Global Scientific and Academic Research Journal of Economics, Business and Management
ISSN: 2583-5645 (Online)
Frequency: Monthly
Published By GSAR Publishers
Journal Homepage Link- https://gsarpublishers.com/journals-gsarjebm-home/

IMPACT OF WATER VENDING ON HOUSEHOLD WATER SUPPLY WITHIN KANO METROPOLIS

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Article History

Received: 06/05/2025
Accepted: 15/05/2025
Published: 17/05/2025

Vol –4 Issue – 5

PP: -26-32

Abstract

The study examines the impact of water vending on household water supply delivery in Kano State Metropolis. The study used data generated through primary and secondary sources. The data was analyzed using both descriptive statistics as well as regression analysis. The descriptive statistics revealed that 251 respondents representing (51.22%) of the population of the study area sourced their water from water vendors. This means water vendors constitute the major sources of domestic water supply in Kano metropolis. From the regression results, the study revealed that, 3 out of the 4 Repressors i.e. Households residential water demand (HRWD), Volume of water supplied by tap (VWST), Volume of Water obtained from other Sources (VWOS) have their hypothesized signs. The study revealed further, that the variables were found to be significant in view of their t-values (2.16, 4.51 and 10.06 respectively) and p-values (0.03, 0.00 and 0.00 respectively). The study concludes and recommends the provision of adequate water infrastructures, ensuring judicious implementations of water laws, soliciting cooperation of water users in managing the resource, and ensuring proper maintenance of the water infrastructure. Also, the study calls for investment in public water infrastructure to reduce reliance on water vending and ensure sustainable water access.

Keywords: *Water Vending, Household, Water Supply, Water Scarcity and Metropolis*

1. Introduction

Availability of safe drinking water has been universally acknowledged as a fundamental human right that drives social, economic, health securities, and environmental sustainability (United Nations General Assembly [UNGA], 2010),in (Boniface, Adamu & Adamu,2024). Clean water stimulates economic growth, reduces poverty, and fosters sustainable development. However, with increasing population growth, urbanization, industrialization, and climate change, the problems affecting city councils, particularly in developing countries, have intensified in complexity, scope, and severity (World Health Organization [WHO] and United Nations International Children's Emergency Fund [UNICEF], 2022), in (Boniface, Adamu & Adamu,2024). These difficulties in supplying clean drinking water result in water insecurity and exacerbate health and environmental crises.

Despite global pushed to achieve Sustainable Development Goal 6 (provide water and good environment for all), recent reports show that 771 million people still do not have access to clean drinking water, while at least 2 billion people use water sources contaminated with fecal matter, which leads to waterborne diseases like cholera, diarrhea, typhoid, and hepatitis (WHO, 2021; UNICEF, 2022). Additionally, while 6.6 billion people now have access to improved water sources, global demand for water is likely to expand due to agricultural expansion, energy production, and industrial use, with freshwater availability in many regions likely to decrease as a result of climate change (UN Water, 2023). These pressures are predicted to disproportionately affect the poor, particularly in regions with existing water stress (United Nations World Water Development Report [UNWWDR], 2022).

In Nigeria, despite its natural endowment of 267 billion cubic meters of surface water and 52 billion cubic meters of groundwater annually, the country faces substantial challenges in managing water resources. These challenges are exacerbated by rapid urbanization, uneven water distribution, pollution, and the impact of climate change (Nwankwoala, 2020). The situation is particularly dire in the

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North West, where unpredictable climatic conditions and low rainfall contribute to severe water insecurity (Ogunbode & Ifa, 2022), in (Boniface, Adamu & Adamu, 2024).

Kano state is the second high populated state in Nigeria and is face with high demand for water which the supply for that water is inadequate. As such, the demand do not meet the supply (Nura, 2014), in (Auwal et al,2021) This study is therefore conducted with the aim of identifying the impact of water vending on household water supply within Kano Metropolis with the view of suggesting lasting solutions to the problem.

