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DETERMINANTS OF THE QUALITY OF WATER SERVICES DELIVERY IN IRAMBA AND SINGIDA DISTRICTS

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Abstract: The quality of water service delivery is unsatisfactory to most household in Iramba and Singida districts. Therefore, a study was conducted to assess the determinants of Quality of water service delivery in Iramba and Singida Districts in Tanzania, where six villages were purposively selected. The study used a cross sectional research design and a total of 350 respondents were sampled randomly and interviewed. Focus group discussions and key informant interviews were used in qualitative data collection while a questionnaire based survey was used to collect quantitative data. Data analysis involved Content analysis for qualitative data while ordinal logistic regression analysis was done for quantitative data. The results showed that water rules and regulations, infrastructure and users' participation were positively and statistically significantly ($p < 0.05$) related to the quality of water service delivery while time, distance and price were negatively related to quality of water service delivery at ($p < 0.05$). Therefore, it is recommended that water service providers and users should improve those identified determinants to enhance quality of water service delivery.

Keywords: *Determinants, Quality of water service, delivery.*

1.0 Introduction

Access to safe drinking water has continued to be one of the most overarching problems. Some regions are still lagging behind others in the globe (UNICEF and WHO, 2019). UN General Assembly included the aspect of water service in Goal Number 6 when developing the Sustainable Development Goals (SDGs). The aspect sates that by 2030 every one on earth should have access to safe and affordable drinking water (UN, 2015). However, approximately 844 million people are facing challenges in access to quality water services (UN SDG, 2019). Some scholars view water as a need for all while others view water as a human right. For example, Katirhu et al. (2017) argue that water availability, sustainable management, and sanitation should be for all. The government of Tanzania, through the National Water Policy of 2002, has acknowledged access to safe and drinking water as a human right (URT, 2002). In this policy, it is clearly stated that every citizen has an equal right to access and use of safe drinking water. Despite this recognition in many developing countries including Tanzania, the quality of water service delivery to citizens remains a challenge. The current trends show more pronounced deficiencies in sub-Saharan Africa. The quality of water service is a growing concern throughout the developing world (UNICEF, 2019). In developing countries such as those in African continents, the challenge of water services delivery is escalating. This is because

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in 2015 for instance, about 48% (319 million people) of the global population without access to quality water service delivery lived in sub-Saharan Africa (SSA). Also, in 2017, only 34% of the population in SSA had access to quality water service delivery (UNICEF 2015 and WHO, 2019).

Several studies have been conducted to explore the quality of water services delivery (see for example, Alexander et al., 2015; Spaling et al., 2014; UN-Habitat, 2009; Katirhu et al., 2017; Lia et al., 2016). In Tanzania, Mandara et al. (2013) show that community management sustains rural water facilities while García-Valiñas, (2013) indicate that majority of population in rural area face the challenge of accessing water services for domestic use. Jimenez and Perez-Foguet (2010) contend that water delivery is the most politicised public service in developing countries including Tanzania. This shows that water service delivery is one of the most problematic of the social services among the people. However, studies that examine the determinants of the quality of water services delivery in Tanzania are limited.

Identifying the determinants of the quality of water service delivery is important because it takes into consideration other factors such as income of the population, household features and other factors such as weather conditions and geographical location of the community (Zeneli, 2016). Other literature sources such as Arbués et al. (2003) and Worthington and Hoffman (2008) cite water price and the average per capita water consumption as the main determinants. Other studies (Fotue and Sikod, 2012; Totouom and Fondo, 2012) show that consumers with higher incomes use more water than those with lower income. Climatic conditions are also considered to affect indirectly the quantity and or frequency of activities that require water consumption such as personal hygiene practices and garden maintenance (Zeneli, 2016). Generally, the determinants of the quality of water service delivery have been classified as being economic/financial, social, institutional, technological and environmental (Alexander et al., 2015; Spaling et al., 2014). Furthermore, other determinants of water consumption include tariffs and income, population characteristics, population density and household features.

Many areas in Tanzania have continued to experience domestic water supply challenges. (García-Valiñas and Miquel-Florensa, 2013). Lack of good quality water services delivery leads to on-going poverty, resulting from the economic costs of poor health and from high proportion of household expenditure which is necessary for water supply in many poor communities, arising from the need of purchasing the water and/or the time and energy expended in water collection (Howard and Bartram, 2003). According to the topographic nature and climatic condition of Iramba District, bore holes, which accounted for 48.4%, are the major source of water supply followed by rain water (23.4%), shallow wells (18.1%), and charcoal/ dam (10.0%). Spring water appeared to be the last as it accounts

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for only 0.33% (URT, 2015a). Through government initiatives and efforts made by other development partners, including religious institutions, the per cent of rural population served with clean water in Iramba District increased from 37.18% in 2012 to 45.93% in 2015 (URT, 2015a).

