource conservation. However, it is important to appreciate previous scientific studies regarding water scarcity, or rather, inadequate or absence of water services, and water resource conservation.

Gilbertson et al. (2011) conducted a comparative analysis in Australia involving 195 households in Mallee (a rural area) characterised by frequent drought seasons and 119 households in Darwin (an urban area) with adequate water supply services to determine the influence of water context on behaviour and attitudes towards water conservation. The findings revealed that households residing in Mallee, where water is scarce, had a more positive attitude towards water conservation and were more supportive of water conservation initiatives than their counterparts residing in Darwin, where there is a surplus of water.

Similar observations were also revealed by Hannibal et al., (2019) in the study of the effect of local water scarcity and drought to water conservation behaviour and by Garcia-Cuerva et al., (2016) in the study of public perceptions of water shortages, conservation behaviours, and support for water reuse in the United States(US

To summarise, the water scarcity, which is sometimes prolonged due to drought-prone weather conditions, is mentioned in order to determine the conservatory attitude and positive behaviour regarding water resources (Rodriguez-Sanchez & Sarabia-Sanchez, 2020).

III. METHODOLOGY

3.1 Research Design and the Study Area

This study employed a quantitative research design with a cross-section survey of households residing in Mwankoko and Ipembe wards in Singida Municipality.

In order to ensure representation of both the rural and urban populations, two wards were chosen from a total of 18 wards using multistage sampling and random sampling was used to select households with access to or no access to clean and safe water and whether they participate or do not participate in water conservation practises. Projections from the Tanzania population and housing census report of 2012 indicate Mwankoko ward has 15,433 people and Ipembe ward has 2,722 people. The sample size of 391 The estimation of households was conducted utilising Taro Yamene's formula, which has been recommended as a more precise method in comparison to the formulas developed by Krejcie & Morgan, Cochran, Green, S. B., and Cohen J. (Uakarn, 2021; Kitole & Utouh, 2023; Utouh & Tile, 2023).Yamane's sampling formula is shown in equation one below.

$$n = \frac{N}{1 + N(e)^2} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots. (i)$$

Whereby:

n = Represents the sample size selected,

N = Represents the study population (18,175) composed of 15,453 and 2,722 people for Mwankoko and Ipembe wards, respectively.

e = Represents the reliability level at which, for this study, a standard reliability level of 0.05 (95%) was used.

3.2 Econometric model

To test the assumption that there is a positive relationship between water accessibility and water resource conservation, the Structural Equation Model (SEM) was chosen due to its ability to accommodate numerous components of an observable or theoretical phenomenon that are believed to be causally structurally related(Ullman & Bentler, 2013). For clarity, the SEM in this study was captured in equation (ii) but also as a diagram in Figure 2.

$$PWCPs_i^* = WA^*\beta + \Sigma_{i=1}\varepsilon_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (ii)$$

Where WA_i^* represent "water accessibility" as a latent exogenous variable that shows whether a household has access to clean and safe water or not, measured in three dimensions which are physical acceptability (PA) for improved water sources, economic acceptability (EA) for affordable water prices and cultural acceptability (CA) for good water quality , β denotes the vector of unobserved parameters to be estimated, $PWCPs_i^*$represents household's participation in WCPs treated as latent endogenous variable with observed variables which are water-saving devices (WSD), Water re-use (WR), Short showers (SS), Avoiding pollution on water sources (AWP) , Rainwater water harvesting (RWH) and ECW represent household engagement in community water related decision making, lastly $\Sigma_{i=1}\varepsilon_i$denotes unobserved error terms of both water accessibility and household's participation in WCPs and is assumed to be independent and normally distributed that is μ_i N~ (0, 1).

