Ethiopian Journal of Environmental Studies & Management 17(2): 277 – 294, 2024
ISSN:1998-0507 doi: https://ejesm.org/doi/v17i3.1
Submitted: May 13, 2024 Accepted: September 16, 2024

THE SIGNIFICANCE OF WATER VENDORS IN DOMESTIC WATER ACCESSIBILTY IN KWALI AREA COUNCIL, FCT-ABUJA, NIGERIA

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Abstract

Water vending is frequently regarded as an indication of a piped water system failure, and it continues to be a vital source of water for a large number of urban dwellers worldwide, including those in Abuja. This study looked at the role of water vendors to urban water supply in Kwali L. G. A, Abuja. Using a survey research approach, 383 copies of questionnaire were distributed. Both systematic and purposive sampling techniques were used to select the sampled areas in the study area as well as the respondents. Descriptive and inferential statistics were employed for the analysis. The study showed that majority of the vended water sources in the study area are privately owned. It was also found that 75.1% of the residents in the study area patronize the services of water vendors, with the majority (64.2%) buying their water from wheelbarrow vendors or handcarts, while 23.9% buy from tanker truck vendors, and the least patronized were head carriage vendors. The primary reasons for water vendors' involvement in domestic water supply are reliability and availability of supply, which account for 32.6% in all zones. The second most cited reason is the timely efficiency of supply compared to other sources. In the study area, there is seasonal variation in vending water demand and supply patterns, with the highest demand occurring during the dry season. Additionally, most supplies are made during the morning and evening hours. It's important to note that 50.8% of the survey participants found the price of water provided by water vendors to be affordable. This indicates that many residents, particularly the surveyed households, can easily afford to purchase water. It was recommended that extension of water infrastructure, including water points, to the study area by the FCT Water Board and other water stakeholders to enhance water availability and vendor services. Institutionalization of water vending by policymakers to regulate water quality and pricing.

Key Words: *Water vendors, Domestic water, Accessibility, Kwali Area Council, Abuja*

Introduction

Water is an essential resource for humanity and is necessary for both the creation and maintenance of economic growth and prosperity. Water is a fundamental resource for ecosystems, humans, and the development of all economic sectors (Fuerte-Velazquez and Gomez-Tagle, 2024). Additionally, it is the cornerstone of climate and natural

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ecosystem function. Water supports livelihoods through consumption, agricultural and industrial activities, sanitation and environmental services (Abanyie *et al*., 2023; Douti *et al*., 2022; European Union, 2010). Water is essential for the growth of any human community and acts as a stabilizer for social systems. Bature *et al*. (2021) noted that there is sufficient fresh water on the planet but due to bad economics or poor infrastructure, every year millions of people, most of them children, die from diseases associated with inadequate water supply, sanitation and hygiene. According to Sustainable Development Goal (SDG) 6, which was established in 2015, the objective is to ensure that everyone has access to water and sanitation services that are both sustainable and accessible by the year 2030. This goal emphasizes the crucial role that water plays in the survival of humans and animals within any given society.

Numerous human activities, including agriculture, farming, animal rising, energy production, and industrial applications, depend on water. Healthy ecosystems, which in turn support our quality of life, also depend on water. Water supply and sanitation in Nigeria, the largest African country and the continent's biggest oil exporter, are characterized by low levels of access to an improved water source and limited access to improved sanitation (Bature *et al*., 2021). The responsibility for water supply is shared between three levels of government namely the federal, state and local governments. The federal government oversees water resources management while state governments have the primary responsibility for urban water supply. Local governments together with communities are responsible for rural water supply. According to Salahudeen (2015), water can be classified into three main groups, based on how humans use it: domestic, industrial, and agricultural.

Water vending can be either official or informal. When carried out by official organizations such as water utilities or registered associations or by small-scale informal suppliers, it is considered formal. Formal vendors often provide water tankers, with the water coming from registered sources or treated utility supplies. On the other hand, unofficial vendors purchase water from various protected and unprotected sources and transport it in small quantities for domestic use using a variety of vehicles, including carts, cycles, wheelbarrows, trolleys, and even tanker trucks. Water vending is a current problem in human society and commerce and is now frequently viewed as a sign of failure in the piped systems that supply water to many urban populations worldwide. Bello *et al*. (2020) opined that water vending is seen as a sign of failure in piped-borne water supply systems, it still plays significant role in providing water especially to urban dwellers in many parts of developing countries, Nigeria inclusive. A significant population of the urban dwellers especially the poor population rely on small-scale private water vendors as the major source of water for their domestic consumption and expressed willingness to pay for improved private sector water provision services (Sheka *et al*., 2020). People who purchase water from vendors, as well as those who obtain it from unimproved wells or surface water sources, are included in the category of people who do not have reasonable access to an improved water supply when international water access statistics are

compiled. Kwali Area Council is not an exception to this.

Ahmad (2017) noted that to cover the water availability gaps, water vendors exist and ignoring their role is potentially deceptive. Therefore, recognizing the significance of water vendors as a crucial component of the water system is thought to aid in the development and implementation of more comprehensive laws that better serve customers. It will also require a re-evaluation of the customary regulatory procedures in terms of quantity and quality to promote a safe water supply. Vendors could be seen as an extension of the pipeline system in some ways. This would lead to better organization of the service, improved planning of investments, and better coordination between the various water sectors stakeholders. Additionally, it would ensure that the local government, particularly in Nigeria, does not take advantage of its customers and that the quality of services received from vendors complies with certain standards. Lastly, it is anticipated that the results of this study will advance knowledge in water resource management and assist policymakers in developing plans for the use of water resources at the local, state, and federal levels of government as noted by WHO and UNICEF (2021) that resource management, particularly water, is a key challenge to urban sustainability. The study is also expected to provide much-needed information to several other stakeholders and government agencies involved in water resource management in the Kwali Area Council, Nigeria, and the world at large to better understand the various challenges faced by residents and improve service delivery.

