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# Household water demand in the peri-urban communities of Awka, Capital of Anambra State, Nigeria

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**The aim of this paper is to determine relevant factors contributing to the water demand in the peri-urban communities of Awka capital city. Towards achieving this aim, questionnaire were developed and served on the households in various communities to collect relevant data on the 13 physical and socio-economic factors we earlier identified as influencing water demand in the area. Water quality was ascertained through microbiological analysis of water samples. The major analytical techniques used were multiple correlations, the result of which was subjected to Principal Component Analysis (PCA) and Principal Component Regression. Result shows that the 13 variables combined to contribute 90.0% of water demand in the area. Furthermore, the low standard error of estimates of 0.029 litres shows that water demand in the communities could be predicted using the 13 variables. Policy and planning measures to improve the water supply situation of the area were suggested.**

**Key words:** Capital, communities, factors, peri-urban, water demand.

## INTRODUCTION

The problem of increasing water demand relative to supply in urban areas of Nigeria has for decades engaged the attention of researchers (Oyebande, 1976; Mabogunje, 1980; Ayoade 1984; Ibeziakor, 1985; Anyadike and Ibeziako, 1987; Ezenwaji, 2009). Regrettably, however, authors in the area have paid scanty attention in examining water demand relative to supply in the peri-urban areas. This has almost always resulted in faulty estimations of urban water supply in most Nigerian urban areas as supply meant for the built up areas are often extended to the surrounding settlements. The result has mostly been that neither the main urban centres nor their immediate surrounding regions receive enough to satisfy their minimum demand. The consequence has been the much experienced long period of dry taps in those areas. To solve this problem, residents of such areas have resorted to fetching and buying water from water sources of doubtful quality with the dire consequence of being afflicted with water-borne diseases.

This problem informed the recent decision of governments to delineate certain space around the new capital cities as special areas for physical and socio-economic development with the main objective of checking and indeed controlling unmitigated physical development of such areas in order to establish sustainable urban environment. The Federal Military Government of Nigeria had in this regard designated an area of about 8,000sq km in the north central part of Nigeria in 1979 as the Federal Capital Territory (FCT) (Binbol and Uzochukwu, 2007). This move by the Federal Government

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encouraged the then newly created States (between 1976 and 1996) to demarcate areas 10km radius from the centre of their respective capital cities as capital territories. Anambra State which was created on the 27th August, 1991 is one of such States that has designated an area (10km radius) from the centre of its capital city as the capital territory. However, unlike the Federal Capital Territory that has been functional since creation, the capital territories in quite a good number of States are merely on paper as no serious physical and socio-economic development have taken place since their pronouncements. In Anambra State, the only reminder of that pronouncement is the relics of boundary pillars erected at that time indicating the geographical extent of the territory. Numerous workers had earlier alerted the State Government, and the affected Local Government Areas as well as planners on the consequences of rapid urbanization of the area presently under the Awka Capital Territory and the need for a controlled development (Okoye, 1979; Akabudu, 2002; Ibeke, 2008). Unfortunately, none of the recommendations of these researchers was taken into consideration by the past governments of the State. The result is that the peri-urban segment of Awka City is now fast being engulfed by unplanned urbanization making planned development of physical infrastructure including water supply difficult. Such areas as Okpuno, Amansea, Abagana, Enugwu-Ukwu, Nawfia, Nibo, Isiagu, Nise, Mbaukwu, Mgbakwu, Umuawulu etc are all showing deep signs of urbanization considering the high rate of their population increase and housing development. One of the consequences of this unprepared urbanization of these areas is lack of basic urban infrastructure; chief among them is the perennial lack of potable water supply. Ogbukagu (1986) recommended that the future planning of a public water supply scheme in the area should take into account the development of certain water bodies. However, he estimated the water supply in the area for 1989 to be 53,347,128 litres per day using the per capita consumption level of 60 litres per day and the 1989 projected population of 780,546. This study was followed by numerous others with most of them concentrating on the examination of quality level of the water bodies in the area (Emejulu et al., 1994; Ibezue, 2005) but the study of the effect of physical and environmental factors to the water demand of the area has been relatively scanty. This is because we are quite aware that there are a range of these factors which affect water demand in the area. Such factors include – the population of the town, number of water using establishments, number of households, income of heads of households, number of schools in the area, average cost of water supply etc.

