



Journal of Applied Sciences

ISSN 1812-5654

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Research Article

The Impacts of Changing Water Price on Consumer Demand: A Case Study of Nsukka, Enugu State, Nigeria

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Abstract

Background and Objective: Water is an essential commodity to life. Economists most of the time claim that an increase in price always leads to a decrease in demand. This research is aimed at finding out the impacts of changing water price on consumer demand by using Nsukka as a case study. **Materials and Methods:** A statistical sampling approach was used in conducting and sharing the questionnaires within the scope of study. Physical observations and field trips were used in addition to the questionnaires to acquire more data for the study. The Midpoint formula for calculating price elasticity was used in calculating the price elasticity of water demand. The target population was the residents of Nsukka that buy water and the water vendors. **Results:** The results gotten from the questionnaire showed that the price of water changes due to a variety of reasons like the season of the year, the proximity from the source of water to where it is been supplied, festive periods, etc. The law of demand does not seem to apply here in some months of the year, as it was seen that despite an increase in price the demand also increased or remained the same, and vice versa. This means that price has little impact on the demand for water in Nsukka. **Conclusion:** The price elasticity of water demand for the year was gotten to be 0.89. This value which is less than 1, implied that the demand for water in Nsukka is inelastic which means that despite the changes in price the demand for water remains the same because there is no substitute for water.

Key words: Impact, changing, water price, consumer demand, price elasticity

Citation: Cordelia Nnennaya Mama. The impacts of changing water price on consumer demand: a case study of Nsukka, Enugu state, Nigeria. J. Applied Sci., 20: 166-172.

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

The importance of water for sustenance of life, whether it is in use for running our homes, rearing animals and growing crops in our farms or the increased uses in industry, remain immeasurable. It can be seen in recent times that the demand for water has increased at a considerable rate whereas the water resources are been depleted due to the effects of global warming, industrialization and population growth, etc. Nations of the world are beginning to look into the issue of sustaining water resources for the ever increasing population. Water is an essential resource in the production of most types of goods and services including food, energy and manufacturing¹.

Water supply (in terms of quantity and quality) at the place where the user needs it, must be reliable and predictable to support financially sustainable investments in economic activities. Around the world, human activity and natural forces are reducing available water resources. Although public awareness of the need to better manage and protect water has grown over the last decade, economic criteria and political considerations still tend to drive water policy at all levels. Water use has been increasing as the global population has risen over the last century. This has minor effect in industrialized nations because of their low birth rates but will keep on escalating in developed nations having higher water consumption rate¹⁻³.

There is serious demand on water resources in virtually all dimensions. These are aggravated by climate change and variations in natural conditions. Each of them has its own specific impact, usually directly on ecosystems and in turn on water resources⁴.

Effective demand management is now the focus of leading water policy worldwide. This is in recognition not only of the detrimental environmental impacts of increasing water diversions, but also of the cost involved in large scale projects such as desalination; dams and conduits. Leading policy-makers are now turning their attention to improving efficiency before increasing supplies. A variety of mechanisms are being implemented to achieve effective demand management, and these are education and public awareness, water restrictions, sustainable building design and pricing⁵.

Nsukka is a local government in Enugu state comprising of several communities, which makes the availability of steady water supply a necessity. The government-provided-water-services is not enough for the increasing population, thereby making members of the community to seek out other means of getting water. This leads to the issue of the price at which these water services cost.

This study is important because, it will help the government know the amount people in the community pay for water services and how the increase or decrease in the price affects their demand. The information gotten from this study will bring about awareness to improve water services in communities in Nsukka so, that in the nearby future, members of the community won't suffer lack of water especially with the issues of global warming. Hence, the main aim of this project is to find out the impacts of changing water price on consumer demand.

