SELF HELP WATER SOURCES, EFFECTS, & THE RENTAL HOUSING VALUE IN THE RAIN FOREST REGION, EVIDENCE FROM ENUGU CITY.

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Abstract
The study aimed to examine the self-help water supply sources in the rainforest region of Enugu. The research objectives were to determine the component factors of self-help water sources, identify the devastating effects on the residents, and determine the impact of self-help water sources on the rental housing value in the city. Based on an empirical approach, this study analyzed a questionnaire survey of 400 households in the town using descriptive statistics and the T-test with the aid of SPSS. The percentage mean score shows that the water vendor was the first component factor of self-help water supply in the study area. Other identified factors include wells, rainwater, and spring water. The high cost of buying water, long distance to water sources, poor hygiene, water-related disease, stress and anxiety, time consumption, and risk of accidents are some of the identified devastating effects of using self-help water sources in the city. Findings also show some houses do not have well-sourced self-help water. Based on the independent t2*-test statistical result (t2 value = 0.573, X = significant level = 0.05 at p > 0.05), the self-help water supply sources do not affect the rental value of any housing in the various densities in the city. Water is a necessary basic housing amenity; therefore, every house should provide a good source of self-help water supply especially the well sources, and measures to harvest water, particularly during the rainy period. A Conservation programme for sustainable water supply is essential.*

Keyword: Self-help water sources, effects, households, rental value, sustainable water.

1.0: Introduction

Water scarcity has been a global issue, especially during dry seasons, characterized by water crises (Lawal and Basorun, 2015). In developing countries, particularly in Nigeria, inadequate access to water is a major challenge (Rathnayaka et al., 2016), and a sustainable supply of adequate water is vital for human well-being, effective functioning of households, productivity, and economic development (Cosgrove and Loucks, 2015; Guarino, 2017).

In Africa, traditional water sources are heavily relied upon for domestic water supply, affecting households' access to water through time and distance and the direct and indirect costs individuals bear in their pursuit of water. Access to water is about the availability, distance, time, and the direct and indirect costs to get water (Alaci et al., 2013). Water is very essential for sustaining life, societies, and the environment. However, the problem of water shortages relative to demand is prevalent in most of the urban areas in Africa. Reports indicate that 40% of Africans lack improved water supply, and in 2004, over 20.7% of African countries had less than 50% of their population access to potable water (Eneh and Eneh 2014). The lack of access to safe water exacerbates poverty and leads to health issues

and economic crises in Africa. These health issues related to poor sanitation account for 50% of hospital bed occupancy and 12% of the health budget (WHO/UNICEF, 2017). The water supply crisis is worse in Nigeria and some low-developing countries (Chukwurah, 2018).

Water is a basic housing and city infrastructure, but these basic amenities have suffered for a long time in Nigeria and other low-developing countries, the SDG 6 goal of which is to provide all domestic water needs by 2030. Despite the significance of water, a natural resource made available in its abundance in the country, it is underutilized, and negligence is continuing to undermine the socio-economic development of Nigeria (Odume and Slaughter, 2017; Independent, 2018; Oyebode et al, 2015; Oyebande, 1978).

In Nigeria, the public water sector is responsible for providing water to households, businesses, institutions, and industries; however, many cities, particularly Enugu, which is the capital city of Enugu State, have not enjoyed an adequate water supply since their inception (Chukwurah, 2018). The inhabitants of the town have resorted to alternative sources of water supply. The problem of water supply in Enugu started with the development of the city. In those early days, the older part of Enugu, which includes Aria Layout, the Colliery Layout (Udi siding), and Hill Top, had a water reservoir, which is the Iva Valley scheme that produces about five million gallons of capacity. The reservoir serves the population till the new scheme starts developing; however, Enugu State Water Corporation faces impediments in providing a regular potable water supply to the Enugu metropolis. Water supply development is not commensurate with the population growth of Enugu. Water scarcity has been a serious problem to the extent that few households occasionally experience running tap water; the majority of the households in the city, like the Trans-Ekulu area, are not included in the water supply scheme, while houses in some parts of the city are out of the water supply and distribution scheme.