This paper, therefore, seeks to determine the relevant factors contributing to water demand of Awka Capital Territory with a view to developing a model that could be employed for estimating the present level of demand and predicting the future water requirements that can meet the expectations of the on-going rapid urbanization of the area.

## MATERIALS AND METHODS

### Study area

Awka Capital Territory is located in the eastern part of Anambra State and covers the whole of Awka South Local Government and some parts of Awka North, Dunukofia, Njikoka and Anaocha Local Government Areas (Figure 1). The area is bounded by Latitudes $6^0$.07 and $6^0$.17N and Longitudes $7^0$.00E and 7.10E, and made up of 26 communities distributed among the aforementioned Local Government Areas as follows: Awka South (9), Awka North (4), Dunukofia (2) Njikoka (6) and finally Anaocha (5). It covers an area of approximately 560sqkm with a 2006 Population of 549,136 persons (NPC, 2006). The topography of the area comprises the western uplands with the highest point of 800m located in Enugwu-Ukwu and Abagana, while the eastern lowlands are seen around the Mamu plains of Ezinato and Amansea, as well as northwards in Mgbakwu and Urum, Ebenebe and other communities of Awka North Local Government Area. Geologically, over 80% of the area consists of Imo shale group of lower Eocene era while a small band of Nanka sands is seen in the western parts of the area (Orajiaka, 1975; Ogbukagu, 1986). Climatologically, records show that the mean annual rainfall of the area is about 1524mm with a relative humidity of 80% at dawn with rainfall concentrating from April to October (Muoghalu and Okonkwo, 1998). Rivers that drain the area are Haba, Obizi and Obibia Rivers in the South, Obizi Okpuno River in the North, Idemili River in the South and Mamu River in the East.

### Sample selection

A total of 24 out of 26 communities in the Capital Territory were used for the study. The two communities which were not used are Awka and Amawbia that are wholly urbanized.

### Data collection and analysis

Data were collected for this work from the area for a period of 3 months (April to June, 2010). The collection was achieved by interviews, questionnaires, field observations and water sample analysis. The sampling method adopted is the stratified random sampling in which every community is a strata while households where sampled randomly within the strata using random numbers collected from the statistical table. These formed the primary data, while literature from published sources formed the secondary data. A total of 13 physical and socio-economic parameters influencing water demand in the area was identified (Table 1). They were defined and parametized mainly by identifying and adding up the number of times a particular variable occurred in the study area in the year 2012 (Table 2). Total water demand and supply for the area was calculated using the per capita demand and supply figures of each community and its 2006 Population (Table 3). For data analysis, we employed the statistical techniques such as multiple correlations to establish relationships among variables and Principal Component Analysis (PCA) to remove severe autocorrelation found in the data so as to produce orthogonal results that are stable and reliable for further analysis. The loadings that appear in various components under PCA analysis were used as explanation variables for the performance of Multiple Linear Regressions to produce a model which is known as the Principal Component Regression (PCR). This model is highly recommended when multicollinearity exists in data as we observed.