MATERIALS AND METHODS

Study area: This field study was carried out in Nsukka, which is a town and Local Government Area in Enugu state, in Southeastern Nigeria (Fig. 1) from January-December, 2018. Towns that share a common border with Nsukka are Eha Alumona, Edem, Alor-uno, Opi (archaeological site), Orba and Ede-Oballa, Obukpa, Obimo. Other nearby towns includes Enugu-Ezike, Ibagwa, Ovoko, Iheaka, Obollo-Afor (formerly centre of the palm oil trade), Nimbo, Adani, Uzo Uwani and Nkpologwu, now also lay claim to the name Nsukka⁶.

The climate of Nsukka is tropical. The average temperature is 24.9°C. The average annual rainfall is 1579 mm. A wet season is experienced from April to October with the wettest month being June. Also, a dry season is experienced from November to March with the driest month in January, with 10 mm of rain. In September, the precipitation reaches its peak; with an average of 299 mm. March is the warmest month of the year. The temperature in March averages⁷ 27.0°C. The random number tables were used in the distribution of questionnaires to various areas in Nsukka (made up of residents of Nsukka town that buy water), while a particular number was randomly given to water vendors in the chosen areas⁸⁻¹⁴, resulting in Table 1 and 2. One hundred copies of the questionnaires for the residents that buy water were printed and distributed, while 20 were given to water vendors in the selected areas. A random number table is a series of digits (0-9) arranged randomly in rows and columns. There are two features of a table of random digits. The first being that every digit from 0-9 is just likely to appear in every entry of the table. The second feature is that the entries are independent of each other.

Data analysis and presentation techniques: The research made use of statistical tools for analyzing of the data collected from the field. Descriptive statistics was used because it allows

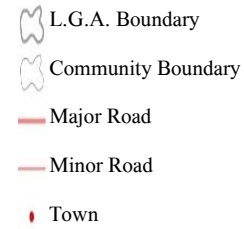


Table 2: Random number table used to assign numbers to selected communities in Nsukka for questionnaire purpose

Selected communities in Nsukka	Assigned random number
Lejja	5
Obimo	20
Ajuona	12
Onuiyi	10
Odin	10
Barracks	2
Ofulonu	7
Nguru	1
Eha-Alumona	15
Orba	9
Ejuona Obukpa	8
Ohodo	19
Nru	4
Iheagu	14
Edem Ani	11

of scores or measurements by the elasticity of water demand was midpoint formula for elasticity.

For this study, the price elasticity of water demand will be calculated using the Midpoint method^{6,15-19}. The price elasticity is calculated to know how the people respond to a change in price. It is mathematically expressed as:

$$PED = \frac{\text{Change in Quantity demand (\%)}}{\text{Change in price (\%)}} \quad (1)$$

$$\text{Change in quantity demand (\%)} = \frac{\text{New quantity (Q2)} - \text{Initial quantity (Q1)}}{\text{Initial quantity}} \times 100 \quad (2)$$

$$\text{Change in price} = \frac{\text{New price (P2)} - \text{Initial price (P1)}}{\text{Initial price}} \times 100 \quad (3)$$

$$PED = \frac{\Delta Q}{\Delta P} \times \frac{P1}{Q1} \quad (4)$$

RESULTS AND DISCUSSION

Questionnaires: Questionnaires (comprised of open ended and structured questions on the issues that are related to the research) printed and given out to residents that buy water in the selected areas of Nsukka and another prepared and distributed to the water vendors in the selected areas, the results are shown in Table 3.

From Table 3, according to Mugenda and Mugenda²¹, a response rate of 50% is adequate for data analysis and

Table 3: Response of the questionnaires

Respondents	No. of planned Questionnaires	The response	The response rate (%)
Residents	100	87	87
Water vendors	20	17	85
Total	120	104	86

reporting, 60% is good and 70% is very good. For this research the response was above 50% which is good for data analysis.

Questionnaire type one: response from the residents: The response from the residents were collected and due to the bulkiness of the data, the average values for the water price and demand were calculated to represent the variations in water price and demand over a year for residents in Nsukka (Fig. 2).