Study Area

The Kwali Area Council is located between latitudes 9°00'00" and 8°30'00" north of the equator and longitudes 6°43'30" and 7°43'00" east of the Greenwich Meridian. Kwali is surrounded by the Gwagwalada Area Council to the north, the Kuje Area Council to the east, the Kuje Area Council to the south, and the Abaji Area Council to the west. According to Ishaya and Olajide (2018), the Kwali Area Council covers an area of 1,206 km^2 and has a population of 85,837 people as of the 2006 census. It is projected to have a population of 119,837 people by 2019. The indigenous cluster style of habitation is primarily found in Kwali town, Yebu, Leda, Danggara, Ashara, Sheda, Dabi, and Pai. The settlement layout is dispersed. In terms of climate, the study area, according to the Koppen classification, has a tropical wet and dry climate. Three weather situations occur annually in the FCT. Pottery is one of the specialties of the people in the Kwali Area Council. The legendary potter, Ladi Kwali, whose likeness is currently featured on the 20 Naira bill, calls this rural area home. Another specialty is fabric production. However, the residents of the Kwali Area Council are also engaged in other occupations such as farming, hunting, and trading.

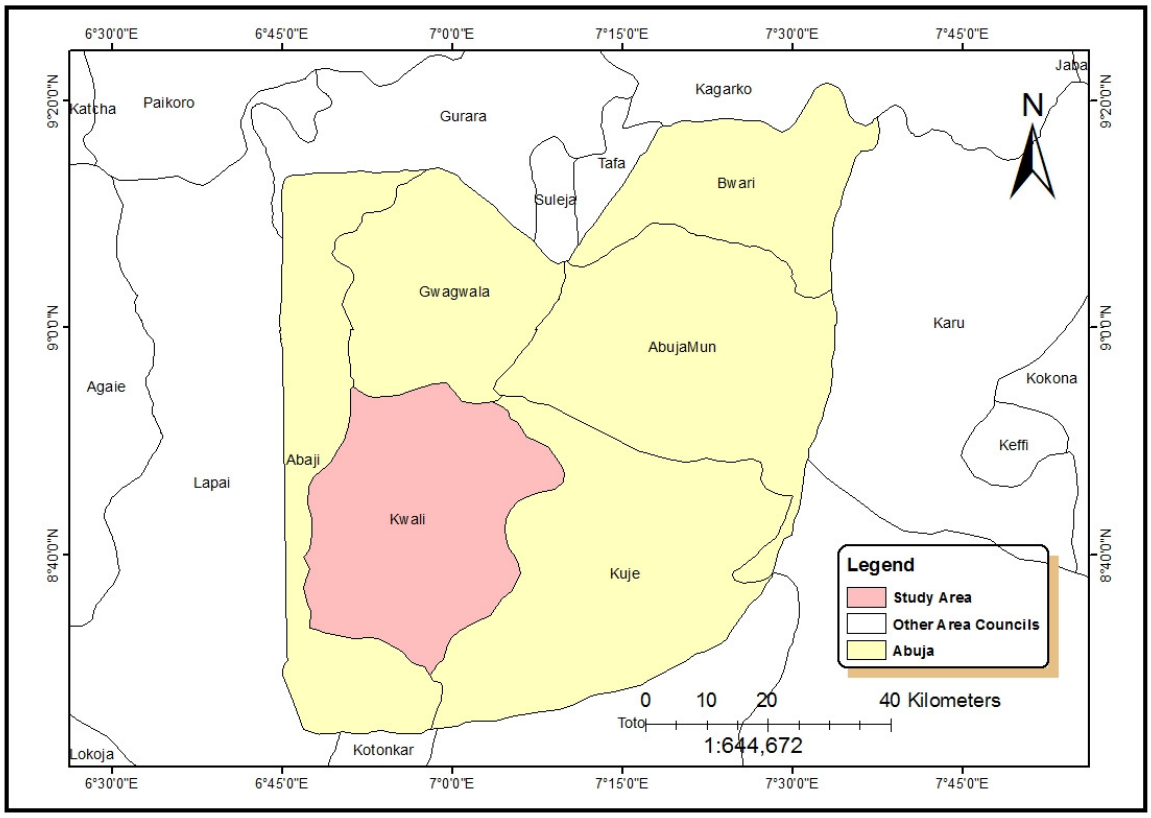

Fig. 1: Map of F.C.T Showing Kwali Area Council
Source: G.I.S Lab, Dept. Of Geography and Environmental Studies, K.S.U (2019)