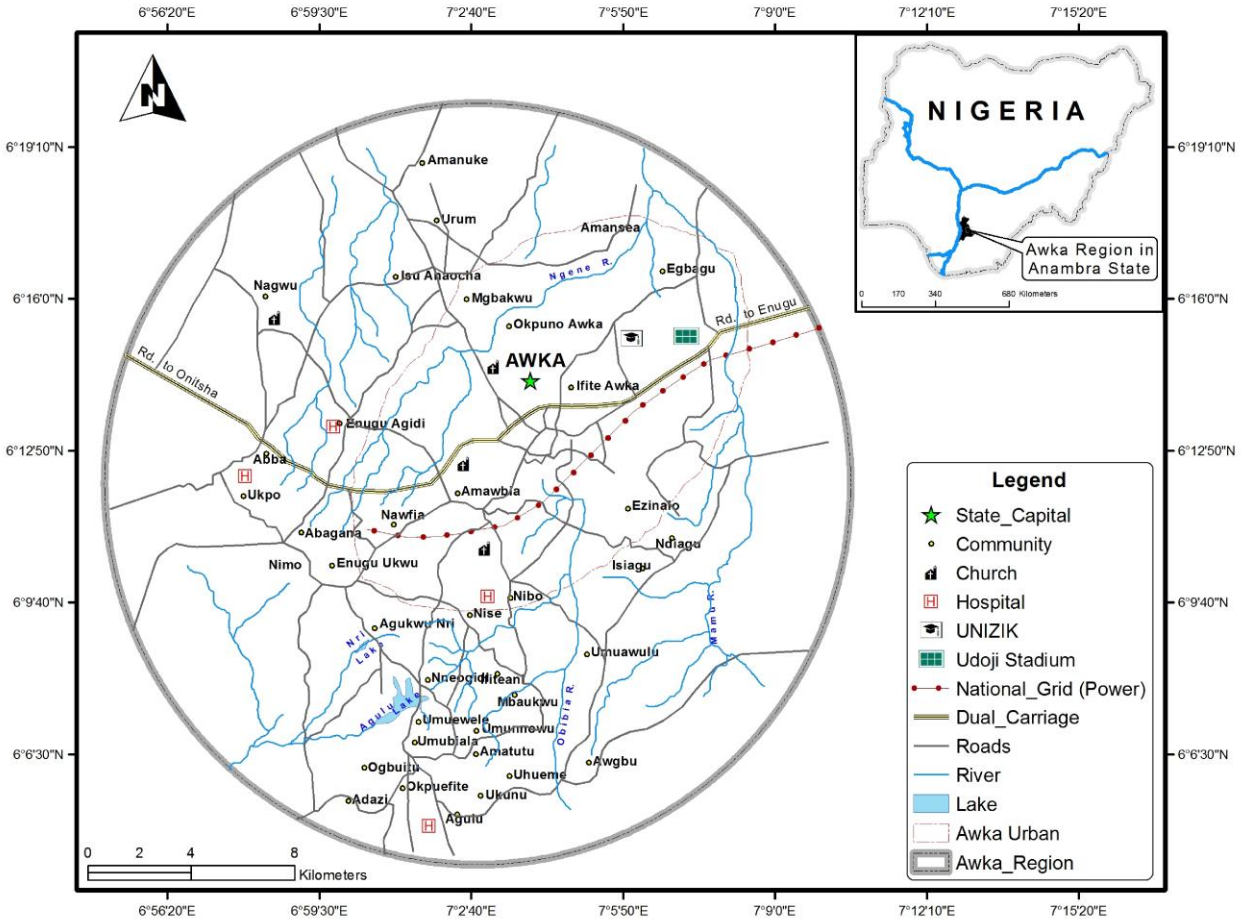


**Figure 1.** Map of Awka capital territory showing various peri-urban communities.

The PCR method produces estimates which have smaller mean square errors compared to the estimates produced by the ordinary least square method. All the statistical analysis was carried out using the SPSS program ran with PC/Windows 2003. Membrane filtration and pour plate were employed to enumerate the total coliform count.