From the clustered chart, it can be seen that there are various responses to change in price with respect to demand in the different months of the year. This is basically a representation of the data gotten from the questionnaires given to the residents, it can be seen in some months that despite the increase in price, their demand did not reduce, this can be due to the season in which the price increased. It is common knowledge that in dry season there is more consumption of water for drinking, domestic uses and irrigation purposes, etc. So it doesn't matter what price the water is been sold for, demand for it will most likely remain the

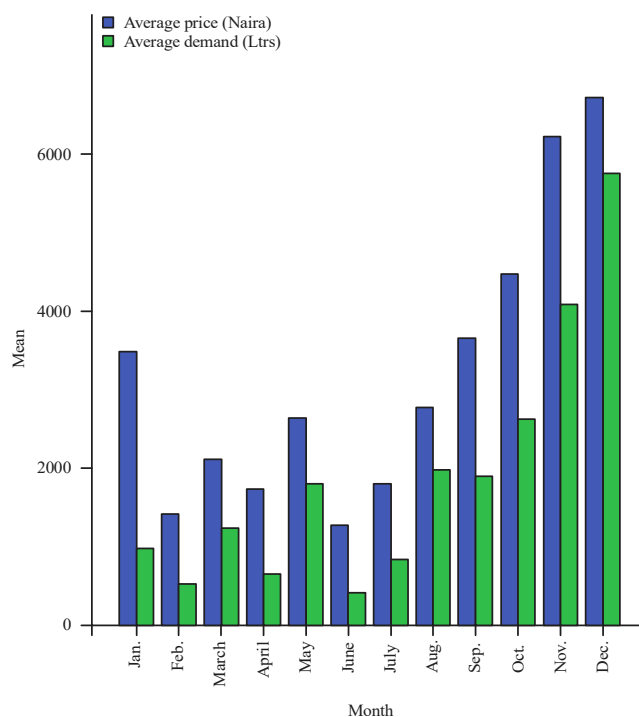


Fig. 2: Variations in water price and demand

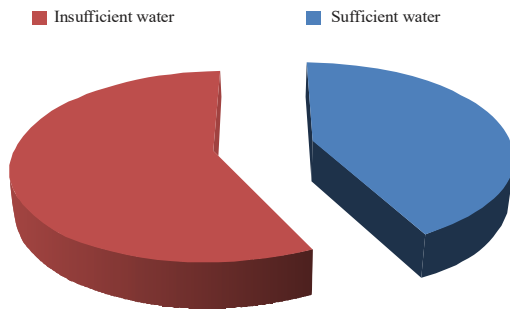


Fig. 3: Water Consumption Sufficiency

same or increase. This also goes for festive seasons, Nsukka being a LGA comprising of several communities, there will be an increase in the population because natives of these villages who live in other states and countries will come back to be with their family during the festive period. This increase in population also means an increase in water consumption and for residents that buy water, it means they have to spend more on water at an increased rate.

Questionnaire type two: response from water vendors: The response from questionnaire type two followed the same trend as questionnaire type one. The water vendors are also residents of Nsukka and they also buy the water they sell to other residents. The price they buy water changes in different months of the year, same as the price they sell.

Water consumption sufficiency: This is the result gotten from observation (field survey). In addition to the questionnaires, it was necessary to find out if these water services been bought were actually sufficient for the residents. The pie chart (Fig. 3) above showed the number of people that buy water and the water is sufficient for their daily or monthly consumption and those that have insufficient water. It can be seen that a majority of the population do not have sufficient water for their household, this showed the neglect on the part of the government. There is no way a city as big as Nsukka can fully function without adequate water resources. A majority of the residents have become accustomed to paying for water services and see borehole as a luxury and this should not be so.