The coverage of water supply in Singida District Council is about 52.5% of 243 743 people (URT, 2015b). Therefore, people who are getting safe and clean water are 127 965. The remaining 47.5% are using water which is obtained from unprotected water sources such as dug wells and ponds for domestic purposes (URT, 2015b). The water sources for the water supply schemes are shallow wells which accounted for 68.0% of the supply, boreholes (deep wells) which accounted for 10.3% of the supply, rain water counted for 9.6% and dams which accounted for 9.1%. The technologies applied in the spread and distribution of water to users includes motorized and hand pumps. Other methods applied are construction of dams and rainwater harvesting (URT, 2015b). This paper focus on the determinants of the quality of water services delivery in Iramba and Singida Districts in Tanzania.

2.0 Theoretical and Conceptual Framework

2.1 Theoretical Framework

The Resource Dependence Theory (RDT) was developed in the 1970s by Pfeffer and Salanick (Pfeffer and Salancik, 1978). RDT characterises the organisation as an open system, depending on contingencies in the external environment. According to Pferffer and Salancik (1978), “to understand the behaviour of an organisation you must understand the context of that behaviour.” RDT recognises the influence of the external factors on the organisation behaviour and although it is constrained by their context, managers can act to reduce environmental uncertainty.

The Resource Dependence Theory (RDT) is based upon how the external resources of organizations affect the organisations. The theory is based upon the following tenets: Organizations are dependent on resources; these resources ultimately originate from the environment of organizations. The environment, to a considerable extent, contains other organizations; the resources one organization needs are thus often in the hands of other organizations and the resources are a basis of power. Legally independent organizations can, therefore, be dependent on each other (Pfeffer and Salancik, 1978).

According to RDT, organisations are not self-sufficient but they depend on a network of relationships which is a response to the uncertainty involved in the relationship and in resource dependence (Pfeffer and Salancik, 1978). Therefore, for any organization to deliver the required service resources is essential, and for Community-Based Water Supply Organisations (CBWSOs), resources are important. For the case of this paper, the degree of dependency emanates from the following factors: time for water collection,

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distance covered, water rules and regulations, water price, income of the households, and water users' participation in decisions making.

2.2 Conceptual framework

The conceptual framework of the study was based on the assumption that background variables such as education, household size and marital status had a direct influence on the institution factors (independent variables). Independent variables were guided by indicators such as household income, the price of water, rules and regulations, time spent (walking and waiting time), infrastructure, distance, and users' participation. As supported by the Resource Dependence Theory (RDT) that organisations depend on external resources, these independent variables had a direct influence on the dependent variable, which is the quality of water service delivery in the study area.