## RESULTS AND DISCUSSION

The result shows that the area has a mean water demand of 79.3litres per capita per day (LCD), and the mean water supply of 43.1lcd. These figures are by far less than the Federal Government recommended minimum of 115LCD, by 35.7 LCD and 71.5LCD respectively. This, however, indicates the low social and economic development of the area. Furthermore, the total quantity of water demand in the area is 33,669, 974litres per day (LD) while the total supply is 16,457,749LD which reflects 48.9% of the demand. Water supply achieved a high percentage of demand in Ezinato (90%), Amansea (87%), Urum (83%), Isuaniocha (80%), Umuawulu (72%) and Nimo (70%), four of these communities namely Ezinato, Amansea, Urum and Isuaniocha are located in the Mamu plain, an area with so many streams and rivers, while Nimo and Umuawulu located on the Awka-Orlu upland achieved the level of water supply ascribed to them because of large presence of springs in their respective locations.

The relationship between 13 physical, socio-economic factors associated with water demand in the area was established with the Pearson's Moment Correlation Technique. The result of this analysis (not shown) indicates that there are serial autocorrelation with some variables showing strong significant positive correlation while others exhibit negative correlation. This problem was solved with the application of Principal Component Analysis (PCA) to the data which was later rotated with varimax technique which reduced the factors into parsimonious number of clearly defined orthogonal ones that can explain the variations in the observed data matrix. The outcome of this

**Table 1.** Physical and Socio-Economic factors influencing water demand in peri-urban Communities of Awka Capital of Anambra State.

| S/NO | Variable label | Variable description |
|---|---|---|
| 1. | POPU | 2005 Population of the community |
| 2. | NUMB | Number of water using industrial establishments in the community |
| 3. | COMM | Number of water using commercial establishments in the area |
| 4. | HOLD | Number of households in the community |
| 5. | HEAD | Number of heads of households with school certificate and above in the community |
| 6. | CERT | Number of heads of households without school certificate |
| 7. | BELO | Number of persons below the age of 15 years in the community |
| 8. | ABOV | Number of persons above the age of 15 years in the community |
| 9. | DIST | Average distance from the community source of water |
| 10. | HOSP | Number of hospitals in the community |
| 11. | SCHL | Number of schools in the community |
| 12. | BIOL | Biological quality of major source of surface water in the community |
| 13. | COST | Average cost of water supply in the community |

Source: fieldwork 2012.

statistical calculation was the emergence of five components shown in Table 4 which collectively account for 84.1% of water demand in the area.

Further analysis was done with the extraction of Component Defining Variables (CDV) from each component. The resultant five variables namely HOLD (Component I), HOSP (Component II), POPU (Component III), DIST (Component IV), and SCHL (Component V) were used as explanatory variables for the Multiple Regression Analysis. The resultant Principal Component Regression Model is written as follows:

$$Y(AMT) = 8.284 + 4.124\,(HEAD) + 1.642\,(HOSP) + 2.113\,(POPU) + 3.214\,(DIST) + 1.401\,(SCHL). \quad (1)$$

The summary of the result is shown in Table 5.

Table 5 shows that the level of variation in water demand in the study area is 90.0%. This means that the sum of individual contributions of the 5 variables explained 90.0% of the variations in water demand in the area. The 10% unexplained by the model is low meaning that the model is a good predictor of water demand in area. The Standard Error of the Estimates (SEE) for this regression is 0.029 litres per community, showing that the estimation of water demand in the component communities of the study area will be fairly predicted using the 13 variables.