The demand and supply of clean Water in Kano State is at disequilibrium position as the state do not have the capacity to provide the water adequately to the growing population. According to available data, the Kano state faces a significant water deficit, with a total water demand exceeding the supply by a large margin,; Water demand rises to 400 million liters per day as at 2022 (News Agency of Nigeria, 2022. Figure 1 gives the summary of both the available demand and supply of water within the State.

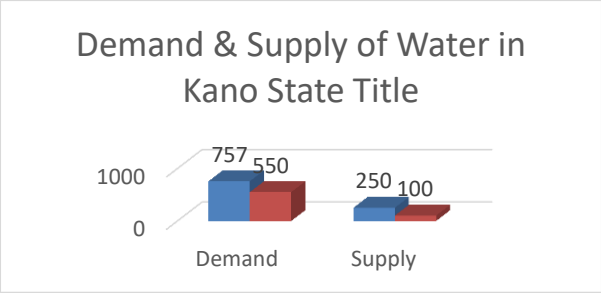

Fig. 1: Demand and Supply of Water in Kano State

Source: Kano State Ministry of Water Resources, 2022

From the figure 1, kano metropolitan demand for water is 757 (mld/bld) while the supply for water in that metropolitan city is 250 (mld). This means there is a deficit of 507 (mld) water to meet the demand of the people in that area. The high demand of water in Kano metropolitan area are likely due to high population, industrial settings and commercial activities. Since the government cannot meet the demand of clean water supply, this problem is partly address through private water supply like the water vendors but more expensive to the government supply. The figure also shows that in the rest of kano, the demand for water is 550 (mld/bld) while the supply of water is 350 (mld). This indicates that there is 957 (mld) deficit of water need to be supplied to the rest of kano to meet it demand.

In spite of the efforts of these governments and relevant donor agencies in addressing this pressing need of the people all over the world, there is still much to be desired. The system of water supply in Kano is traditionally oriented, local and outdated equipment are still in used for water supply. Similarly, the existing infrastructural facilities used for water supply are not maintained regularly and erratic power supply to run the machinery for better supply. Other factors that led to deficit supply of portable water within the metropolis include rural - urban migration, ongoing banditry in the neighboring states, rapid infrastructure development, urban industrialization, social development and population increase across the state. To cover this deficit in water provision by public utilities in the state, alternative suppliers exist such as Non-State Water Providers (NSPs) including both formal and informal local private providers popularly known as *pure water* factories and water vendors respectively. Historically, water vending is an old practice in Kano metropolitan. The activities of these vendors are more evident in Dala LGA (one of the selected case study) which has been home to a large number of water vendors in *Dandinshe* area called *Duniyar Yangaruwa* (that is, water vendors' world) (Ahmad, 2016). Thus far, few studies have been carried out to examine the effectiveness of water supply by private sectors in Kano metropolitan except the works of Ahmad (2016) who focused on Dala LGA of Kano State. Therefore, this study investigates the impact of water vending on household water supply within Kano Metropolis.

2. Literature Review

2.1 Conceptual Definitions

The Concept of Water

Water is a transparent, tasteless, and odorless inorganic compound with the chemical formula H_20. The clean liquid that has no color, smell, that falls from the clouds as rain, that forms streams, lakes, and seas, and that is used for drinking, washing etc (Britannica dictionary,1771)

Potable Water

Potable water as defined by Aizawa and Magara (2008), in (Boniface, Adamu & Adamu, 2024), as the quality of water that is suitable for human consumption with health-related chemicals and microbiological constituents, with suitable aesthetic and organ genic characteristics, and usable for all normal domestic purposes, including personal hygiene.

Water Supply

Houghton (2004) defines water supply as a process or activity by which water is provided for use. Robinson and Davidson (2006) defines water supply as obtaining and distribution of water to a town or community. Once the water is provided to the point of consumption, is called potable water.

Water Vending

According to Olajuyibe *et al.* (2012) in (Boniface, Adamu & Adamu, 2024), defines water vending as the practice of selling purified or treated water to the consumers through different means such as water vending machine, water kiosks, shops etc. The water vending can be classified into wholesale vendors, distributing vendors, and direct vendors. Some of the obstacles facing the vendors are poor water availability, distances in getting the water (sources), poor roads network to transport the water to consumer among others.