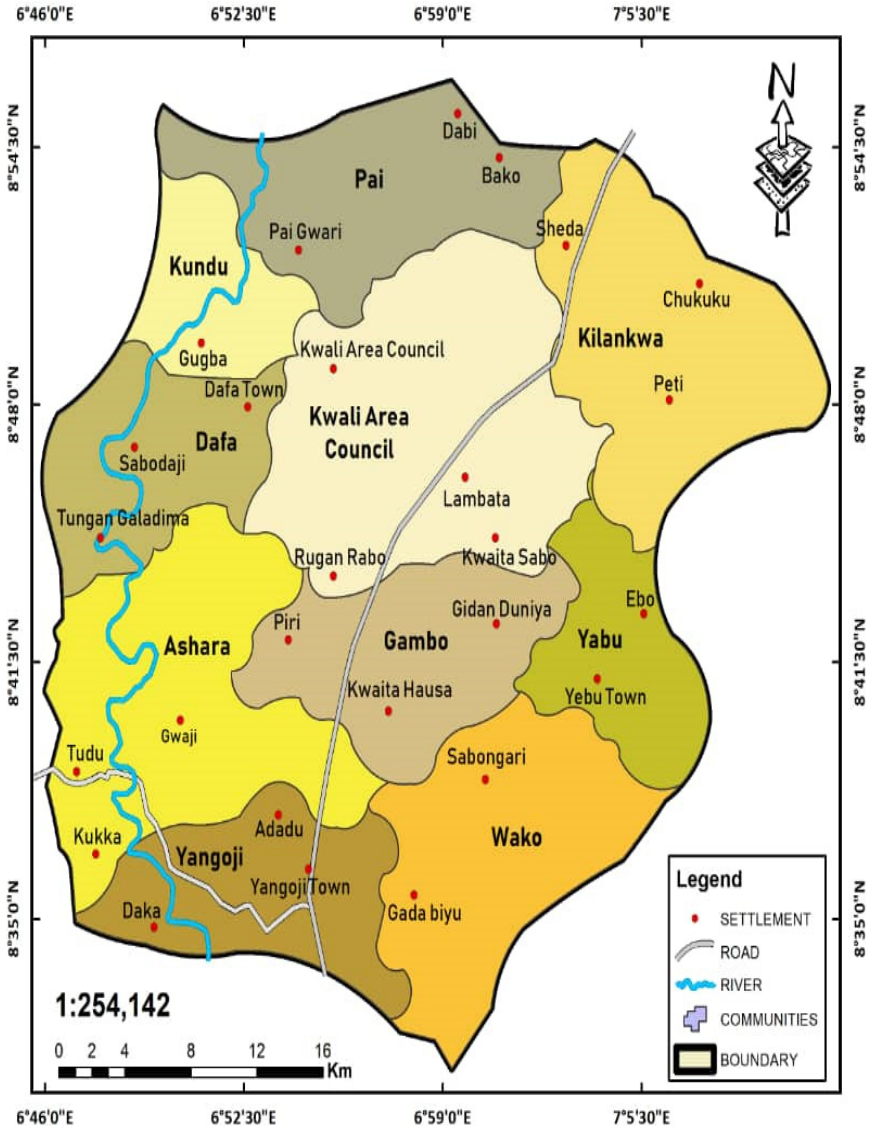

Fig. 2: Map of Kwali Area Council showing all the wards
Source: G.I.S Lab, Dept. Of Geography and Environmental Studies, K.S.U (2019)

Materials and Methods

A reconnaissance survey was conducted in the study area to gather information on the water supply status and activities of water sellers in and around the Area Council before starting the research. Oral interviews were carried out during a brief visit to determine the relevant questions to include in the questionnaire, focusing on water supply issues in general and water vending activities. The survey also helped in selecting the sampling areas and methods to be used. The data for the study included demographic information, data on domestic water vending in Kwali Area Council, data on sources and locations of vended water supply in Kwali Area Council, and data on the factors contributing to the involvement of water vendors in domestic water supply in Kwali

Area Council. A well-structured questionnaire was distributed to 383 respondents in the study area using purposive sampling technique. Out the total number distributed, 359 copies of the questionnaire were correctly filled and returned. The collected data were coded analyzed using descriptive statistical tools.

Result and Discussion

Socioeconomic Status of Respondents

Ogunbode *et al*. (2023) opined that water consumption at any time and space is dependent on factors such as household gender composition, income, household size, among others. The sample from Table 1 is diverse in terms of gender, age, marital status, education, income, and occupation, providing a comprehensive representation of the population. Female respondents (55.7%) outnumbered male respondents (44.3%). This gender distribution indicates a relatively balanced representation in the survey. Respondents are distributed across different age groups: Less than 25 (35.7%), 25-50 (49.9%), 51 and above (14.5%). The majority falls within the 25-50 age range, suggesting a relatively young to middle-aged demographic. For marital status, the majority of respondents are married (53.2%), single individuals account for 37.3%, and other categories (divorced, widow, widower) make up smaller proportions. The marital status distribution reflects a diverse range of respondents. Tertiary education is the most common qualification (39.0%), secondary education follows at 30.9%, and postgraduate education is at 14.8%. The distribution indicates a relatively educated sample, with a significant proportion having completed higher education. Income is one of the variables that affect household water use (DHS, 2019). The largest group falls within the income range of N500 to N20,000.00 (46.0%). This result is in line with the results of Ahmad (2017) which stated in his work that majority of the respondents could be considered as low income (poor) because the average monthly income was below minimum wage. Income distribution is relatively spread across different brackets with 8.4% earning N81,000.00 and above. This suggests a diverse range of income levels among respondents. Civil servants represent the largest occupational group (37.0%). Other significant groups include trading (23.1%) and students (14.8%). The occupation distribution reflects a mix of formal employment, entrepreneurial activities, and students. Education qualification, income, occupation among others play vital role in domestic water demand especially in developing countries. Oyerinde and Jacobs (2022) opined that estimating residential water demand in developing countries is complicated by the unique nature of water supply, characterized by unequal access and multiple water sources. The determinants include access to water, household size, tripe number, monthly income, payment for water, educational qualification, trip time and house type. Several socioeconomic, demographic and climatic factors influence the demand for residential and municipal water (Oyerinde and Jacobs, 2022; Marinez-Santos, 2017; Meyer *et al*., 2018).

Table 1: Socioeconomic Status of Respondents

Variable	Category	Frequency	Percentage (%)
Sex	Male	159	44.3
	Female	200	55.7
	Total	359	100.0
Age	Less than 25	128	35.7
	25-50	179	49.9
	51 and above	52	14.5
	Total	359	100.0
Marital status	Married	191	53.2
	Single	134	37.3
	Divorced	13	3.6
	Widow	14	3.9
	Widower	7	2
	Total	359	100.0
Educational qualification	Primary education	36	10.0
	Secondary education	111	30.9
	Tertiary education	140	39.0
	Post graduate and above	53	14.8
	No formal education	19	5.3
	Total	359	100.0
Income Level	₦500 to ₦20,000.00	165	46.0
	₦21,000.00 to ₦40,000.00	74	20.6
	₦ 41,000.00 to₦60,000.00	55	15.3
	₦61,000.00 to ₦80,000.00	35	9.7
	₦81,000.00 and above	30	8.4
	Total	359	100.0
Occupation	Farming	28	7.8
	Trading	83	23.1
	Civil servant	133	37.0
	Full housewife	11	3.1
	Artisan	12	3.3
	Student	53	14.8
	Unemployed	5	1.4
	Others	34	9.5
	Total	359	100.0

Source of Water in the Study Area

Figure 1 depicts the locations of water sources utilized by water vendors to supply water to households. The presentation clearly illustrates that most vendors acquire their water from private boreholes, as well as the wards within Kwali Area Council. Within the study region, nearly all of the sources from which vendors obtain water for subsequent distribution to families or communities are privately owned. The distribution of water vendor supply locations within the research area indicates that these vendors must travel significant distances to fulfil the water needs of families and towns in that area. Oyerinde and Jacobs (2022) noted that households in some parts of Nigeria use different water sources for different

purposes. Drinking water is typically reserved exclusively for water sources with higher quality, that are relatively more expensive such bottled water, sachet water and processed water bought from vendors.