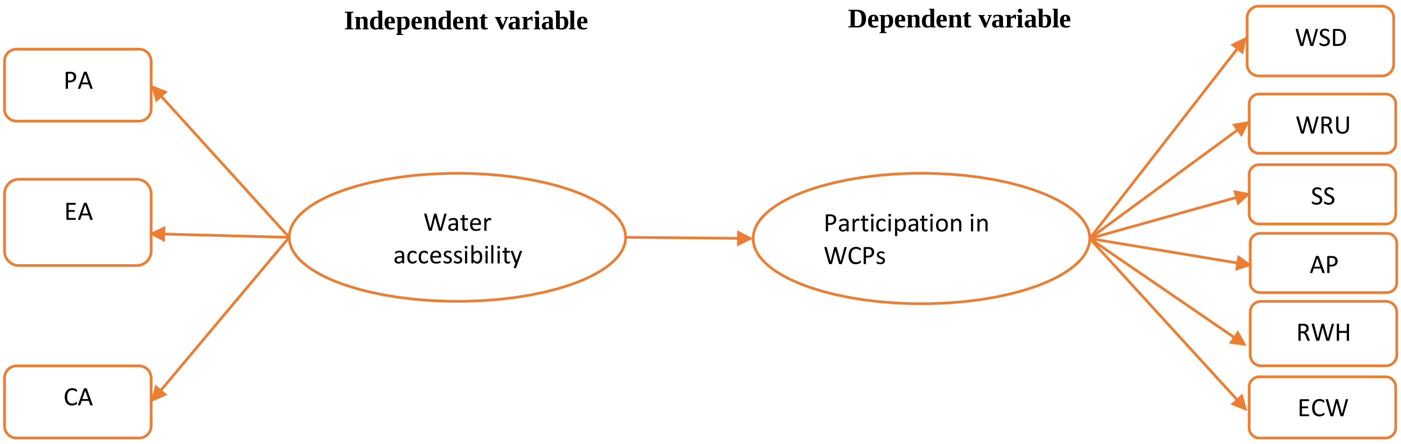

Figure 2
SEM Diagram Showing the Relationship between Water Accessibility and Household's Participation in WCPS

IV. FINDINGS

4.1 Descriptive analysis

The study collected data from 391 respondents, and the descriptive results in Table 1, reveal that in Singida Municipality, out of 391 respondents, only 18.9% had access to clean and safe water in both aspects of physical access, economic access, and cultural access, and 19.2% participated in water conservation practices. This signifies that in the study area, water inaccessibility and household participation in water resource conservation are still big challenges. The results indicate that the majority of households(38.87%) practice rainwater harvesting, followed by those who take short showers (24.0%). 62 households equivalent to 15.86%, avoided water pollution, and 50 households, equivalent to 12.79%, re-used water. Only a few household (6.39%) responded to installing water-serving devices to minimise amount of water used by household. Furthermore, the results indicate only 4.9% of households were aware of water resource conservation and 8.8% were part of social groups. At least 30% of the households surveyed expressed a positive attitude and perception towards water resource conservation, despite being neglected in decision-making, which was recorded to include only 26.1%.

Table 1

Descriptive Statistics of key Variables

Variable	Observations	Percent (%)
Water Accessibility (1=yes, 0=no)	391	18.9
Participation in Water Conservation Practices(1=yes,0=no)	391	19.2
Water serving device (1=yes, 0=no)	391	6.4
Short shower practice (1=yes, 0=no)	391	24
Water reuse practice (1=yes, 0=no)	391	12.8
Avoiding water pollution (1=yes, 0=no)	391	15.9
Rainwater harvesting practice (1=yes, 0=no)	391	38.9
Engagement in Community water conservation (1=yes, 0=no)	391	19.7
Awareness campaigns (1=yes, 0=no)	391	4.9
Attitude (1=positive, 0 = negative)	391	34
Social member (1=yes, 0=no)	391	8.2
Perception(1=good, 0=bad)	391	34.5
Water borne diseases sensitivity (1=yes, 0=no)	391	8.4
Involvement in decision making (1=yes, 0=no)	391	26.1

4.2 Econometrics results

The diagnosis check for model fitness of the SEM diagram shown in Figure 3, revealed poor fitness of the model, resulting to model modification in Figure 4 by using Modification Indices.