Concept of Metropolis

A metropolis is a large, busy city that's important to the cultural and economic identity of a region. It's often the capital city of a country or region. Kano metropolis is the area covered by eight local governments (Dala, Fagge, Gwale, Kumbotso, Munincipal, Nassarawa, Tarauni and Ungogo) and

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the total population the area was over 3 million (Census, 2006). Currently, the population of the area is estimated at about 10, million people. Water demand for the Kano metropolitan area was estimated at 450, million litres per day of which only 33674018 liters was supplied daily (FOS 2008).

Currently, Kano state government has plans to provide 750, miliion litres of water daily to meet the growing needs of residents in the metropolitan city. To achieve this target, the state had invested over N 1 billion in acquiring ten high capacity water pumps for the Tamburawa and Challawa water treatment plants (Daily Post, 2025).

Water scarcity

Water scarcity is a situation where there is not enough water for all uses, whether agricultural, industrial or domestic. Water scarcity is a situation in which the resource is less than 1,000m3 per year per person. Kano is one of the fastest growing cities in Nigeria with over 11 million people (2006 census). As a result, access to water resources for irrigation and safe water supply to urban and rural areas is one of the major expectations of the people of Kano, despite the endowed water resources. As at 2010, about 45% of its population had access to safe water source. On the average, 50% of the households in Kano State have access to safe water source during the periods highlighted (Tsauni, 2012).

A study of 500 residential water users conducted in Kano metropolis revealed that 71.8% of households have no access to pipe-borne water. By implication, only 27.3% had adequate pipe-borne water supply. Majority of households in Kano, therefore, depend on other sources of water like bore-hole water (18.09%), well water (30.69%) and vendors (51.22%) (Ali, 2010). Although there are improvements in the government effort to increase the water production capacity, available evidence revealed that, a quite number of major towns, even though, in the metropolis could not have access to safe water. Hence, water scarcity nonetheless, has been a critical challenge for the future of Kano.

2.2 Theoretical Framework

Informal Economy Theory

Water vending is often analyzed through the lens of the informal economy, which refers to economic activities operating outside formal regulations and institutional frameworks. In 1972 an ILO Employment mission to Kenya first analyzed economic activities outside the formal economy using the term" informal sector" which had been coined by economist Keith Hart. Keith Hart's work on informal economies in developing nations underscores how marginalized groups create livelihoods through unregulated markets.

Informal systems emerge when formal institutions (e.g., government utilities) fail to meet basic needs. In Nigeria, weak public water infrastructure and governance gaps force communities to rely on informal vendors to fill service voids. This theory, popularized by Garrett Hardin, argues that shared resources (e.g., public water systems) are overused and degraded when access is unregulated. When public water systems are poorly managed or underfunded, users turn to alternative sources (e.g., water vendors). In Nigeria, over-extraction of groundwater by vendors or pollution of public water sources can exacerbate scarcity, perpetuating reliance on vended water.

2.3 Empirical Review

Bala et al. (2021) explores the intersection of climate change and the water vending industry in Maiduguri, Nigeria. The study found that water vending has become a major livelihood strategy for many in Maiduguri, particularly for low – income households. Water vending is a significant source of income for many families, especially women and youth. However, the cost of water from vendors is often higher than from public sources placing a financial burden on already vulnerable population. The study found that vendors face difficulties in accessing reliable water sources due to climate induced scarcity. The cost of transportation and equipment e.g. (jerry cans, trucks) has increased, reducing profit margins

Oluwasanya et al., (2011), Studied Water Vending in Urban Nigeria: A Case Study of Lagos. His findings shows Water vending is prevalent in Lagos due to inadequate public water supply. Vendors source water from boreholes, wells, and tanker trucks. Prices are significantly higher than piped water, with low-income households spending up to 20% of their income on water .Quality control is weak, with risks of contamination during storage and transportation. The findings Highlights the need for improved public water infrastructure and regulation of informal vendors.