Currently, there is no running tap water in most of the buildings, including residential houses, in Enugu. Water is a basic necessity for life, household survival, and the effective functioning of man's existence. Water is an essential commodity for every developmental activity in the city and development sustainability. The severe water crisis in Enugu has forced individuals and households to find alternative means of water supply, which could be polluted water sources (Udeze, 1998) for their survival and day-to-day running. Udeze (1998) noted that the importance attached to the use of water in various households covers a wide range of domestic activities, ranging from drinking to cooking, bathing, toiletries, and

cleaning drains and the total surrounding. Lack of access to water hinders the smooth running of daily livelihoods in homes and sanitation. Climate change, which results in floods and deforestation, increases water pollution and causes a shortage of water supply (Obuka et al., 2022). Water scarcity has affected various households and the environment. For instance, WHO/UNICEF (2019) bolstered that inadequate access to safe water exacerbates poverty, leads to health challenges, and economic crises in Sub-Saharan Africa.

Many households in the city spend time getting water from other sources, including the danger of crossing, and some households spend lots of money to purchase water for both drinking and domestic activities like washing clothes and plates, among others. Poor funding and damaged infrastructure could be some of the causes of water shortage (Egbo et.al., 2022). The problem of water scarcity in Nigerian cities in Enugu has been a matter of concern.

Though studies have focused on water scarcity in Enugu, no significant changes have occurred. For instance, Utsev et al. (2012) considered water shortages and health problems in Benue State; Tasiu (2019) studied the challenges and consequences of water scarcity in Jigawa State; and Chakkaravarthy and Balakrishnan (2019) focused on the causes of water scarcity and economic water scarcity, respectively, which is a lack of investment in infrastructure or technology.

Previous studies, such as Chukwurah (2018), have examined the challenges and prospects of water supply in Enugu; others have examined water management and sustainable development in Nigeria (Onuh & Bassey, 2021) and the health effects of domestic water supply in Osogbo, Osun State, Nigeria (Fadare and Olawuni, 2008). Although these studies provide insight into water scarcity, only a few focus on Enugu, and no detailed study has qualitatively and quantitatively examined the self-help water supply sources and the devastating effect on the households in the study area. Considering the necessity of water supply, which is also a basic household infrastructure, and the recurring challenges of water scarcity and the problems associated with the self-help water supply Enugu is currently witnessing, there is an urgent need to examine the chief sources and effects of water supply; hence the need for this study to fill the gap and examine the self-help water supply sources and the devastating effects in Enugu. The specific objectives were (1) to examine the self-help water supply sources in Enugu metropolis, (2) to determine the devastating effects of self-help water supply, and (3) to determine the influence of self-help water supply sources on the rentage value of housing in Enugu, Nigeria. The study provides baseline information on self-help water supply

sources and the devastating effects on various households, which is vital for water infrastructural planning and housing development in the city and for further research on this subject. Its findings are crucial to contribute to the existing knowledge that would advance strategic policy formation towards making adequate access to quality water supply available for the social and economic development of the city. Finally, it also analyzed the implications of water scarcity to provide insight into other infrastructures that require more attention for the wellbeing of the people and development in the rain forest region, Nigeria, and beyond.

Studies done by Chakkaravarthy and Balakrishnan (2019) reveal that water scarcity is one of the greatest challenges of the twenty-first century, which is caused by overpopulation, improper government policies, and lack of investment in infrastructure and technology to draw water from rivers, aquifers, or other water sources to meet the water demand. Utsev et al. (2012) opined that water shortages and health problems in Benue State, Nigeria, indicated that water shortages in the communities were attributed to population increases and decreases in well capacity. Gusikit (2014) posited that population growth, as one of the drivers of water scarcity, results in an increase in water for food production and household uses. Utsev et al.'s (2012) study identified some of the effects of water shortages, like drought, low crop yield, and some waterborne diseases, which endanger species, including human life. Water scarcity hampers household productivity, and effort is expended in searching for water, which could negatively affect economic development at both the household and community levels. According to the World Health Organisation (WHO), between 50 and 100 litres of water per person per day are needed to ensure that most basic needs are met and few health concerns arise. In the USA, Europe, and Asia, the human need for portable water has not been completely met.

Chukwurah (2018). Studies on the measures to be employed to reduce water scarcity in Nigeria and mitigate its effects were done by Guskit (2014). The study revealed rainwater harvesting, water resources management, and artificial water recharge as ways of mitigating the impacts of water scarcity. Chidozie and John (2018) agree with this notion that rainwater harvesting reduces the demand for water tankers, thereby reducing the price of water and expenses of residents on the purchase of water from water vendors.

On the contrary, Okeke (2015) stated that means of mitigating the effects of water scarcity on residents include hand-dug wells and water vendor patronage. Garg (2011) asserted that groundwater harvesting consists of wells, cisterns, and aquifers, and can be used to store

water and ensure supply to residents. However, a study by Egbo et al. (2022) opined that harvesting portable water through infiltration technology from freshwater bodies can quell the perennial water scarcity in the area.