Price elasticity of water demand: Price elasticity of water demand is a measure of the degree of change in water demand to the change in price of water²²⁻²⁶. It can be elastic (greater than one) which means with a change in price there is a high change in demand, unitary (equal to one) which

means with a change in price there is an equal change in demand or inelastic (less than one) which means with a change in price there is a low change in demand. Usually, price elasticity of demand is elastic (greater than one)²²⁻²⁶, but for some commodities which have few substitutes it will be inelastic (less than one). The results gotten from questionnaire type one (Fig. 2) was used to determine the price elasticity. Since, there are values from January to December, the values that were used for this calculation were the ones for January (beginning of the year) and June (middle of the month).

Initial quantity (Q1)	=	1000 ltrs
New quantity (Q2)	=	440 ltrs
Initial price (P1)	=	₦3,500
New price (P2)	=	₦1,300

$$\Delta Q = Q2 - Q1 = 440 - 1000 = -560 \text{ ltrs}$$

$$\Delta P = P2 - P1 = ₦1,300 - ₦3,500 = - ₦2,200$$

$$PED = \frac{560}{2200} \times \frac{3500}{1000} = 0.89 \quad [5]$$

$$PED = 0.89$$

Thus, price elasticity of water demand is 0.89 (Eq. 5). This value is less than one which means it is inelastic. This implies that water is an inelastic commodity, there is no substitute for water, so no matter the price at which water is put at, it will still be sought for.

Significance statement: This study discover that the demand for water in Nsukka is inelastic, which means that despite the changes in price the demand for water remains the same, that can be beneficial for planning and managing the water resources of the area. This study will help the researcher to uncover the critical areas of population growth and economic management that many researchers were not able to explore. Thus a new theory on these environmental factors and possibly other combinations may be arrived at.

CONCLUSION

The results gotten from the questionnaire showed that the price of water changes due to a variety of reasons like the season of the year, the proximity from the source of water to where it is been supplied, festive periods, etc. The law of demand does not seem to apply here in some months of the year, as it was seen that despite an increase in price the

demand also increased or remained the same and vice versa. This means that price has little impact on the demand for water in Nsukka. The price elasticity of water demand for the year was gotten to be 0.89. This value which is less than 1, implied that the demand for water in Nsukka is inelastic which means that despite the changes in price the demand for water remains the same because there is no substitute for water.

RECOMMENDATIONS

It is recommended that Nsukka local government together with Enugu state government should look into the water production plant and work on it in order to provide a centralized water supply system for the community at large. Also, a uniform tariff can be placed for all residents for the provision of water supply and this tariff can be used to maintain the water production plant and also to sustain and ensure the availability of water all year round.

ACKNOWLEDGMENT

The author thanks immensely Miss L.N. Nnagboro for helping to carry out this research.