Adeniyi et al, (2018)**,** studied the Economics of Water Vending in Nigeria: A Case Study of Abuja, his findings shows that Water vending is a lucrative business, with vendors earning significant profits, especially during dry seasons. The study further shows that high costs of vended water disproportionately affect low-income households, exacerbating poverty. Vendors often lack access to formal financial systems, limiting their ability to expand operations.

Nwachukwu et al., (2017), studied Quality Assessment of Vended Water in Port Harcourt, Nigeria. His findings shows that Water samples from vendors often fail to meet WHO quality standards due to contamination during storage and transportation. High levels of coliform bacteria and chemical pollutants were detected, posing health risks to consumers. Lack of regulation and oversight contributes to poor water quality. The study emphasizes the need for stricter regulation and monitoring of vended water to protect public health.

Danjuma et al., (2020), Studied Governance of Informal Water Markets in Nigeria: A Case Study of Kano. The outcome of the research shows that Informal water markets thrive due to weak governance and underfunding of public water utilities. The study further believed that Vendors operate with little to no regulation, leading to price gouging and inconsistent quality. Integrating informal vendors into formal systems could improve service delivery and accountability.

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3. Methodology

3.1 Data and Sources

Data was sourced primarily with the aid of a structured questionnaire and secondary data from published works, reports and electronically retrievable sources.

3.2 Population and Sample of the study

The population of this study composed of the entire residences of four local Government Area of Kano Metropolitan. However, the population was divided into two distinct groups. The demand side, which constitutes all the residential water users and the supply side, covers the water supply agents (vendors). A sample of 500 households was drawn using stratified random sampling procedure

Table 1: Distribution of Questionnaires

Areas	No. of Questionnaire	percentages
Dala	120	24 %
Kano Municipal	105	21 %
Kumbotso	80	16 %
Tarauni	70	14 %
Fagge	125	25
Total	500	100 %

Sources: Author's fieldwork 2025

3.3Technique of Data Analysis

Both descriptive and regression methods were employed in analyzing the data collected.

3.4 Model Specification

Since the paper intends to investigate impact of water vending on households water supply Delivery, it is assumed therefore, that Household Water Supply (HWSD) is a function of Household's Residential Water Demand (HRWD) + Volume of Water Supplied by Tap (VWST) + Volume of Water obtained from other Sources (VWOS) + Price of Water (WP) from other sources)

Thus:

HWS

$= f(HRWD, VWST, VWOS, PW) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$

Meanwhile, the stated function is expressed in econometric form capable of analyzing causal - effect relationship between household water supply and other variables below:

$HWS =$

$f\ (\alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 +$

$\mu \ldots\ldots\ldots\ldots \quad (2)$

Where:

$\alpha =$ Constant term

X_1 = households residential water demand

X_2 = volume of water supplied by tap

X_3 = volume of water obtained through other source

X_4 = price of water generated from other sources

β1, β2, β3 and β4 are the unknown parameters

μ = error term

The priori expectation is that: β1, β2, β3 &β4 > 0

Where μ is the error term,

4. Result and Discussions

4.1 Descriptive Analysis

Table 2: Respondent's Income per day

Level of income	Number of Respondents	Percentages
Less than 1000	150	30.42%
1000 – 2000	250	50.70 %
2000 – 3000	60	12.17 %
More than 3000	33	6.69 %
Total	493	100 %

Sources: Author's fieldwork 2025

Almost half of the respondents on table 3 had the daily income ranging from 1000 – 2000 (50.70%) 30.42% of the respondents earn between N1 to N1000 and only 12.17% earned an income between N2000 -3000 per day. This was in line with the educational levels as well as nature of the occupations of the respondents.

Table 3: Other Sources of Water to the Respondents

Sources of water	No of respondents	Percentages
Well	151	30.62 %
Boreholes	89	18.06 %
Water Vendors	253	51.32
Total	493	100 %

Sources: Author's fieldwork 2025

Water supply from well (30.69%); boreholes (18.09); and water vendors (51.22%), constitute the major sources of domestic water supply in Kano metropolis and the least comparative proportion is accessed from tap source.