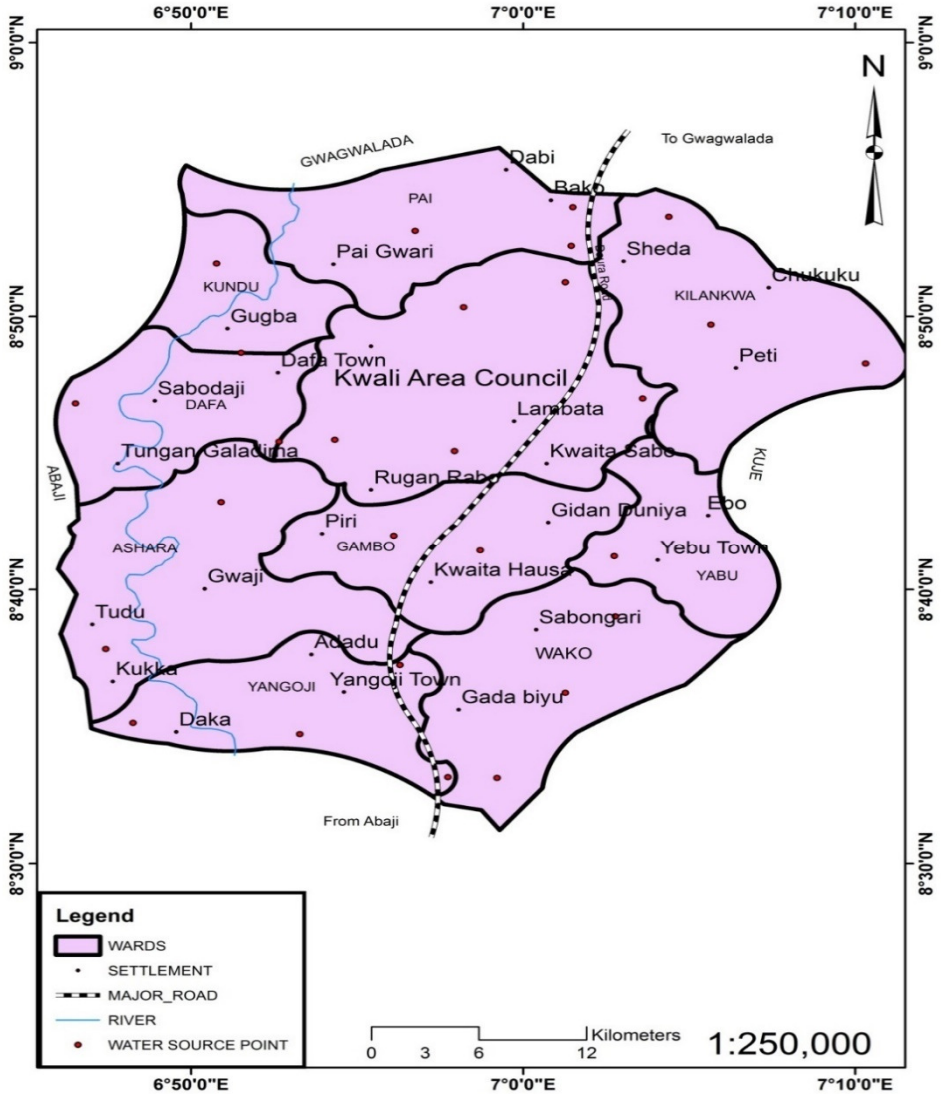

Fig. 3: Locations of Vended Water Sources in the Study Area
Source: G.I.S Lab, Dept. Of Geography and Environmental Studies, K.S.U

Table 2 presents data on the water supply sources in five different locations. In Zone A, 6.0% of respondents reported using a well as their primary source, followed by 60.7% using a borehole, 28.6% using a tap, and 2.4% using a river and rainfall, respectively. In Zone B, 15.7% of residents relied on a well, 49.4% on a borehole, 30.1% on a tap, 3.6% on a river, and 1.2% on rainfall. In Zone C, 8.8% of respondents used a well, 62.5% used a borehole, 26.2% used a tap, and 2.5% used rainfall. Moving on to Zone D, 13.5% used a well, 61.5% used a borehole, 23.1% used a tap, and 1.9% used rainfall. In Zone E, 15% used a well, 50% used a borehole, 28% used a tap, 3% used a river, and 1% used rainfall. These results

indicate that the primary source of water in all zones is the borehole. Additionally, 51 respondents in Zone A showed that the majority of their water came from boreholes, while only 2 respondents relied the least on rivers and rainfall. These findings are consistent with the findings of Bature *et al*. (2021), which stated that water for domestic purposes (cooking, laundry and hygiene activities) is mainly from protected hand pump, borehole and tube well. According to the respondents, water obtained from a common source is insufficient for daily needs. Barriers to constructing piped systems include difficult terrain, high utility costs, and unrecognized squatter settlements; widely spread rural areas, and rapidly developing peri-urban areas.