2.0 Study Area

Enugu is the study area. It is located between 6^0 27^1N and 7^0 29^1 E. Enugu has an area of about 73 square kilometers. It sits about 223 meters above sea level. Enugu is bound in the south by the River Nyaba and in the north by Amaoji Agu-Nike, and towards the west it is bound by Obiagu. Enugu falls within the equatorial belt, with temperature, rainfall, and seasons indicating a tropical rainforest. Enugu consists of about six built-up areas divided by streams, valleys, and the railroads, which cut a great swath through the middle of the town. Enugu has about twenty-two (22) distinct neighborhoods that may be categorized as low, medium, and high-density zones. It is pertinent to note that the housing types are typical of a dense area. For example, tenants' buildings dominate and are characteristic of high-density locations such as Ogui New Layout and Obiagu neighborhoods, while blocks of flats are prevalent in New Heaven and Achara Layouts.

In low-density areas, bungalows and duplexes are common. Geologically, the town lies in the eastern Nigeria sedimentary basin, covered by Enugu shales, lower coal measure (Mamu formation), and false bedded sandstone (Ajalli formation). The topographical features are classified into three, namely the escarpment zone, the plains, and the lowlands of the Cross River Basin.

3.0 MATERIALS AND METHODS

Research Methodology

This study employed a survey research design. primary sources of data were deployed for data collection. The research population was drawn from the three residential neighborhoods in Enugu urban, and the study population comprises various households' residents who lived in the city. The sample size for the study was determined using the Taro Yamane formula.

X = N / 1 + Ne.
Where X = sample size;
N = population of the study;
e2 = level of significance or error factor, which is a = 0.052 to obtain a sample size of 400 respondents for the study. Enugu was stratified into low, medium, and high-density areas. A simple random sampling technique was employed to select the respondents from the nine neighborhoods in the study area. The study was analytic since the stated hypothesis was to determine the influence of self-help water supply sources on the rent age value of housing in the study area. About 400 questionnaires were randomly distributed to the various households in the three densities, which include independence layout, Maryland, and

Abakpa, representing the low, medium, and high residential densities, respectively. However, only 300 questionnaires were successfully retrieved, which represents 75% of the 400 administered, which is valid, for built-environment survey response rates which vary between 7% and 40% (Moyo and Crafford, 2010; John-Nsa, 2021).

Data was collected mainly from primary and secondary sources. The primary data was collected with a structured questionnaire and oral interview. The questionnaire was purposively administered to households' heads, males and females, in the various density areas during the morning and evening periods between 8 am-10 am and 4 pm - 6 pm on Saturdays. The questionnaire administration was done within 2 months, from the 10th of February to the 5th of April, by 3 of the researchers with 3 student assistants. The questionnaire consisted of three sections. Section A consisted of open-ended questions concerning the self-help water supply sources in the neighbourhoods. Section B contained four Likert scale items presented as structured questions on the devastating effects of self-help water supply sources extracted from the literature. Section C consisted of open-ended questions regarding the influence of a self-help (well) water supply on the rental value of a 3-bedroom flat paid annually.

The research examines the annual cost of a three-bedroom flat for low, medium, and high-density residents with or without the well sources of self-help water provided in the residential housing. Data were analysed using descriptive and inferential statistics such as SPSS 25 version, frequency tables, charts, and independent T2 tests, respectively. The Independent Sample T2-Test was used to examine whether there is a significant difference in the rental housing values with or without well water sources in the study area.

4.0 Data Analyses and Result

The Self-help Sources of Water Supply in Enugu City

Table 1 shows the self-help sources of water supply in Enugu, based on the survey results from the respondents. The study revealed water vendors, rainwater, wells, and streams. The analysis shows that water vendors are the major drivers of self-help water supply, with about 46%, 51%, and 57% for high, medium, and low density, respectively, in the study area. The analysis also shows the level of usage of other self-help sources of water. About 15% of the respondents in high-density areas source water from rainwater, compared to 10% and 8% in medium and low-density areas, respectively. While some 28%, 39%, and 35% of the respondents in the high, medium, and low density, respectively, get water from shallow wells, which most often dries up during the dry

season. More so, in high-density areas, only about 11% of household residents source water from springs/streams, particularly during the rainy seasons.

Table 1. Responses on the Self-help sources of water supply

Source of water	High density	Medium density	Low density
Water vendors	46 %	51%	57%
Rain water	15%	10%	8%
Well	28%	39%	35%
Stream/ spring	11%	-	-
Total	100	100	100

Source: researchers survey, 2024.