Table 4: Daily Water Demand of the respondents

Daily water demand	No. of respondents	Percentages
1-5 jerry cane	82	16.63 %
6 – 10	219	44.51 %
	192	39.02 %
Total	493	100 %

Sources: Author's fieldwork 2025

From table 4, more than 44% of the respondents used 126 to 250 liters of water daily for domestic purposes. Further, 52.68% of their demand for water depends on their family sizes, availability of toilet facilities, number of rooms, and recreational facilities. While 24.59% relates their water

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demand to water prices, 22.36% of the respondents opined that, it is the level of income that determines their water demand.

Table 5: Price of Water per Jerry Cane

Prices	No. of respondents	Percentages
50	105	21.29 %
75	305	63.94 %
100	68	14.26 %
Total	477	100 %

Sources: Author's fieldwork 2025

Respondents from the study area had to pay varying amount of money as prices of water from other sources. Majority of them pay N75 per jerry cane (N0.8 per liter) of water-to-water vendors. Exactly 21.8% of the respondents pay N50 per jerry cane (0.6 per liter) and 14.26% pay N100 per jerry cane. While water tariff on tap water ranges from N400 to N600 per month, this constitutes the views of 95%

Table 6: Reasons for Price variation of vended water

factors responsible for price fluctuations across the season	**No of respondents**	**Percentages**
Higher demand for water by households	120	24.43 %
Shortage of supply at the vendors purchasing point	170	34.48
Distance from vendors purchase points to supply points	110	22.31
Other specify	93	18.86
Total	**493**	**100 %**

Sources: Author's fieldwork 2025

Table 6, shows what causes the price fluctuations across the season higher of water by the household constitute 24.43% while others constitute 18.86%. This indicated that the high demand of water by the household causes the price fluctuations. Similarly, some residents located far away from the water point as such water vendors travelled long distances hence price tend to be a little bit high than those located close to water points. Sometimes, especially in the rainy season the vendors tend to be scarce because they travel to their respective villages for farming activities and therefore, the price of vended water may increase because the demand is high and the supply is limited

Table 7: Frequency of purchasing Water from vendors by the residents in the study area

Amount of water purchase from Vendors	Number of Respondents	Percentages
Daily	250	50.70 %
Weekly	80	16.22 %
Twice Weekly	90	18.25 %
Trice Weekly	73	14.80 %
Total	493	100 %

Sources: Author's fieldwork 2025

Table 7, shows how frequent in buying water from vendors where daily buying constitute 50.70% while trice weekly constitute 18.25%. This indicated that the majority of water use on a daily basis is buying every day from the vendors. This is so because they cannot afford to buy much due to economic constraints and they do not have storage facilities to store water.

Table 8: Respondents' Daily Spending on Water from other Sources

Amount Spends	No. Respondents	Percentages
Less than 500	86	17.48 %
500 – 1000	202	40.97 %
1100 – 1500	198	40.24 %
More than 1500	07	01.42 %
Total	493	100 %

Sources: Author's fieldwork 2025

On daily water spending, it was discovered from the result that, despite their levels of income, more than 81% of the respondents spend between N500 to N1500 on portable water used in their houses. Precisely eighty-six respondents (17.48%) spend less than N500 on water daily and only seven people (1.42%) spends more than N1500, respectively.

Table 9: Causes of Water Scarcity in the Study Area

Causes	No. Respondents	Percentages
Poor infrastructures	219	44.88 %
Mismanagement of water resources	109	22.34 %
Environmental pollution	34	6.96 %
High population growth	110	22.54 %
High agricultural demand	17	03.48 %
Total	488	100 %

Sources: Author's fieldwork 2025

A large proportion of the respondents (44.88%) table 9, blame the use of poor infrastructure as the cause of water scarcity in Kano metropolis, 22.34% revealed mismanagement of water resources as the cause of the severe shortages in the area. Other causes include environmental pollution, high population growth and high agricultural demand as shown in the analysis.