## Policy and planning implications

From our findings, only 48.9% of water supply in the study area satisfies demand, meaning that 51.1% of the balance are sourced by the inhabitants of these communities from unconventional sources of doubtful quality. This has the unpleasant consequences which include the affliction of the large population of the area with water-borne and water related diseases, high cost of water supply measured in monetary terms and huge individual energy losses expanded in fetching water. Added to these is the high number of children that are involved in water related accidents. These problems will guide the future policy direction for solving the water scarcity of the area. The policy framework for water supply in this area will, therefore, emphasize the extension of water infrastructure from the core urban area to these peri-urban communities of the capital territory. The reorganization of the now moribund State Water Corporation which is expected to be renamed State Urban Water Asset Holding Corporation (SUWAHC) should be accelerated. When SUWAHC is established, it should be given specified and defined responsibilities regarding adequate supply of water to the peri-urban areas of the capital territory. Consumers in individual communities should be meant to participate effectively in water supply planning and maintenance of water supply infrastructure in the area. Each of these communities should in this way be made to take effective ownership of water supply and facilities in their areas. Furthermore, all consumers in each community who are to be supplied from the urban water source should be encouraged to form Water Consumers Association (WCA). Such an association should also have adequate representation from government, of women and where possible the youth of the affected communities together with equitable representation of consumers from component wards which exist in the communities.

With this policy measure, water supply in the peri-urban communities will undoubtedly increase from the present supply level of 43.1LCD to a level that will reduce the existing huge supply-demand gap. A close examination of the daily water demand and supply data (Table 3) reveals

**Table 2.** Parametized data of the factors affecting water demand in Awka Capital of Anambra State.

| S/NO | Community | Variables | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | POPU | NUMB | COMM | HOLD | HEAD | CERT | BELO | ABOV | DIST (KM) | HOSP | SCHL | BIOL cfu/100ml | COST (₦) |