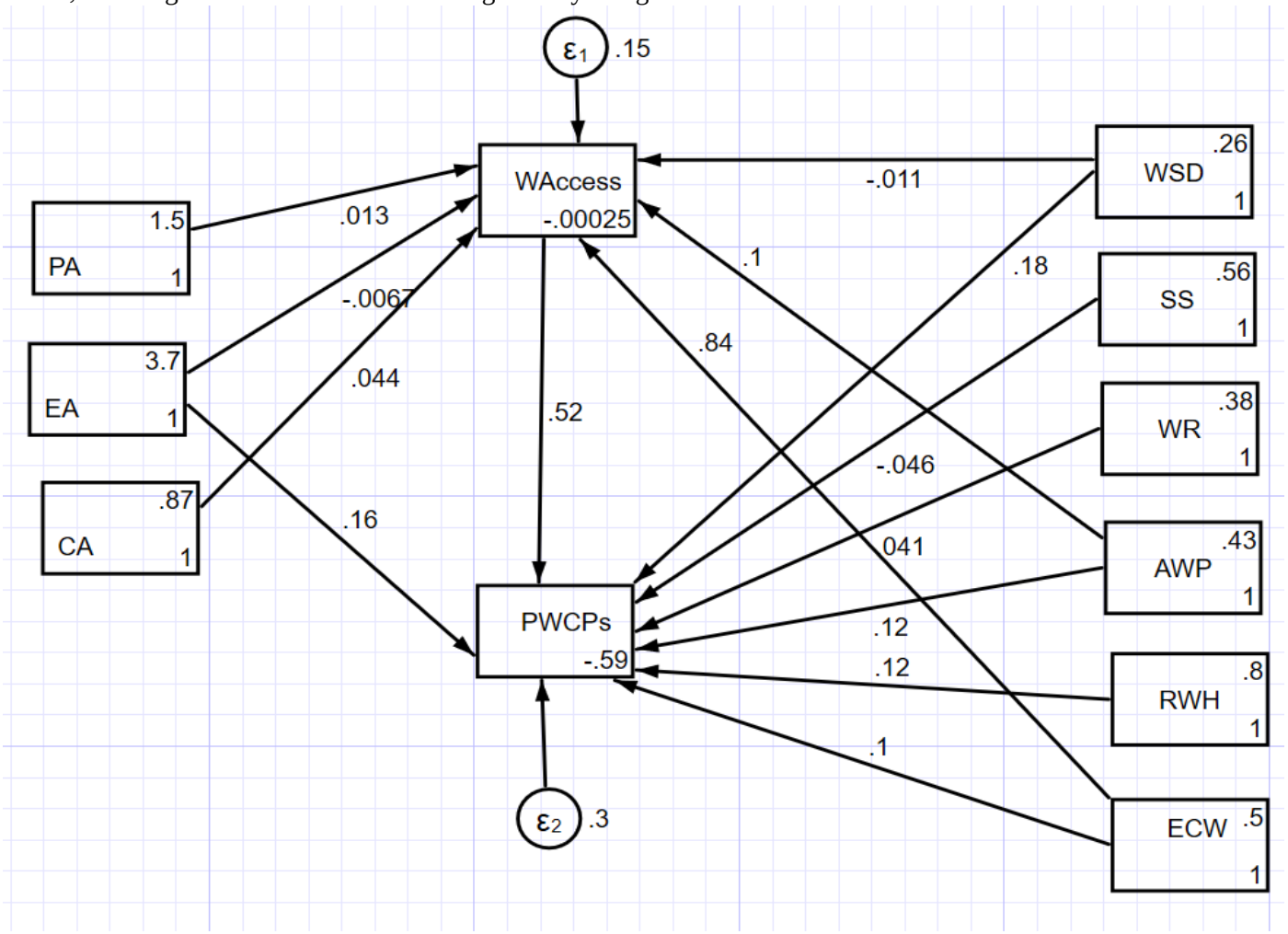

Figure 3

SEM Showing the Relationship between Water Accessibility and Participation in WCPs