Table 2: Source of water in the study area

Name of area	Well	Bore hole	Tap (Water board)	Stream	rainfall	Total
Zone A	5(6.0%)	51(60.7%)	24(28.6%)	2(2.4%)	2(2.4%)	84(100.0%)
Zone B	13(15.7%)	41(49.4%)	25(30.1%)	3(3.6%)	1(1.2%)	83(100.0%)
Zone C	7(8.8%)	50(62.5%)	21(26.2%)	0(0.0%)	2(2.5%)	80(100.0%)
Zone D	7(13.5%)	32(61.5%)	12(23.1%)	0(0.0%)	1(1.9%)	52(100.0%)
Zone E	9(15.3%)	30(50.8%)	17(28.8%)	2(3.4%)	1(1.7%)	59(100.0%)
Total	41(11.5%)	204(57.0%)	99(27.7%)	7(2.0%)	7(2.0%)	358(100.0%)

Key: Zone A (Kwali Central Ward), Zone B (Pai and Kundu), Zone C (Dafa and Ashara), Zone D (Yangoji and Wako), Zone E (Gambo, Kilankwa and Yebu)

Table 3 shows that 83.5% of the respondents patronize water vendors in zone A, while 16.5% do not. In zone B, 75.3% purchases water from vendors while 24.7% do not. In zone C, 67.1% patronize water vendors while 32.9% do not. 76.9% and 72.4% purchases water from vendors and 27.6% and 24.9% do not (respectively for both Zone D and E). The study therefore reveals that majority of the respondents in the study area patronizes water vendors. Most vended water providers are in low-income neighbourhoods, relying on public or private sources. During water shortages, public standpipes attract many users, resulting in long waiting times. Those who can afford it buy water from vendors delivering to their doorsteps, while the extremely poor endure long lines for water collection.

Table 3: Patronage of Water Vendors

Name of area	Yes	No	Total
Zone A	66(83.5%)	13(16.5%)	79(100.0%)
Zone B	61(75.3%)	20(24.7%)	81(100.0%)
Zone C	53(67.1%)	26(32.9%)	79(100.0%)
Zone D	40(76.9%)	12(23.1%)	52(100.0%)
Zone E	42(72.4%)	16(27.6%)	58(100.0%)
Total	262(75.1%)	87(24.9%)	349(100.0%)

Key: Zone A (Kwali Central Ward), Zone B (Pai and Kundu), Zone C (Dafa and Ashara), Zone D (Yangoji and Wako), Zone E (Gambo, Kilankwa and Yebu.

Type of Domestic Water Vending in the Study Area

In Zone A, 14.3% of respondents purchase water from hand tanker trucks, 67.1% from vendors who distribute using wheelbarrows, and 18.6% from vendors who use head carriages. In Zone B, 10.1% of customers purchase their water from head carriage sellers, 68.1% from wheelbarrow distributors, and 21.7% from tanker truck vendors. The majority of respondents, with percentages of 72.7%, 49.0%, and 59.3%, respectively, purchase water from wheelbarrow distribution vendors in Zones C, D, and E. The least preferred type of water vendor among the respondents is a head donkey carriage vendor, who received 0.0% in Zones A, B, and E, 1.5% in Zone C, and 2.0% in Zone D (Table 4). The majority of respondents purchase their household water from vendors, which can be attributed to the inadequate service coverage and inconsistent water supply from pipes in the research area. Also, water supply at public faucets is often erratic and short-lived, leading city dwellers to heavily rely on commercial borehole owners, itinerant water tanker drivers, or water vendors for their daily water needs. In this regard, Gross *et al*. (2024) opined that water retailers will need to implement water demand management and conservation strategies to meet goals depending on local characteristics of efficiency investments, landscape irrigation, and land use characteristics. Water suppliers have addressed water scarcity challenges through a mix of supply and demand-side measures.

Table 4: Type of water vendors patronized by the respondents

Name of area	tanker trucks	wheelbarrow distribution vendors	head carriage vendors	donkey carriage vendors	Total
Zone A	10(14.3%)	47(67.1%)	13(18.6%)	0(.0%)	70(100.0%)
Zone B	15(21.7%)	47(68.1%)	7(10.1%)	0(.0%)	69(100.0%)
Zone C	14(21.2%)	48(72.7%)	3(4.5%)	1(1.5%)	66(100.0%)
Zone D	19(37.3%)	25(49.0%)	6(11.8%)	1(2.0%)	51(100.0%)
Zone E	16(29.6%)	32(59.3%)	6(11.1%)	0(.0%)	54(100.0%)
Total	74(23.9%)	199(64.2%)	35(11.3%)	2(.6%)	310(100.0%)

Key: Zone A (Kwali Central Ward), Zone B (Pai and Kundu), Zone C (Dafa and Ashara), Zone D (Yangoji and Wako), Zone E (Gambo, Kilankwa and Yebu)

Quantity of water bought from vendors (weekly estimate)

As shown in Table 5, From zone A, about 44.9% buy about 50-100 litres of water weekly, 18.8% buy 101-150 litres, 23.2% buy 151-200 litres, and 13.0% buy above 201 litres. In zone B, 35.8% buy 50–100 litres as the majority and 16.4% as the least. In the Kwali area council in general, 41.0% buy about 50–100 litres of water weekly as the majority, and 17.7% buy above 201 litres as the least. With the suggestion by Onyenechere *et al*. (2012) that water vending occurs more frequently daily than on a weekly or monthly basis, the daily purchase of water can be justified. It also enables various households to have their water demand met by their daily supplies with the least likelihood of experiencing waste, which is typically the case when they have more water than they need for a day.

Table 5: Quantity of water bought from vendors (weekly estimate)

Name of area	50-100 Liters	101-150 litres	151-200 litres	201 litres and above	Total
Zone A	31(44.9%)	13(18.8%)	16(23.2%)	9(13.0%)	69(100.0%)
Zone B	24(35.8%)	18(26.9%)	14(20.9%)	11(16.4%)	67(100.0%)
Zone C	29(42.0%)	7(10.1%)	16(23.2%)	17(24.6%)	69(100.0%)
Zone D	27(52.9%)	9(17.6%)	4(7.8%)	11(21.6%)	51(100.0%)
Zone E	16(29.6%)	11(20.4%)	20(37.0%)	7(13.0%)	54(100.0%)
Total	127(41.0%)	58(18.7%)	70(22.6%)	55(17.7%)	310(100.0%)

Key: Zone A (Kwali Central Ward), Zone B (Pai and Kundu), Zone C (Dafa and Ashara), Zone D (Yangoji and Wako), Zone E (Gambo, Kilankwa and Yebu)

Table 6 reveals spending patterns on water vendors in different zones. In Zone A, 27.1% of respondents spend less than #200 weekly, 31.4% spend between #205 and #500, 27.1% spend between #510 and #1,000, 5.7% spend between #1,050 and #1,500, and 8.6% spend above #1,500. Similarly, in Zone B, 13.4% spend less than #200 weekly, while 37.3% spend between #205 and #500. In Zone C, 18.3% spend less than #200 weekly, 22.5% spend between #205 and #500, and so forth for other zones. This expenditure is deemed affordable compared to the respondents' monthly income ranging from #500 to #20, 000, suggesting that most residents, particularly the study households, can conveniently afford water, though some may face constraints.