Table 10: Ways to Improve Water Supply in the Area

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Ways	No. Respondents	Percentages
Provision of good/adequate infrastructures	346	70.33 %
Policy implementation on water laws	75	15.24 %
Control of urban industrial pollution	35	7.11 %
Involving poor in water decisions	37	7.50 %
Total	493	100 %

Sources: Author's fieldwork 2025

In order to improve water supply in Kano metropolis, 70.33% of the respondents on table 10, maintained that provision of adequate and up to date infrastructures, and others recommend effective implementation of water laws, control of urban pollution and involving poor in urban water decisions.

4.2 Regression Results and Analysis

Table 11: Regression Results

Variables	Coefficients	S.E	t values	Prob	F stat	DW	R^2	R^{-2}
C	-218.0850	18.25198	-1.25198	0.0000				
HRWD	6.091637	2.817497	2.162074	0.0324				
WP	-3.200423	2.492023	-.284267	0.2013	544.1654	1.534671	0.944	0.942
VWS	13.26456	2.940586	4.510856	0.0000				
VWST	11.24026	1.116963	10.06323	0.0000				

Source: Authors' Computation using E views 5.1:2025

It can be observed from the regression results that, 3 out of the 4 Repressors i.e. Households residential water demand (HRWD), Volume of water supplied by tap (VWST), Volume of Water obtained from other Sources (VWOS) have their hypothesized signs. Further, the variables were found to be significant in view of their t-values (2.16, 4.51 and 10.06 respectively) and p-values (0.03, 0.00 and 0.00 respectively). Therefore, HRWD, VWST and VWS are the major determinants of Households spending on portable water supply. While the price of water obtained from other sources (WP) was found be statistically insignificant. This means that Households residential water demand, volume of water supplied by tap, volume of water obtained from other sources have direct positive relationship with household's water supply by vendors. In contrast, a unit change in WP leads to decrease in household's water supply by vendors by 3.2, but it does not mean decrease in water consumption. With the decrease in water supply by vendors, households result to other means that do not require committing expenditure, but effort to fetch where necessary.The implication of this finding is that almost 80% of the parameters were found to be the key determinants households' water supply delivery by vendors in Kano metropolis. This finding is consistent with that of Renwick and Archibald (1998) and Millock (2007), and is also in line with the t Public Choice Theory. The findings equally pointed out that variation in households' water supply delivery by vendors in Kano metropolis results from changes in the explanatory variables.

5. Conclusion and Policy Recommendations

Households in Kano metropolis have been spending huge amount of money to get access to portable drinking water. The water supply by vendors in the study area depends on households' residential water demand, volume of water supplied by tap and volume of water obtained from other sources. Water price did not necessarily affecting the amount of water to be consumed, as household's device other means to have their water needs met. However, in the process, significant working and study hours were lost leading to falling productivity and education standard, and good health conditions compromised. In spite of the commitment of over N1.5 billion monthly on water supply from 2023 to date, which improved the water production capacity in Kano state, something was found to be going wrong somewhere as over 60% of the people of Kano metropolis, especially the poor have no access to the water.

Based on the findings, the study made the following recommendations:

i. The provision of adequate and updated water infrastructures or facilities as most of them are out dated, ensuring judicious implementations of water laws, soliciting cooperation of water users in managing the resource, and ensuring proper maintenance of the water infrastructure.

ii. There is a need for policies to regulate the water vending industry, ensure fair pricing, and provide support to vendors.

iii. The study also suggests that formalizing the water vending industry could help regulate prices, improve service quality, and provide vendors with better access to resources and support.

iv. To reduce dependence on water vending, the research recommends that there is a need for significant investment in public water

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infrastructure to ensure reliable and affordable water supply.

v. Providing training, financial support, and access to better equipment could help vendors improve their operations and profitability.

vi. Educating consumers about water conservation and the importance of using safe water sources can help reduce the demand for vended water and improve public health**.**

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