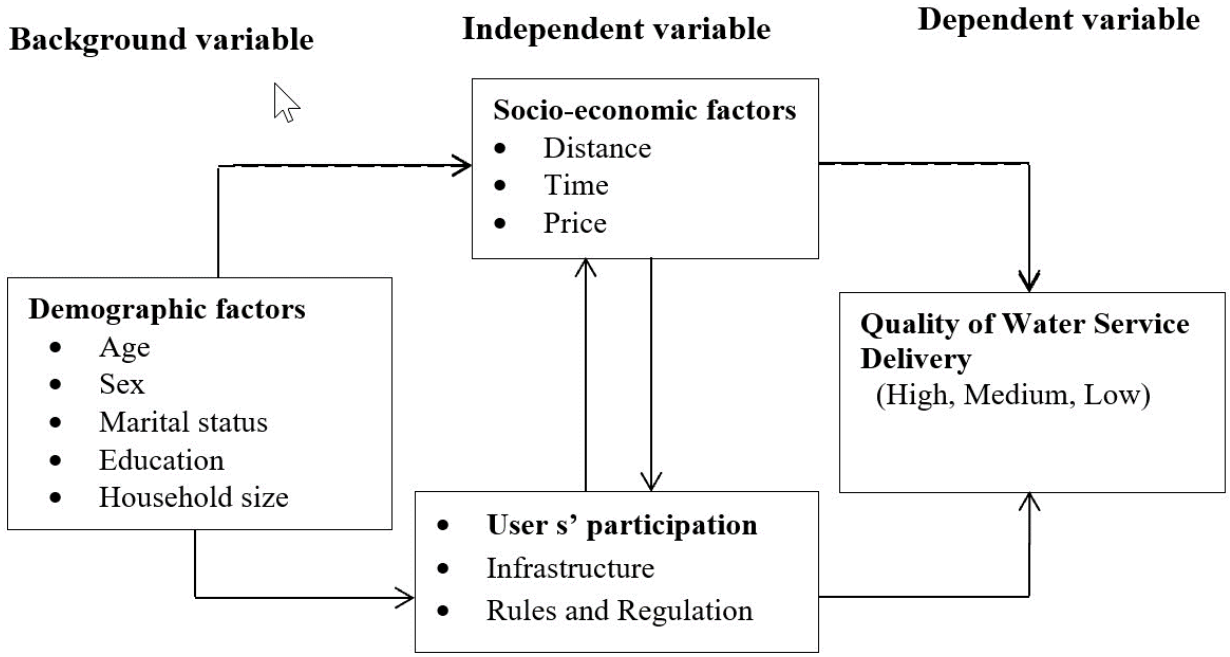

Figure 1: Conceptual framework on determinants of quality of water service delivery

3.0 Methodology

The study adopted a cross-sectional research design to examine the existing determinants of quality of water services in Iramba and Singida Districts, Tanzania. Singida Region.

Six wards were selected through multistage sampling (three from each district). Three villages from each district were purposively selected, making a total of six villages with boreholes and piped water systems in the village. A sample of 350 households was involved in the study. Proportional sampling using a household village register was applied to determine sub-samples from each village and thereafter simple random sampling was used to pick respondents from each village.

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Data collection methods included a questionnaire based household survey, FGDs, and key informant interviews. The data collected addressed responses on the determinants of the quality of water service delivery. The questionnaire, which used a 5-level scale, was filled in through interviews with the respondents.

Content analysis was employed in analysing qualitative data which were collected through key informant interviews and FGDs. Data were analysed by using thematic analysis whereby data were coded and conclusions were drawn based on the themes of the study. For Creswell (2012), the use of themes is another way of analysing data because themes are similar, and codes are aggregated together to form a major idea in the data base. With the aid of IBM-SPSS ver 16.0 computer programme, descriptive statistics including frequencies and percentages were obtained. Inferential statistics involved an ordinal logistic regression model to establish the relationship between determinants and quality of water service delivery. The dependent variable (Y) was the quality of water services delivery. The independent variables (explanatory variables) were waiting time, distance, rules and regulations, infrastructure, users' participation and the price of water.

Determinants of the delivery of quality of water services included the costs (financial and time spent on water collection), the quality and reliability of water services, household knowledge on government policy and the existing rules and regulations governing water service delivery (Kithinji, 2016). According to Lia et al. (2016), the quality of water service delivery is determined by two dimensions namely, tangibles (measured by sediments, taste, smell and colour) and reliability (measured by hours). The ordinal logistical regression model was used specified below (Agresti &Finlay, 2009). The dependent variable was categorised into three levels of low, medium and high.

$$P(y) = \frac{e\alpha + \beta 1x1 + \ldots \beta kxk \quad k}{1 + e\alpha + \beta 1x1 + \ldots \beta kxk}$$

Where:

P (y) = the probability of the quality of water service delivery being high
e = the natural log
α = the intercept of the equation
β1 to βk = coefficients of the predictor variables
X1 to X11 = predictor variables entered in the regression model

Received February 2022
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The dependent and predictor variables that were used in the ordinal logistic regression model were the ones defined in Table 1.

Table 1: The variables used in the ordinal logistic regression analysis

Variable symbol	Variable Name	Explanation
P (y)	Quality of water service delivery	0 = Low, 1 = Medium, 2 = High
X_1	Time spent	In hours
X_2	Distance	In meters
X_3	Rules and regulations	1 = Presence, 0 = Otherwise
X_4	Infrastructure (pipes, water points, water tanks)	1 = Presence, 0 = Otherwise
X_5	Price of water	1 = Yes, 0 = Otherwise
X_6	Users' participation in delivery	1 = Yes, 0 = Otherwise

4.0 Results and Discussion

4.1 Determinants of Quality of Water Service Delivery

The results revealed that the time spent on water collection, the distance covered to water collection point, water rules and regulations, users' participation and the price of water were found to have significant influence on the quality of water service delivery as shown in Table 2 below.