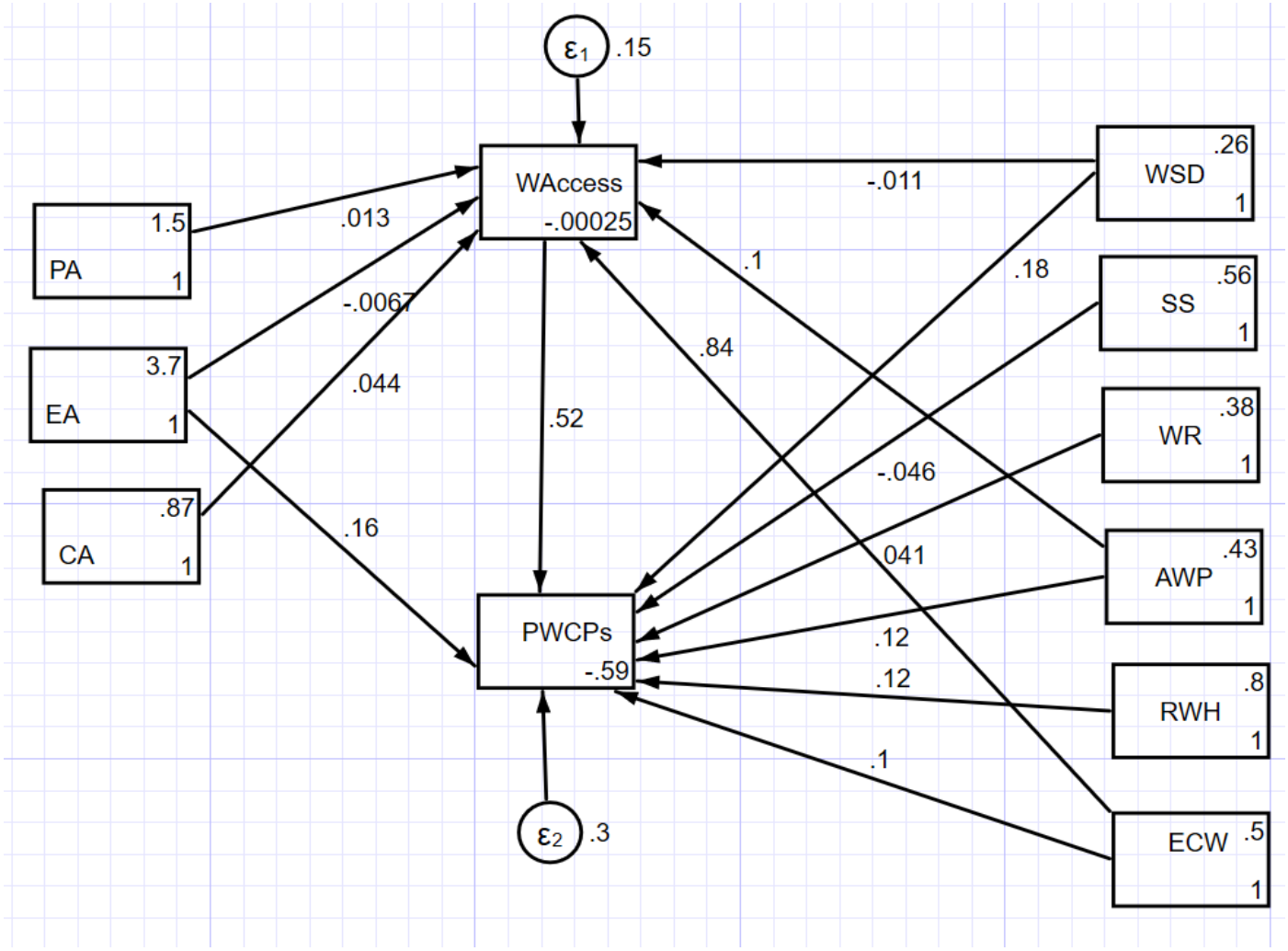

Figure 4
Modified SEM

The SEM model is accepted as a good fit ifp > chi2 at a specified confidence level is significant, the goodness of fit index (GFI), the Tucker and Lewis index (TLI), and the Confirmatory Fit Index (CFI) should be > 0.90, the Root Mean Squared Error of Approximation (RMSEA), and Standardised root mean square residual (SRMR) < 0.05.The results from the SEM model in figure 3 indicate LR chi2_ms (26) = 281.288; p > chi2 = 0.000, and chi2_bs (36) = 959.125; p > chi2 = 0.000, which are statistically significant at 1%. The Confirmatory fit index (CFI) and Tucker and Lewis index (TLI) were 0.723 and 0.617, respectively, not > 0.9;the root mean squared error of approximation (RMSEA) = 0.158 and the standardized root mean square residual (SRMR) = 0.1 which is not < 0.05. The results of modified SEM model in Figure 4indicateLR chi2_ms (5) = 5.771; p > chi2 = 0.329; chi2_bs (19) = 1224.260; p > chi2 = 0.000, which is statistically significant at 1%. The confirmatory fit index (CFI) and Tucker and Lewis index (TLI) were 0.999 > 0.9 and 0.998 > 0.9, respectively, with root mean squared error of approximation (RMSEA) = 0.020 < 0.05 and Standardised root mean square residual (SRMR) = 0.007 < 0.05, hence the diagnostic check indicates a good fit of the model. The model fit and relationship results are presented in Table 2.