REFERENCES

1. WWAP., 2015. The United Nations World Water Development Report 2015: Water for a Sustainable World. UNESCO Publishing, Paris, France, ISBN-13: 9789231000713, Pages: 122.
2. Ezenwaji, E.E., B.M. Eduputa and J.E. Ogbuozobe, 2015. Employing water demand management option for the improvement of water supply and sanitation in Nigeria. *J. Water Resour. Prot.*, 7: 624-635.
3. Ezeokpube, N.D. and C.J. Obiora, 2014. Level of sachet water consumption in Nsukka Urban, Enugu state, Nigeria. *IOSR J. Hum. Soc. Sci.*, 19: 26-30.
4. Okello, C., B. Tomasello, N. Greggio, N. Wambiji and M. Antonellini, 2015. Impact of population growth and climate change on the freshwater resources of Lamu Island, Kenya. *Water*, 7: 1264-1290.
5. Danya, B. and B. Gidon, 2009. Best practices in domestic water demand management. Friends of the Earth Middle East. http://ecopeaceme.org/uploads/publications_public106_1.pdf.
6. Ezeokpube, N.D., C.J. Obiora and P.O. Phil-Eze, 2014. Environmental problems of sachet water waste disposal in Nsukka urban, Enugu State, Nigeria. *Civil Environ. Res.*, 6: 105-113.
7. Ugwuishiwu, B.O., J.C. Nwodo and E.A. Echiegu, 2016. Municipal solid waste characterization in nsukka urban in south east Nigeria. *Trans. Rev.*, 24: 808-815.
8. Yaya, J.A., 2014. A comprehensive guide to research methodology (Part 1): Tips for sampling and sample techniques. Ph.D. Thesis, Babcock University, Ilishan Remo, Ogun State, Nigeria.
9. Zohrabi, M., 2013. Mixed method research: Instruments, validity, reliability and reporting findings. *Theory Pract. Lang. Stud.*, 3: 254-262.
10. Popoola, S.O., 2011. Research methodologies in library and information science. Proceedings of the Training Workshop on Building Research Capacity for Library and Information Science Professionals, September 18-22, 2011, Organized by the Nigerian Library Association, Ogun State Chapter, Covenant University, Ota, Nigeria.
11. Mama, C.N., P.I. Obe, C.C. Nnaji, K.G. Odo, K.O. Alumona, I.A. Yakubu and F.O. Okechukwu, 2018. An investigation into drainage failures: A case study of university of Nigeria, Nsukka. *Asian J. Water Environ. Pollut.*, 15: 115-123.
12. Akinade, E.A. and T. Owolabi, 2009. Research Methods: A Pragmatic Approach for Social Sciences, Behavioural Sciences and Education. Connel Publications, Lagos.
13. Adedokun, J.A., 2003. Basics of Research Methodology. New Hope Publisher, Sagamu.
14. Adeniyi, A.L., A.O. Oyekanmi and M.O. Tijani, 2011. Essentials of Business Research Methods. CSS Bookshops Limited, Lagos.
15. Mann, P.C. and P.R. LeFrancois, 1983. Trends in the real price off water. *J. Am. Water Works Assoc.*, 75: 441-443.
16. Srouji, H., 2017. The Impact of Residential Water Price Increases and Subsidy Reductions on Elasticity of Demand in Abu Dhabi city. Master's Thesis, Harvard Extension School, Harvard University, USA.
17. Gaudin S., 2006. Effect of price information on residential water demand. *Appl. Econ.*, 38: 383-393.
18. Kanayo, O., U. Ezebuilo and O. Maurice, 2013. Estimating the willingness to pay for water services in Nsukka Area of South-Eastern Nigeria Using Contingent Valuation Method (CVM): Implications for sustainable development. *J. Hum. Ecol.*, 41: 93-106.
19. Nataraj, S., 1995. Do residential water consumers react to price increases? Evidence from a natural experiment in Santa Cruz. Giannini Foundation of Agricultural Economics, University of California, pp: 9-11.
20. Nzeadibe T.C., 2009. Development drivers of waste recycling in Nsukka urban area, Southeastern Nigeria. *Theor. Empir. Res. Urban Manag.*, 3: 137-149.

21. Mugenda, O.M. and A.G. Mugenda, 1999. Research Methods: Quantitative and Qualitative Approaches. Acts Press, Nairobi.
22. Brent, D.A., 2014. Estimating water demand elasticity at the intensive and extensive margin: The role of landscape dynamics. Working Paper, October 2014. https://www.lsu.edu/business/economics/files/Brent_JobMarketPaper.pdf.
23. Ezenwaji, E.E., B.M. Eduputa and C.O. Okoye, 2016. Investigations into the residential water demand and supply in Enugu Metropolitan area, Nigeria. Am. J. Water Resour., 4: 22-29.
24. Howe, C.H., 2005. The functions, impacts and effectiveness of water pricing: Evidence from the United States and Canada. Int. J. Water Resour. Dev., 21: 43-53.
25. Kramer, L., 2018. How does the law of supply and demand affect prices? <https://www.investopedia.com/ask/answers/033115/how-does-law-supply-and-demand-affect-prices.asp>.
26. Millerd, F.W., 1984. The role of pricing in managing the demand for water. Can. Water Resour. J., 9: 7-16.