Table 2: Determinants of quality of water service delivery (n = 350)

Variables	Estimate	Std. Error	Wald	Df	Sig
Time spent on collecting water	-0.036*	0.015	4.187	1	0.026
Distance covered to water collection point	-3.746**	0.563	6.700	1	0.000
Rules and regulations for water service	4.293**	0.804	26.425	1	0.000
Water infrastructure	0.246	0.463	0.567	1	0.452
Users' participation in delivery of water service	1.312*	0.509	5.561	1	0.018
Price of water per bucket	-1.890*	0.327	3.024	1	0.031

Model Summary: Cox and Snell R2 = 0.657, Nagelkerke R2 = 0.693, Model fitting information Chi-square 278.403 ($p < 0.001$), Test of parallel line -2 Log Likelihood = 28.534 ($p < 1.000$).
Note: * = Significant at 5% and ** 1%

The Nagelkerke R2 value that was 0.693 means that the independent variables which were entered in the model explained about 69.3% of the variation in the outcome variable. The results from the statistical analysis showed that there was a relationship among the constructs of education, time, distance, rules and regulations, users' participation and the price of water to the quality of water services delivery.

4.2 Rules and Regulations for Water Services Delivery

The results showed that there was a significant relationship between community awareness and enforcement of rules and regulations of water and the quality of water service delivery (Coefficient = 4.293, $p < 0.01$) which means that rules and regulations guiding water services were statistically significant ($p< 0.01$) and positively influencing the

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quality of water service delivery. For a unit increase in awareness and enforcement of rules and regulations, the chances of getting high quality of water services increased by 4.293 units. The result was also supported by water users as revealed in a focus group discussion at Nselembwe Village who reported the following:

> "*The available village rules for protecting water sources and its supply help us to ensure water sources and pipes are protected. Whoever is caught destroying a water source or a pipeline is punished to pay a fine according to the damage. These rules help us to be careful with our water supply system*" (FGD, Nselembwe Village 10th December, 2018)

4.3 Users' Participation in Water Service Delivery

The results showed that there was a significant relationship between users' participation in delivery and the quality of water service (Coefficient = 1.312, $p < 0.05$). This means that users' participation in water services was statistically significant ($P< 0.05$) and positively influencing the quality of water service delivery. As users' participation increased by one unit, the chances of getting high quality of water services increased by1.312 units, other variables being held constant. Therefore, users' participation in water services is a significant factor which is associated with changes in the quality of water service delivered to the community. The implication of this result is that people who participate in the decision making on water service projects influence the delivery of water services. The importance of people participation in delivery of water service, which is also emphasised by Benequista and Gaventa (2011), indicates that citizens' participation in government decision-making helps them to know their rights, demand for their rights, and perhaps seek to expand them in new areas. These findings were supported by discussions with one of the key informants at Mtinko Village who reported that:

> "*Involving water users in the provision of water services is important because they are the ones who will use the services. Therefore, there is a need of involving them since the beginning of the project through the implementation to the end of the project. If villagers are not involved they cannot feel a sense of ownership of the project, and they cannot contribute their efforts and protect the project*" (A male key informant, Mtinko Village, 16th December, 2018).

4.4 Training, Education Level and Youth Employment Creation

Distance covered from the household to the water collection point had a negative significant impact on quality of water service delivery (Coefficient =-3.746, $P < 0.01$). It implies that an increase in distance covered from the household to the water collection point would lead to decrease in the delivery of quality water services. As distance from a household to a water collection point increased by one unit, the chances of getting high quality of water services decreased by 3.746 units, other variables held constant. Similar

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results are reported by Howard and Bartram (2003) who revealed that distance is a crucial factor in determining access to water. The more distant the source of water is from the household, the less the amount of water consumed.

As revealed by Human Development Report (UNDP, 2006), women in Africa and Asia walk for an average distance of 6 kilometres to collect water. This results in getting less amount of water for domestic use as water is heavy, and they (women) cannot afford to carry large quantities of water for long distances. The National Water Policy (NAWAPO) of 2002 defines water as being well accessible when one water point is within a distance of 400 meters and users spend no more than 30 minutes for a round trip (URT, 2002; Mandara et al., 2016). Although the Tanzania National Water Policy stipulates that the required distance to a water collection point should not be more than 400 metres, the reality is not the case. Literature shows that about 50% of the households in arid areas obtain water service at distances of more than 3000 metres from their homes (Mkonda, 2015). Similar results were reported by FGD participants in Mgori Village who had this to say:

> "*We walk long distances of more than one kilometre to collect water from the sources, the long distances make us to get little amount of water for domestic use. We are suggesting that water collection points should be allocated near to the households to enable us get enough water*" (Female FGD participants, Mgori Village, 6th December, 2018)

4.5 Time Spent to Collect Water

The results showed that there was relationship between the time spent to collect water and the quality of water service delivery (Coefficient = -0.036; $p < 0.05$). This means that the time spent on water collection was statistically and negatively influencing the quality of water services delivery. As the time for water collection increased by one unit, the chances of getting high quality of water service delivery decreased by 0.036 unit, other variables being held constant. Therefore, waiting time is a significant factor which is associated with changes in the quality of water service delivered to the community. In developing countries, women spend almost one hour per trip collecting water (Kayser et al., 2013). Studies by Ako et al. (2010) confirmed that the farther away a water source is from the household the more time is spent in sourcing water. When household members have to travel for about 3 to 30 minutes to get drinking water, then they are able to meet their daily requirements of about 15 to 25 litres per person per day. However, these members would tend to resort to concessions on domestic water uses if they have to spend beyond 30 minutes to access the water. As stated by Onundi and Ashaolu (2014), the longer the time it takes to the source of water the more the rational use and allocation of water is made.

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This observation was supported by participants' responses in a focus group discussion in Nguvumali Village who said:

> "*We walk long distances to fetch water using one or more hours to get water for domestic use. Because we spend a lot of time on fetching water, it makes us delay to get to our farms to work and to our small businesses*" (Female FGD participants, Nguvumali Village, 16th December 2018).

4.6 Price of Water per Bucket

The results showed that there was negative statistically significant relationship between the price of water per bucket paid by villagers and the delivery of quality water services (Coefficient = -1.890; $p < 0.05$). The price is considered as a determining factor for the quality of water service delivery. As the price of water increased by one unit, the chances of getting high quality of water services decreased by1.890, other variables being held constant. The results are in line with findings by Zekri and Dinar (2003); they indicated that as the price of water increased, the quality of water service delivery decreased. According to Zeneli (2016), water price is one of the most used instruments for monitoring water demand. According to literature, the price increase in water causes a decrease in per capita water consumption (the influence of water quantity demand price elasticity).

The results were supported by a key informant at Mtinko village who had the following to say:

> "*Villagers sometimes fail to pay the water tariff of Tsh 50/= per bucket of 20 litres to get enough water for their families. Because of a large number of people in their households, therefore, they opt to fetch water from unprotected sources where animals also use the same source*." (A male key informant, Mtinko village, 14th December, 2018)

4.7 Water Infrastructure

Water supply infrastructure which are used in the service delivery such as water tanks, pipelines, and water pumps had insignificant impact on the quality of water service delivery (Coefficient = 0.246, $p = 0.452$). The results imply that an increase in the quality of water infrastructure; such as water tanks, pipelines and water pumps; would hardly lead to an increase in the delivery of the quality of water services. However, an interview with a key informant seemed to highlight the importance of improved infrastructure as the following remarks show: -

> "*Water service in the village is not supplied according to the demand of the villagers. This is because the pipelines are old and the tank capacity is not sufficient and it is out of date. We need to replace the new tank and pipelines for good water supply in the village*" (A female key informant, Mtinko Village, 14th December, 2018)

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5.0 Conclusion and Recommendations

5.1 Conclusion

Quality of water service delivery is still a challenge in rural areas of the country. As expected, distance, time, and the price of water are statistically significant and inversely related to the delivery of quality water services. Thus, the longer the distance to the source of water, the longer the time spent on collecting water; and the higher the price of water the poorer the delivery of quality water services. As per Resource Dependency Theory, the quality of water service delivery depends on different resources. Resources which influence the quality of water service delivery in this study include income of the household, price of water, rules and regulations, time spent (walking and waiting time), infrastructure, distance and users' participation. These results give policy-makers useful guidance in their attempt to provide quality water services to the rural community. Also, the study will contribute to the literature on the determinants of delivery of quality water services

5.2 Recommendations

District Councils and community-based water supply organisations (CBWSOs) should improve water infrastructure by replacing old pipeline systems and water pumps with new ones. Also, water users' participation should be strengthened through conducting village meetings to discuss water service delivery and its challenges. Users should be given opportunities of providing their opinions in improving the quality of water service delivery. District Councils and CBWSOs should increase water collection points so that the distance travelled and the time spent on water collection can be minimised to meet the national distance standard of at most 400 metres and not more than 30 minutes of a round trip to the source of water.

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