| 1. | Abba | 12,273 | 2 | 1 | 1,534 | 721 | 813 | 6,382 | 5891 | 1.0 | 3 | 4 | 162 | 10.00 |
| 2. | Enugwu-Agidi | 15,183 | 3 | 1 | 1,898 | 432 | 1466 | 7,895 | 7,288 | 0.5 | 2 | 5 | 189 | 10.00 |
| 3. | Nawfia | 8,037 | 2 | 1 | 1,005 | 620 | 385 | 4,179 | 3,858 | 0.4 | 4 | 5 | 203 | 8.00 |
| 4. | Abagana | 39,206 | 6 | 5 | 4,900 | 2144 | 2,756 | 26,387 | 18,819 | 0.5 | 6 | 9 | 108 | 10.00 |
| 5. | Nimo | 34,011 | 4 | 2 | 4,251 | 1063 | 3,188 | 17,685 | 16,326 | 1.0 | 4 | 6 | 270 | 10.00 |
| 6. | Enugwu-Ukwu | 56,743 | 8 | 4 | 7,093 | 2,948 | 4,145 | 29,506 | 27,237 | 1.2 | 7 | 10 | 211 | 10.00 |
| 7. | Isiagu | 4,335 | 0 | 0 | 542 | 69 | 473 | 2,254 | 2,081 | 0.5 | 0 | 2 | 301 | 5.00 |
| 8. | Ezinato | 1,300 | 0 | 0 | 163 | 27 | 136 | 671 | 624 | 0.2 | 0 | 2 | 314 | 5.00 |
| 9. | Umuawulu | 9,382 | 1 | 2 | 1,173 | 679 | 479 | 4,878 | 4,504 | 0.1 | 2 | 5 | 208 | 5.00 |
| 10. | Mbaukwu | 19,322 | 1 | 1 | 2,415 | 833 | 1582 | 10,047 | 9275 | 0.5 | 4 | 6 | 216 | 10.00 |
| 11. | Nibo | 23,292 | 4 | 5 | 2,915 | 902 | 2013 | 12,112 | 11,180 | 0.5 | 6 | 6 | 197 | 10.00 |
| 12. | Nise | 14,481 | 2 | 3 | 1,810 | 710 | 1100 | 7,530 | 6951 | 1.2 | 4 | 4 | 211 | 5.00 |
| 13. | Okpuno | 4,624 | 2 | 6 | 578 | 101 | 477 | 2404 | 2220 | 1.6 | 2 | 4 | 217 | 10.00 |
| 14. | Nri | 20,390 | 1 | 1 | 2,549 | 788 | 1761 | 10,603 | 9787 | 0.9 | 3 | 4 | 164 | 5.00 |
| 15. | Agulu | 65,183 | 5 | 4 | 8,149 | 3465 | 4684 | 33,895 | 31,288 | 0.8 | 9 | 12 | 149 | 5.00 |
| 16. | Adazi-Nnukwu | 16,378 | 2 | 1 | 2,047 | 711 | 1,336 | 8,516 | 7,862 | 0.6 | 4 | 6 | 151 | 10.00 |
| 17. | Neni | 17,906 | 3 | 1 | 2,238 | 479 | 1759 | 9,311 | 8595 | 0.4 | 4 | 6 | 141 | 5.00 |
| 18. | Obeledu | 9,978 | 1 | 1 | 1,250 | 407 | 843 | 5189 | 4789 | 0.2 | 2 | 4 | 192 | 5.00 |
| 19. | Mgbakwu | 9,252 | 1 | 1 | 1,150 | 332 | 818 | 4,812 | 4440 | 0.6 | 1 | 4 | 286 | 5.00 |
| 20. | Isuaniocha | 6,011 | 0 | 1 | 751 | 210 | 541 | 3125 | 2886 | 0.4 | 0 | 3 | 219 | 5.00 |
| 21. | Urum | 5,947 | 0 | 0 | 743 | 178 | 565 | 3092 | 2855 | 0.5 | 0 | 3 | 200 | 5.00 |
| 22. | Amansea | 3,919 | 2 | 1 | 490 | 114 | 376 | 2038 | 1881 | 0.5 | 1 | 2 | 321 | 5.00 |
| 23. | Ukpo | 18,952 | 2 | 1 | 2,369 | 1134 | 1235 | 9855 | 9097 | 1.1 | 2 | 6 | 161 | 5.00 |
| 24. | Nawgu | 10,184 | 0 | 0 | 1,273 | 628 | 645 | 5296 | 4888 | 0.8 | 1 | 4 | 204 | 5.00 |