Table 2
Model Fitting and Hypothesis Results of Modified SEM

Relationship assumption	**Standardized estimates coefficient**	**Standard error**	**Z - Value**	**P-Value**
Water accessibility affect positively participation in WCPs	0.5155	0.0702	7.34	0.000
R - squared				
Participation WCPs	0.70			
Model Fitting				
CFI = 0.999 , TLI = 0.998 ,RMSEA=0.020, SRMR = 0.007 and Overall R - Squared = 0.88				

The structural equation model with results is presented in equation (iii)

$$PWCPs_i^* = 0.52\,WA^* - 0.23 + \varepsilon \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots iii$$

The results in Table 2 shows, the influence of water accessibility on WCPs participation was positive and significant at 1% ($p<0.01$).

V. DISCUSSION

The descriptive results in Table 1, reveal that an overall access to clean and safe water in Singida Municipality was at a low level (18.9%). Given that Juma et al. (2018) reported similar findings at Kigamboni in the Dar es Salaam region and by Sani & Scholz (2021) in Nigeria, it is not surprising to learn that the study area has a low level of water accessibility below 50%. However, within African regions, there are areas with a high level of water accessibility above 50%, as reported by (Khan & Naaz, 2018) in the Swabi district of Pakistan, (Simelane et al., 2020) at Eswatini in South Africa, and (Andualem et al., 2021) in Ethiopia. These promising findings might be favoured by the fact that many studies consider the general definition of water accessibility without taking into account the detailed observation of water quantity adequacy, quality acceptability, walking distance and time consumed, and price affordability (Omotayo et al., 2021; Smiley, 2017).

On the other hand, regarding households' participation in water conservation practices, descriptive results indicate the level is very low, not exceedingly even 20% of the study sample. The results indicate that among the six water conservation practices recorded, rainwater harvesting practice had the most counts, followed by community engagement programmes, short showers, water pollution avoidance, water re-users, and the least group were users of water serving devices. This simply means there is active participation in conservation practices that do not require high investment costs or technical knowledge. The identified low participation level to conserve water in Singida Municipality is consistent with different academic studies conducted in different areas. The study findings of Diakite & Amadou, (2020) in Mali reported that many respondents were aware of WCPs but had low participation in conservation practices. The study by Kusena et al., (2016)in Zimbabwe assessing public participation in water conservation found that only a few respondents participate in conserving water due to limited involvement in decision-making and conservation practice literacy. Also, though this paper did not concentrate on the determinants of household participation in WCPs, the descriptive results on parameters related to the theory of planned behaviour, which includes individual attitude, social membership, and perception, indicate less than 40% of the respondents had a good attitude and perception towards WCPs, suggesting that in the study area there is little emphasis on social–psychological factors to influence pro-environmental behaviours as proclaimed by (Ajzen, 1991) and (Bosnjak et al., 2020).

Also as expected, the econometric results in Table 2, inform that there is a positive relationship between household's access to clean and safe water and participation in conservation of water resource. The importance of water for human survival highlights why an individual with access to clean and safe water, is driven to participate in different interventions wherever, whenever and whatever possible to conserve this scarce resource. The study findings are consistence with the concept of Warner & Diaz, (2021), that water accessibility trigger positively behavioural intent of an individual to conserve water through the modified paradigm of connectedness to water (CTW). Also (Zylstra et al., 2014) assert conservation behaviours in most cases are cantered on consciousness, cognitive ability and physiology, since water has intrinsic values there is a strong interrelatedness between one-self and this resource which explain active participation of households who had access clean and safe water.

VI. CONCLUSION & POLICY IMPLICATION

Informed by the results, the challenge of accessing water in various regions, including Singida Municipality, contributes to an extremely low level of community participation in water resource conservation. Households with access to clean and safe water value this precious resource and engage in different conservation interventions, such as rainwater harvesting, water re-use, and avoiding water pollution, to ensure its waste is at the minimum level possible. Connectedness to water is a valid concept because it provides the way forward to increase the level of participation and extent of participation to conserve water resources, particularly in areas with low water service levels, to ensure water security.

The study suggests that extending water services to all community members is a viable solution to the problem of water inaccessibility, thereby promoting the right to water for all and increasing participation in water resource conservation. The result of this recommendation is an improvement in the living standards of people because water is vital in every aspect of human life, but conserving water resources is also necessary to ensure water security, which globally has been identified as among the major threats.

Also, in order to put more emphasis on social–psychological factors to promote water conservation behaviour within households, it is recommended that interventions prioritise the dissemination of information through educational campaigns. This can be achieved by highlighting the environmental and health advantages of conservation, as well as encouraging behavioural changes through the promotion of social norms and peer influence.