Devastating Effects of Self-help water supply sources in Enugu Metropolis

The study made some further interesting revelations, as presented in Table 2**.** The study, as seen in Table 2, shows the devastating effects of self-help water supply sources in various households in the rainforest region. The analysis shows that high costs of water expenditure are experienced by 23% of residents living in high-density, 45% in medium-density, and about 58% of residents in low-density areas. Therefore, residents in low and medium-density areas spend more money to purchase water than residents in high areas. It is seen that the low-density areas spend more money than other densities in terms of water purchase. The effect of water-related disease can be seen to be experienced mostly by residents in high densities, with a percentage of 8%. This is because the purchasing power of the residents is low, and the majority of them rely on untreated stream waters and shallow wells as sources of water for carrying out household chores and drinking most of the time. The poor hygiene effect of water scarcity affects 21%, 25%, and 18% of residents in high, medium, and low densities, respectively. Some respondents stated that the water is managed, and as a result, toilets are not being flushed properly, and a minimal amount of water is used in bathing and doing house chores. The issue of being prone to accidents in the course of getting water is seen to affect 5% and 12% of high and medium-density residents only. Residents of Maryland are being affected by this issue more than other states, due to the narrowness of some roads and fast-moving vehicles. People who managed to purchase water from water vendors are faced with the issue of crossing busy roads and walking along the narrow ways with heavy gallons of water on their heads or multiple gallons of water in wheelbarrows. Furthermore, the analysis shows that in high-density areas such as Abakpa, 20%

of residents have to walk long distances to be able to get water for use; about 8% and 6% of residents in medium and low-density areas, for example, Maryland and Independence Layout, trek long distances to get water. Finally, the analysis revealed that about 9% of the respondents living in the low-density area experience stress and anxiety, while 17% and 12.3% of residents living in high and medium-density areas experience stress while looking for water.

Table 2: Responses on the effects of water scarcity in Enugu city

Effects of water scarcity	High density (Abakpa)		Medium density (Maryland)		Low density (Independence Layout)		Total	
	Freq.(n =134)	100%	Freq.(n =134)	100%	Freq.(n =132)	100%	Freq. n=400	100%
High expenditure on water purchase	38	23	49	35	78	58	155	40.4
Long distance to water source	24	20	10	8	8	6	42	13.2
Prone Water related disease	7	8	5	4	4	3	26	5.6
Poor hygiene / sanitation	27	21	33	25	22	17	82	22
Risk of accidents	11	5	15	12	0	0	16	4.8
Stress and anxiety related to water availability	21	17	16	12.3	12	9	46	11.2
Time consuming	6	5	6	5	0	0	12	4
Total	134	100	134	100	132	100	390	100

Source: Field survey, 2024.

SPSS RESULT

Independent Sample T-Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
cost of rent	Equal variances assumed	4.000	.116	.612	4	.573	1.000	1.633	-3.534	5.534
	Equal variances not assumed			.612	2.560	.590	1.000	1.633	-4.741	6.741

Another important revelation from this study is that self-help water sources do not influence the rental value of housing in the study area. see the independent T- test result in table 3.

The quantitative result shows that rental values for 3 bedroom flats housing provided with and without well source of self-help water supply is not significantly different as the p value = 0.573 and significant level= 0.05. The p value >0.05, therefore the null hypothesis was accepted which states that there is no significant difference between rental values of housing provided with and without well source of self-help water supply in Enugu. Findings therefore revealed that the housing rental values are not affected by the presence or absence of self-help water supply.

5.0 Discussion

Water vendors, wells, rain, and spring water were the self-help sources of water available for households in Enugu. The study shows a descriptive analysis indicating that households from the three densities, such as high density, middle density, and low-density areas, get about 46%, 51%, and 57% of their self-help water sources from water vendors. The analysis shows that water vendors are one of the major sources of self-help water supply in the study area. Eventually, every household buys water for domestic use. This finding corroborates the assertion of Eneh and Nnaji (2021), Ugwuoti (2019), and Okeke (2015), who revealed that water scarcity results in increased spending on mobile water supplies. The study also discovered rainwater as one of the sources of self-help water supply, though in minute percentages of 15%, 10%, and 8% of residents in high, medium, and low density, respectively, during the rainy season. Surveys from the respondents show that water collected during the rainy seasons and occasional rainfall during the dry season is stored in tanks and serves as a source of self-help water supply. Further observations revealed that houses that utilize rainwater have big tanks connected to their rooftops through funnels and are stored for use in the early periods of dry seasons.