Table 6: Amount spent on purchasing water from vendors (weekly estimate)

Name of area	less than 200	205- 500	510- 1,000	1,050-1,500	1,500 and above	Total
Zone A	19(27.1%)	22(31.4%)	19(27.1%)	4(5.7%)	6(8.6%)	70(100.0%)
Zone B	9(13.4%)	25(37.3%)	16(23.9%)	7(10.4%)	10(14.9%)	67(100.0%)
Zone C	13(18.3%)	16(22.5%)	14(19.7%)	13(18.3%)	15(21.1%)	71(100.0%)
Zone D	8(15.7%)	21(41.2%)	17(33.3%)	2(3.9%)	3(5.9%)	51(100.0%)
Zone E	7(13.0%)	20(37.0%)	9(16.7%)	7(13.0%)	11(20.4%)	54(100.0%)
Total	56(17.9%)	104(33.2%)	75(24.0%)	33(10.5%)	45(14.4%)	313(100.0%)

Key: Zone A (Kwali Central Ward), Zone B (Pai and Kundu), Zone C (Dafa and Ashara), Zone D (Yangoji and Wako), Zone E (Gambo, Kilankwa and Yebu)

As depicted in Figure 2, 66.5% of respondents affirmed knowledge of their water source from vendors, while 33.5% reported uncertainty. In Zone A, Figure 4.3 shows that 57.4% indicated vendors' source water from private boreholes, 31.9% from taps, and 10.6% from wells. In Zone B, 76.5% of vendors use boreholes, 21.6% taps, and 2.0% wells. Zone C has 58.2% from boreholes, 30.9% taps, and 10.9% wells; Zone D has 72.7% boreholes, 20.5% wells, and 6.8% wells. In Zone E, 63.0% obtain water from boreholes, 34.8% from taps, and 2.2% from wells. The findings suggest that the majority of vendors source their water from private boreholes for distribution to customers.

Table 7: Reasons for Patronizing Water Vendors

Name of area	more affordable than pipe borne water	more reliable and available in supply	more better in terms of quality compare to other sources	timely efficiency in supply compared to other sources	that is the only source of water in my community	Total
zone A	11(16.4%)	20(29.9%)	9(13.4%)	21(31.3%)	6(9.0%)	67(100.0%)
zone B	7(10.3%)	25(36.8%)	3(4.4%)	21(30.9%)	12(17.6%)	68(100.0%)
zone C	14(22.6%)	21(33.9%)	5(8.1%)	13(21.0%)	9(14.5%)	62(100.0%)
zone D	11(21.6%)	15(29.4%)	4(7.8%)	8(15.7%)	13(25.5%)	51(100.0%)
zone E	13(24.5%)	19(35.8%)	3(5.7%)	9(17.0%)	9(17.0%)	53(100.0%)
Total	56(18.6%)	100(33.2%)	24(8.0%)	72(23.9%)	49(16.3%)	301(100.0%)

Key: Zone A (Kwali Central Ward), Zone B (Pai and Kundu), Zone C (Dafa and Ashara), Zone D (Yangoji and Wako), Zone E (Gambo, Kilankwa and Yebu)

In Table 7, the predominant reason cited across all zones for purchasing water from vendors is "more reliability and availability of supply," comprising 32.6%. Following closely, 23.9% of respondents mentioned "timely efficiency in supply compared to other sources." In Zone A, 16.4% of respondents stated affordability as a reason, while 29.9% emphasized reliability and availability. Additionally, 13.4% cited better quality, 31.3% mentioned timely and efficient supply and 9.0% noted the exclusivity of vendor-supplied water in their community. In Zone B, 11.8% cited affordability, 35.3% highlighted reliability and availability, 4.4% mentioned better quality, 30.9% emphasized timely efficiency, and 17.6% indicated vendor water as the sole community source. Zone C saw 22.6% citing affordability, 33.9% emphasizing reliability and availability, 14.5% mentioning better quality, 21.0% highlighting timely efficiency, and 14.5% indicating exclusivity. In Zone D, 21.6% cited affordability, 29.4% emphasized reliability and availability, 7.8% mentioned better quality, 15.7% highlighted timely efficiency, and 25.5% noted exclusivity. In Zone E, 24.5% cited affordability, 34.0% emphasized reliability and availability, 5.7% mentioned better quality, 17.0% highlighted timely efficiency, and 18.9% indicated exclusivity.

Table 8: Government effort towards water provision

Name of area	communal sources	private sources	personal sources	other sources	Total
Zone A	38(47.5%)	26(32.5%)	11(13.8%)	2(2.5%)	80(100.0%)
Zone B	27(34.6%)	26(33.3%)	16(20.5%)	2(2.6%)	78(100.0%)
Zone C	40(55.6%)	23(31.9%)	5(6.9%)	1(1.4%)	72(100.0%)
Zone D	36(73.5%)	12(24.5%)	1(2.0%)	0(0.0%)	49(100.0%)
Zone E	29(50.0%)	17(29.3%)	8(13.8%)	0(0.0%)	58(100.0%)
Total	170(50.4%)	104(30.9%)	41(12.2%)	5(1.5%)	337(100.0%)

Key: Zone A (Kwali Central Ward), Zone B (Pai and Kundu), Zone C (Dafa and Ashara), Zone D (Yangoji and Wako), Zone E (Gambo, Kilankwa and Yebu)

In Zone A, Table 8 indicates that a majority of respondents (47.5%) obtain water from communal sources provided by local government authorities, suggesting governmental efforts to provide water to the residents. Additionally, 32.5% access water from private sources, 13.8% from personal sources, and 2.5% from alternative sources such as rivers, wells, or rainfall. In Zone B, 34.6% source water from communal outlets, 33.3% from private sources, 20.5% from personal sources, and 2.6% from other sources. Zone C shows that 55.6% rely on communal sources, 31.9% on private sources, 6.9% on personal sources, and 1.4% on other sources. In Zone D, 73.5% access water from communal sources, 24.5% from private sources, and 2.0% from personal sources. Further analysis in Zone E reveals that 50.0% acquire water from communal sources, 29.3% from private sources, and 13.8% from personal sources.