REFERENCES

Addo, I. B., Thoms, M. C., & Parsons, M. (2018). Barriers and drivers of household water-conservation behavior: A profiling approach. *Water (Switzerland)*, *10*(12). https://doi.org/10.3390/w10121794

Aiga, H., & Umenai, T. (2003). Standardisation of the definition of access to safe water [2]. *Lancet*, *361*(9375), 2156. https://doi.org/10.1016/S0140-6736(03)13703-8

Ajzen, I. (1991). Theory of Planned Behaviour. *Organizational Behaviour and Human Decision Process*, *50*, 179–211. https://doi.org/10.47985/dcidj.475

Ajzen, I. (2020). The theory of planned behavior: Frequently asked questions. *Human Behavior and Emerging Technologies*, 1–11. https://doi.org/10.1002/hbe2.195

Andualem, Z., Dagne, H., Azene, Z. N., Taddese, A. A., Dagnew, B., Fisseha, R., Muluneh, A. G., & Yeshaw, Y. (2021). Households access to improved drinking water sources and toilet facilities in Ethiopia: A multilevel analysis based on 2016 Ethiopian Demographic and Health Survey. *BMJ Open*, *11*(3). https://doi.org/10.1136/bmjopen-2020-042071

Angoua, E. L. E., Dongo, K., Templeton, M. R., Zinsstag, J., & Bonfoh, B. (2018). Barriers to access improved water and sanitation in poor peri-urban settlements of Abidjan, Côte d'Ivoire. *PLoS ONE*, *13*(8), 1–13. https://doi.org/10.1371/journal.pone.0202928

Araya, F., Osman, K., Spearing, L., & Faust, K. M. (2019). Water conservation in the household: The implications of metrics and the association between characteristics and presence of conservation. *Growing With Youth*.

Barrera-Hernández, L. F., Sotelo-Castillo, M. A., Echeverría-Castro, S. B., & Tapia-Fonllem, C. O. (2020). Connectedness to Nature: Its Impact on Sustainable Behaviors and Happiness in Children. *Frontiers in Psychology*, *11*(February), 1–7. https://doi.org/10.3389/fpsyg.2020.00276

Bidaisee, S. (2018). The Importance of Clean Water. *Biomedical Journal of Scientific & Technical Research*, *8*(5). https://doi.org/10.26717/bjstr.2018.08.001719

Boretti, A., & Rosa, L. (2019). Reassessing the projections of the World Water Development Report. *Npj Clean Water*, *2*(1). https://doi.org/10.1038/s41545-019-0039-9

Bosnjak, M., Ajzen, I., & Schmidt, P. (2020). The Theory of Planned Behavior : Selected Recent Advances and Applications. *Europe's Journal of Psychology*, *16*(3), 352–356.

Demie, G., Bekele, M., & Seyoum, B. (2016). Water accessibility impact on girl and women's participation in education and other development activities: the case of Wuchale and Jidda Woreda, Ethiopia. *Environmental Systems Research*, *5*(1). https://doi.org/10.1186/s40068-016-0061-6

Diakite, H., & Amadou, T. (2020). Comparative Study Between Gender Bias in Household Water Conservation and Management in Commune of Pelengana. *Journal of Resources Development and Management*, *April*, 37–47. https://doi.org/10.7176/jrdm/63-05

Dinka, M. O. (2018). Safe Drinking Water: Concepts, Benefits, Principles and Standards. *Water Challenges of an*

Urbanizing World. https://doi.org/10.5772/intechopen.71352

Feitelson, E. (2012). What is water? a normative perspective. In *Water Policy* (Vol. 14, Issue SUPPL. 1, pp. 52–64). IWA Publishing. https://doi.org/10.2166/wp.2012.003b

Garcia-Cuerva, L., Berglund, E. Z., & Binder, A. R. (2016). Public perceptions of water shortages, conservation behaviors, and support for water reuse in the U.S. *Resources, Conservation and Recycling*, *113*, 106–115. https://doi.org/10.1016/j.resconrec.2016.06.006

Gavrilescu, M. (2021). Water, soil, and plants interactions in a threatened environment. In *Water (Switzerland)* (Vol. 13, Issue 19). MDPI. https://doi.org/10.3390/w13192746

Gilbertson, M., Hurlimann, A., & Dolnicar, S. (2011). Does water context influence behaviour and attitudes to water conservation? *Australasian Journal of Environmental Management*, *18*(1), 47–60. https://doi.org/10.1080/14486563.2011.566160