The rainwater source helps to reduce the amount of money spent on water. This finding is consistent with Guskit (2014) and Chidozie and John (2018), discovering that rainwater harvesting reduces the demand for water vendors, thereby reducing the price of water and expenses of residents on the purchase of water. Hand-dug well water is also an available self-help source of water supply. However, it was discovered that the wells are shallow and not every household has access to a well in their residence, even though about 41% of residents in Enugu City source their water from shallow wells. The well water serves as one of the self-help sources of water supply during the rainy season because the majority of the wells dry up during the dry season.

This finding supports Garg (2011) opinion that well water can serve as an alternative means of water supply, and groundwater harvesting,

which consists of wells, can also be used to store water. Streams/spring water, popularly known as Miri-Ani in the area, is also identified as one of the self-help sources of water supply. However, analyses from the respondents' survey shown that only about 11% of residents from the high-density area in Enugu use stream/spring water as their source. Further observations show that the spring water is polluted, as it serves as a dumping site for refuse, which could be very harmful for use, and the distance to this source is not close to the residents. This finding supports Chukwurah (2018), who stressed that stream/spring water is one of the available sources of water supply in Enugu.

Findings from the respondents' survey show that high expenditure on water purchase, long distance to water sources, prone water-related diseases, poor hygiene/sanitation, risk of accidents, stress and anxiety related to water availability, and time consumption are some of the major devastating effects of self-help sources of water supply which result from water scarcity in Enugu. The study analysis (see table 1) shows that almost all the households purchase water for their day-to-day existence and household functioning. The 11% of residents from the high-density area that sometimes rely on stream/spring sources trek a long distance to get the stream/spring water. Opinions from the survey of the respondents show that self-help water supply has devastating effects on hygiene and sanitation, particularly in the high-density area. People who trek to water sources spend quality time and suffer the risk of accidents. This finding supports the opinion of Ugwu (2022) that a shortage of water supply in Enugu could have some negative effects on the residents, such as the high cost of purchasing water, long distance to water sources, water-related diseases, and other factors. Surprisingly, this study revealed that self-help water supply sources, particularly the hand-dug well, do not affect the rental value of the residential housing in the various densities. The respondents' survey of the annual rental values of 3-bedroom flat residential housing provided with well-sourced water supplies and houses provided without any source of well water in the low, medium and high density. The result shows that the range of rent for a three-bedroom flat with a provided supply hand-dug well of a self-help source of water ranges from 850000 to 450000, while the range of rent for a three-bedroom flat without a hand-dug well of a self-help source of water supply in Enugu metropolis is also between 850000 and 400000.

6.0 Conclusion

The study revealed four noted sources of self-help water supply and seven (7) devastating effects of self-help water supply sources in the various households in Enugu. An important implication of the findings is linked to the

awareness of the self-help water supply sources in Enugu, which may be similar to other parts of the city in the rainforest region in Nigeria and other Sub-Saharan African countries. This finding implies that the state water corporation has been moribund for years, and individuals have resorted to self-help water sources for survival. Considering the devastating effects of water scarcity and its necessity for human existence and development. It is therefore, important that the government should derive a lasting measure to put an end to water scarcity in the city through some of the following ways: the government, as a matter of policy, should rehabilitate the public water supply systems, ensure adequate funding and monitoring, and revamp the dilapidated water infrastructure across the city.

Also, the federal and state governments, alongside the non-governmental agency and the water cooperation agency in Enugu State, should work together to achieve the rehabilitation and redevelopment of the water supply distribution networks and supply systems in every part of the city. Efforts should strive towards harnessing spring and stream water sources like Miri-Ani, instead of allowing them to become dumping sites**.** The survey of the respondents and the quantitative analysis show that the rental values of residential houses are not affected by the presence or absence of a hand-dug well or self-help water supply. The finding implies that the cost of renting residential houses does not depend on the self-help water sources, even though water supply should be a basic amenity. Therefore, the government, as a matter of policy, should also ensure that every house gets connected to the rehabilitated water supply scheme and that every household and sector, such as commercial, institutional, and industrial buildings, make provisions for water conservation through rainwater harvesting and many others. The study is apt and significant as no known research has focused on the issues addressed in this paper in the study area in the rainforest region. The current study is limited to self-help sources of water supply and the devastating effects in Enugu. Further study on rehabilitating the public water supply system and its sustainability should be considered in detail.

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