Table 9: Alternative water sources

Name of area	Water vendors	protected spring/river water	hand dug wells	rain water	bore hole/pipe borne water	Total
zone A	27(35.5%)	10(13.2%)	6(7.9%)	7(9.2%)	26(34.2%)	76(100.0%)
zone B	35(46.1%)	6(7.9%)	8(10.5%)	1(1.3%)	26(34.2%)	76(100.0%)
zone C	33(49.3%)	8(11.9%)	10(14.9%)	3(4.5%)	13(19.4%)	67(100.0%)
zone D	29(61.7%)	3(6.4%)	1(2.1%)	0(0.0%)	14(29.8%)	47(100.0%)
zone E	21(38.2%)	10(18.2%)	9(16.4%)	4(7.3%)	11(20.0%)	55(100.0%)
Total	145(45.2%)	37(11.5%)	34(10.6%)	15(4.7%)	90(28.0%)	321(100.0%)

Key: Zone A (Kwali Central Ward), Zone B (Pai and Kundu), Zone C (Dafa and Ashara), Zone D (Yangoji and Wako), Zone E (Gambo, Kilankwa and Yebu)

Table 9 illustrates that water vendors are the primary alternative water source in the Kwali area council. In Zone A, 35.5% of respondents use vendors, 13.2% rely on protected spring or river water, 7.9% on hand-dug wells, 9.2% on rainwater, and 34.2% on private borehole or pipe-borne water. Zone B reports 46.1% sourcing water from vendors, 7.9% from protected spring or river water, 10.5% from hand-dug wells, 1.3% from rainwater, and 34.2% from private borehole or pipe-borne water. In Zone C, 49.3% choose vendors, 11.9% opt for protected spring or river water, 14.9% use hand-dug wells, 4.5% rely on rainwater, and 19.4% access private borehole or pipe-borne water. Zone D indicates 61.7% obtaining water from vendors, 6.4% from protected spring or river water, 2.1% from hand-dug wells, and 29.8% from private borehole or pipe-borne water. Further analysis in Zone E shows that 38.2% choose vendors, 18.2% rely on protected spring or river water, 16.4% on hand-dug wells, 7.3% on rainwater, and 20.0% on private borehole or pipe-borne water. This implies that the major source of alternative water supply in the study area is by water vendors. This finding contradicts with the findings of Ghana Statistical Service (2014) as cited by Gbedemoh *et al*. (2022) that the four main sources of water in the Yilo Krobo Municipality are boreholes, streams, public taps, and pipe-borne water. Just like boreholes, nearly one out every five households in the Municipality use rivers or streams as their main source of drinking water. Other sources of drinking water are pipe-borne outside dwelling units and public standpipes (Gbedemoh *et al*., 2022).

Table 10: Cost of buying Water from Water Vendors

Name of area	20 and 25 Naira respectively	30 and 35 Naira respectively	Others	Total
Zone A	17(54.8%)	10(32.3%)	4(12.9%)	31(100.0%)
Zone B	23(57.5%)	9(22.5%)	8(20.0%)	40(100.0%)
Zone C	35(70.0%)	11(22.0%)	4(8.0%)	50(100.0%)
Zone D	21(70.0%)	8(26.7%)	1(3.3%)	30(100.0%)
Zone E	22(51.2%)	17(39.5%)	4(9.3%)	43(100.0%)
Total	118(60.8%)	55(28.4%)	21(10.8%)	194(100.0%)

Key: Zone A (Kwali Central Ward), Zone B (Pai and Kundu), Zone C (Dafa and Ashara), Zone D (Yangoji and Wako), Zone E (Gambo, Kilankwa and Yebu)

Table 10 shows that majority of respondents (60.8%) reported purchasing water within the price range of 20 and 25 Naira. A significant proportion (28.4%) bought water in the range of 30 and 35 Naira. A smaller percentage (10.8%) falls into the "Others" category, indicating varied pricing beyond the specified ranges. The predominant cost range in Zone A is 20 and 25 Naira (54.8%), with a smaller proportion opting for the 30 and 35 Naira ranges (32.3%). Similar to Zone A, the majority in Zone B reported purchasing water in the 20 and 25 Naira range (57.5%), with 22.5% choosing the 30 and 35 Naira range. Zone C shows a higher preference for the 20 and 25 Naira range (70.0%), while a smaller percentage opted for the 30 and 35 Naira range (22.0%). In Zone D, a significant majority purchased water within the 20 and 25 Naira range (70.0%), and a smaller proportion chose the 30 and 35 Naira range (26.7%). Zone E exhibits a preference for the 20 and 25 Naira range (51.2%), with a notable percentage also selecting the 30 and 35 Naira range (39.5%). The consistent preference for the 20 and 25 Naira range suggests that this price point is widely accepted and affordable across different zones. Also, variations in pricing, especially in the "Others" category, indicate that some vendors may adopt different pricing models or offer additional services, impacting the overall cost.