Gleick, P. H. (1998). *The human right to water*. 487–503. www.elsevier.com/locate/watpol

Hannibal, B., Sansom, L., & E. Portney, K. (2019). The effect of local water scarcity and drought on water conservation behaviors. *Environmental Sociology*, *5*(3), 294–307. https://doi.org/10.1080/23251042.2018.1519882

Iftikhar, A., Farid, N., & Nawaz, S. (2021). Water Conservation Attitude of Residents of Rawalpindi. *Global Social Sciences Review*, *VI*(II), 38–53. https://doi.org/10.31703/gssr.2021(vi-ii).05

Juma, M., Nuhu, S., & Juma, F. B. (2018). Challenges of water accessibility in peri-urban areas in Tanzania: A case of Kigamboni Dar es Salaam. *The Journal of Social Sciences Research*, *4*(3), 47-54. doi: 10.32861/jssr.43.47.54

Khan, M. I., & Naaz, S. (2018). The role of water and hygiene project of Integrated Regional Support Programme (IRSP) in district swabi, khyber pakhtunkhwa. *Sociology International Journal*, *2*(4), 327–333. https://doi.org/10.15406/sij.2018.02.00066

Kimaro, J. (2019). A Review on Managing Agroecosystems for Improved Water Use Efficiency in the Face of Changing Climate in Tanzania. *Advances in Meteorology*, *2019*. https://doi.org/10.1155/2019/9178136

Kılıç, Z. (2020). The importance of water and conscious use of water. *International Journal of Hydrology*, *4*(5), 239–241. https://doi.org/10.15406/ijh.2020.04.00250

Kitole, F. A., & Utouh, H. M. (2023). Foreign direct investment and industrialization in Tanzania admixture time series forecast analysis 1960-2020. *Applied Economics Letters*, 1-8.

Koop, S. H. A., Van Dorssen, A. J., & Brouwer, S. (2019). Enhancing domestic water conservation behaviour: A review of empirical studies on influencing tactics. *Journal of Environmental Management*, *247*(June), 867–876. https://doi.org/10.1016/j.jenvman.2019.06.126

Kumari, M., & Singh, D. (2016). *Water conservation: Strategies and solutions*. https://www.researchgate.net/publication/312525328

Kusena, W., Desai, S., Heinz, B., & Abel, C. (2016). Assessing public participation in water conservation and water demand management in water stressed urban areas: Insights from the City of Gweru, Zimbabwe. *Review of Social Sciences*, *1*(8), 30. https://doi.org/10.18533/rss.v1i8.51

Lameck, E., Sesabo, J., & Mkuna, E. (2021). Household behaviour towards water conservation activities in Mvomero District in Tanzania: a convergent parallel mixed approach. *Sustainable Water Resources Management*, *7*(3). https://doi.org/10.1007/s40899-021-00514-y

Leopold, A. (1949). *A Sand County Almanac and Sketches here and there*. Oxford University Press.

Manríquez-Betanzos, J. C., Corral-Verdugo, V., Vanegas-Rico, M. C., Fraijo-Sing, B. S., & Tapia-Fonllem, C. O. (2016). Positive (gratitude, eudaimonia) and negative (scarcity, costs) determinants of water conservation behaviour. *Psyecology*, *7*(2), 178–200. https://doi.org/10.1080/21711976.2016.1149986

MoW-URT. (2002). *National Water Policy (NAWAPO)*. MoW-URT.

Omotayo, A. O., Olagunju, K. O., Omotoso, A. B., Ogunniyi, A. I., Otekunrin, O. A., & Daud, A. S. (2021). Clean water, sanitation and under-five children diarrhea incidence: Empirical evidence from the South Africa's General Household Survey. *Environmental Science and Pollution Research*, *28*(44), 63150–63162. https://doi.org/10.1007/s11356-021-15182-w

Rasoulkhani, K., Logasa, B., Reyes, M. P., & Mostafavi, A. (2018). Understanding fundamental phenomena affecting the water conservation technology adoption of residential consumers using agent-based modeling. *Water (Switzerland)*, *10*(8). https://doi.org/10.3390/w10080993

Rodriguez-Sanchez, C., & Sarabia-Sanchez, F. J. (2020). Does water context matter in water conservation decision behaviour? *Sustainability (Switzerland)*, *12*(3026), 1–16. https://doi.org/10.3390/su12073026