Table 11: Perceptions for the Cost of Water Supplied by Water Vendors

Name of area	Cheap	Affordable	Expensive	don't know	Total
Zone A	15(18.1%)	54(65.1%)	4(4.8%)	10(12.0%)	83(100.0%)
Zone B	22(26.8%)	34(41.5%)	12(14.6%)	14(17.1%)	82(100.0%)
Zone C	23(28.8%)	38(47.5%)	16(20.0%)	3(3.8%)	80(100.0%)
Zone D	10(19.6%)	20(39.2%)	18(35.3%)	3(5.9%)	51(100.0%)
Zone E	14(23.3%)	35(58.3%)	6(10.0%)	5(8.3%)	60(100.0%)
Total	84(23.6%)	181(50.8%)	56(15.7%)	35(9.8%)	356(100.0%)

Key: Zone A (Kwali Central Ward), Zone B (Pai and Kundu), Zone C (Dafa and Ashara), Zone D (Yangoji and Wako), Zone E (Gambo, Kilankwa and Yebu)

Table 11 provides a breakdown of respondents' perceptions of the cost of water supplied by water vendors across different zones. The majority of respondents, 50.8% (181 individuals), perceive the cost of water supplied by water vendors as affordable. 23.6% (84 individuals) consider it cheap, while

15.7% (56 individuals) find it expensive. A small percentage of respondents (9.8%, 35 individuals) indicated that they don't know the cost. The majority (65.1%) of respondents in Zone A find the cost of water supplied by vendors to be affordable. 18.1% consider it cheap, and only 4.8% perceive it as expensive. 12.0% of respondents in this zone are uncertain about the cost. Similar to Zone A, most respondents in Zone B (41.5%) see the cost as affordable. 26.8% find it cheap, 14.6% expensive, and 17.1% are unsure. Zone C has the highest percentage (47.5%) of respondents perceiving the cost as affordable. 28.8% consider it cheap, 20.0% expensive, and 3.8% are uncertain. Unlike other zones, Zone D has a relatively balanced distribution of perceptions. 39.2% find the cost affordable, 19.6% cheap, 35.3% expensive, and 5.9% don't know. The majority of respondents in Zone E (58.3%) find the cost affordable. 23.3% consider it cheap, 10.0% expensive, and 8.3% are unsure. The data suggests that, overall; a significant portion of respondents finds the cost of water supplied by vendors to be affordable. Variations across zones indicate that perceptions may be influenced by local factors such as economic conditions or vendor practices. The uncertainty about the cost (9.8% of total respondents) emphasizes the need for more transparent pricing information or awareness campaigns.

Table 12: Factors Responsible for the Variation in the Price Fluctuation across Season

Name of area	higher demand for water by house holds	shortage of supply at vendors purchasing points	distance from vendors purchase point to supply points	others, specify	Total
Zone A	33(39.8%)	18(21.7%)	28(33.7%)	4(4.8%)	83(100.0%)
Zone B	23(27.7%)	16(19.3%)	42(50.6%)	2(2.4%)	83(100.0%)
Zone C	35(43.8%)	12(15.0%)	29(46.2%)	4(5.0%)	80(100.0%)
Zone D	15(28.8%)	9(17.3%)	24(46.2%)	4(7.7%)	52(100.0%)
Zone E	26(43.3%)	14(23.3%)	16(26.7%)	4(6.7%)	60(100.0%)
Total	132(36.9%)	69(19.3%)	139(38.8%)	18(5.0%)	358(100.0%)

Key: Zone A (Kwali Central Ward), Zone B (Pai and Kundu), Zone C (Dafa and Ashara), Zone D (Yangoji and Wako), Zone E (Gambo, Kilankwa and Yebu)

The most frequently cited factor is "distance from vendors' purchase point to supply points," accounting for 38.8% of total responses. "Higher demand for water by households" follows closely, with 36.9% of respondents attributing price variation to this factor. "Shortage of supply at vendors' purchasing points" is the third most mentioned factor at 19.3%, while "others specify" constitutes 5.0% of responses. Zone-wise Analysis: The primary factor perceived in Zone A is "higher demand for water by households" (39.8%), followed by "distance from vendors' purchase point to supply points" (33.7%). In Zone B, the most frequently cited factor is "distance from vendors' purchase point to supply points" (50.6%), indicating a strong influence on price variation. Similar to Zone B, respondents

in Zone C emphasize "distance from vendors' purchase point to supply points" (46.2%) as the primary factor. "Distance from vendors' purchase point to supply points" is also the dominant factor in Zone D (46.2%), followed by "higher demand for water by households" (28.8%). In Zone E, "higher demand for water by households" (43.3%) is the most frequently mentioned factor, closely followed by "distance from vendors' purchase point to supply points" (26.7%). The consistent emphasis on "distance from vendors' purchase point to supply points" across zones suggests that logistics and transportation play a crucial role in price fluctuations. "Higher demand for water by households" is a significant factor, indicating that the level of demand directly impacts pricing. Water purchased from vendors is primarily used for drinking and occasionally for cooking. Some households buy water every day, while others do so less frequently, using saved water on remaining days. Water vending is a daily occurrence, minimizing waste and meeting daily water demand for different households. Distance from vendors for purchasing is the primary reason (38.8%) for price fluctuation across seasons, followed by increased home water consumption (36.9%).

Conclusion

Based on the study's findings, the following conclusions were drawn: certain zones (wards) displayed scarcity in both the zones and sources from which water vendors obtain their supply for end users, mainly relying on private sources. Although wheelbarrow vendors are the predominant water sellers, some residents opt for tanker truck vendors. Factors contributing to water vendors' involvement in urban water supply include households lacking pipe-borne water connection, irregular pipe-borne water frequency, vended water's dependability, availability influencing residents' preferences, and vendors' economic empowerment. The distribution pattern indicates nearly all wards in the research area are served by vended water, with seasonal variations in accessibility, notably higher during dry seasons. Water vendors maintain a constant presence throughout the day, leading to daily selling pattern variations. It was recommended that extension of water infrastructure, including water points, to the study area by the FCT Water Board and other water stakeholders to enhance water availability and vendor services. Institutionalization of water vending by policymakers to regulate water quality and pricing. Recognition of vendors as essential components of the water system, leading to more comprehensive regulations benefiting poor end-users. Drinking water policies should extend beyond the faucet, acknowledging vendors as extensions of the piped system, ensuring greater reliability and affordability for water service providers. Review of water sector policies involving all stakeholders (FCT Water Board, end-users, and vendors) through a participatory process to legitimize the vended water industry and establish guidelines for standardized prices. Development of alternative sources such as boreholes to alleviate challenges caused by the high cost of vended water, offering backup in case of piped water network failures. Provision of soft loans to standpipe and tanker owners, as well as handcart and wheelbarrow vendors, to offset equipment costs, ultimately

lowering water prices and improving services.

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