Rosinger, A. Y., & Young, S. L. (2020). The toll of household water insecurity on health and human biology: Current

understandings and future directions. *Wiley Interdisciplinary Reviews: Water*, *7*(6), 1–22. https://doi.org/10.1002/wat2.1468

Russell, S. V., & Knoeri, C. (2020). Exploring the psychosocial and behavioural determinants of household water conservation and intention. *International Journal of Water Resources Development*, *36*(6), 940–955. https://doi.org/10.1080/07900627.2019.1638230

Rutter, D. R., & Bunce, D. J. (1989). The theory of reasoned action of Fishbein and Ajzen: A test of Towriss's amended procedure for measuring beliefs. *British Journal of Social Psychology*, *28*(1), 39–46. https://doi.org/10.1111/j.2044-8309.1989.tb00844.x

Sani, Y., & Scholz, M. (2021). Water-energy-food accessibility and tracking progress towards achieving sustainable development goals in the savannah region of katsina state, nigeria. *Water (Switzerland)*, *13*(24). https://doi.org/10.3390/w13243595

Simelane, M. S., Shongwe, M. C., Vermaak, K., & Zwane, E. (2020). Determinants of Households' Access to Improved Drinking Water Sources: A Secondary Analysis of Eswatini 2010 and 2014 Multiple Indicator Cluster Surveys. *Advances in Public Health*, *2020*. https://doi.org/10.1155/2020/6758513

Smiley, S. L. (2013). Complexities of water access in Dar es Salaam, Tanzania. *Applied Geography*, *41*, 132–138. https://doi.org/10.1016/j.apgeog.2013.03.019

Smiley, S. L. (2017). Defining and measuring water access: lessons from Tanzania for moving forward in the post-Millennium Development Goal era. *African Geographical Review*, *36*(2), 168–182. https://doi.org/10.1080/19376812.2016.1171154

Sorenson, S. B., Morssink, C., & Campos, P. A. (2011). Safe access to safe water in low income countries: Water fetching in current times. *Social Science and Medicine*, *72*(9), 1522–1526. https://doi.org/10.1016/j.socscimed.2011.03.010

Spellman, F. R. (2015). *The science of water : concepts and applications* (3rd Edition). Taylor & Francis Group.

Thiam, D. R., Dinar, A., & Ntuli, H. (2021). Promotion of residential water conservation measures in South Africa: the role of water-saving equipment. In *Environmental Economics and Policy Studies* (Vol. 23, Issue 1). Springer Japan. https://doi.org/10.1007/s10018-020-00286-3

Trafimow, D. (2009). The Theory of Reasoned Action: A Case Study of Falsification in Psychology. *Theory & Psychology*, *19*(4), 501–518. https://doi.org/10.1177/0959354309336319

Uakarn, C. (2021). Sample size estimation using Yamane and Cochran and Krejcie and Morgan and Green formulas and Cohen statistical power analysis by G*power and comparisons. *Apheit International Journal*, *10*(2), 76–88.

Ullman, J. B., & Bentler, P. M. (2013). Structural Equation Modeling in Handbook of Psychology. In *Handbook of Psychology, John Wiley & Sons, Inc.*

UN. (2016). *Integrated Monitoring Guide for SDG 6 Targets and global indicators*. United Nations.

United Nations. (2016). *The Sustainable Development Goals*. United Nations.

Utouh, H., & Tile, A. (2023). *T*he Nexus between Foreign Direct Investment and Nominal Exchange Rate, Real GDP, and Capital Stock In Tanzania. *Acta Scientiarum Polonorum. Oeconomia, 22*(1), 73-87.

Warner, L. A., & Diaz, J. M. (2021). Amplifying the Theory of Planned behavior with connectedness to water to inform impactful water conservation program planning and evaluation. *Journal of Agricultural Education and Extension*, *27*(2), 229–253. https://doi.org/10.1080/1389224X.2020.1844771

WHO/UNICEF. (2021). *Global Progress Report on Wash in Health Care Facilities: Fundamentals first*.

Young, S. L. (2021). Viewpoint: The measurement of water access and use is key for more effective food and nutrition policy. *Food Policy*, *104*, 102138. https://doi.org/10.1016/j.foodpol.2021.102138

Zylstra, M. J., Knight, A. T., Esler, K. J., & Le Grange, L. L. L. (2014). Connectedness as a Core Conservation Concern: An Interdisciplinary Review of Theory and a Call for Practice. *Springer Science Reviews*, *2*(1–2), 119–143. https://doi.org/10.1007/s40362-014-0021-3