Source: fieldwork 2012.

that communities that are close to the core urban centre have a relatively high per-capita water demand. Such communities and their water demand figures are Okpuno (144LCD), Nibo (117LCD), and Nise (114LCD). This reveals one fact that these communities consume large quantities of water which in itself reflects their high rate of urbanization with the consequent population pressure. It is, however, worrisome that in spite of this high demand, the water supply to these communities remains as low as in other areas. It is important to ensure that the planning of water supply in these named peri-urban communities should be done in conjunction with other authorities supervising the construction of such facilities such as roads; electricity, telephone etc. in the area to avoid disruption of water infrastructure if each body handled its developmental program separately. Also the planning will ensure that the physical, social and environmental factors identified in this paper are taken into serious consideration since they collectively contributed as high as 90% to the water demand of the peri-urban communities.

The base constant value of the regression model was 8.284 litres, and showed the quantities of water demand that must be reached before the

**Table 3.** Daily water demand and supply in peri-urban Communities of Awka Capital of Anambra State.

| S/NO | Community | Population | Per capita water demand (L) | QTY of water demanded per community (L) | Per capita water supply (L) | QTY of water supply per community (L) | % demand satisfied by supply |
|---|---|---|---|---|---|---|---|
| 1. | Abba | 12,273 | 84 | 1,030,932 | 43 | 527,739 | 51 |
| 2. | Enugwu-Agidi | 15,183 | 70 | 1,062,810 | 41 | 622,503 | 59 |
| 3. | Nawfia | 8,037 | 98 | 789,626 | 49 | 393,813 | 50 |
| 4. | Abagana | 39,206 | 101 | 3,959,806 | 37 | 1,450,622 | 37 |
| 5. | Nimo | 34,011 | 82 | 2,788,902 | 58 | 1,972,638 | 70 |
| 6. | Enugwu-Ukwu | 56,743 | 103 | 5,844,279 | 44 | 2,408,692 | 41 |
| 7. | Isiagu | 4,335 | 53 | 229,755 | 35 | 151,725 | 66 |
| 8. | Ezinato | 1,300 | 42 | 54,600 | 38 | 49,400 | 90 |
| 9. | Umuawulu | 9,382 | 60 | 562,920 | 43 | 403,426 | 72 |
| 10. | Mbaukwu | 19,322 | 62 | 1,197,964 | 40 | 772,880 | 60 |
| 11. | Nibo | 23,292 | 117 | 2,725,164 | 49 | 1,141,308 | 42 |
| 12. | Nise | 14,481 | 114 | 1,650,834 | 54 | 781,974 | 47 |
| 13. | Okpuno | 4,624 | 144 | 665,856 | 81 | 374,544 | 56 |
| 14. | Nri | 20,390 | 61 | 1,243,790 | 39 | 795,210 | 64 |
| 15. | Agulu | 65,183 | 109 | 2,744,947 | 43 | 1,082,850 | 39 |
| 16. | Adazi-Nnukwu | 16,378 | 72 | 1,179,216 | 29 | 474,962 | 40 |
| 17. | Neni | 17,906 | 88 | 1,575,728 | 39 | 698,334 | 44 |
| 18. | Obeledu | 9,978 | 60 | 598,680 | 28 | 279,384 | 47 |
| 19. | Mgbakwu | 9,252 | 64 | 592,128 | 24 | 222,648 | 38 |
| 20. | Isuaniocha | 6,011 | 52 | 315,572 | 42 | 252,462 | 80 |
| 21. | Urum | 5,947 | 49 | 291,403 | 41 | 243,827 | 83 |
| 22. | Amansea | 3,919 | 82 | 321,358 | 71 | 278,249 | 87 |
| 23. | Ukpo | 18,952 | 97 | 1,838,344 | 44 | 833,888 | 45 |
| 24. | Nawgu | 10,184 | 40 | 407,360 | 24 | 244,416 | 60 |
| | TOTAL | 386,289 | 1,903 | 33,669,974 | 1,036 | 16,457,749 | 48.9 |
| | MEAN | 16,095 | 79.3 | 1,402,895 | 43.1 | 685,740 | 48.9 |

Source: fieldwork 2012.

**Table 4.** Varimax rotated component matrix of 13 physical and socio-economic factors associated with water demand in peri-urban communities of Awka Capital of Anambra State.

| Variable label | Components | | | | |
|---|---|---|---|---|---|
| | I | II | III | IV | V |
| POPU | 0.13 | 0.02 | 0.64***** | 0.02 | 0.00 |
| NUMB | 0.18 | 0.15 | 0.16 | 0.42 | 0.034 |
| COMM | -0.10 | 0.00 | -0.05 | -0.15 | -0.43 |
| HOLD | 0.93***** | -0.01 | -0.06 | 0.11 | 0.09 |
| HEAD | 0.92 | -0.04 | -0.02 | 0.14 | 0.08 |
| CERT | 0.15 | 0.01 | 0.14 | 0.00 | 0.05 |
| BELO | 0.61 | 0.08 | -0.04 | -0.06 | 0.15 |
| ABOV | 0.07 | 0.02 | 0.65 | 0.04 | 0.01 |
| DIST | 0.00 | -0.07 | 0.14 | 0.70***** | -0.04 |
| HOSP | -0.28 | 0.71***** | 0.07 | 0.39 | 0.08 |
| SCHL | 0.11 | 0.04 | -0.06 | 0.39 | 0.76***** |
| BIOL | 0.18 | 0.61 | -0.20 | 0.16 | -0.41 |
| COST | 0.04 | 0.04 | -0.03 | 0.64 | 0.08 |
| Eigen value | 2.53 | 1.33 | 1.13 | 1.03 | 1.00 |
| Variance explained | 33.2 | 17.5 | 13.5 | 10.8 | 9.2 |
| CUM PCT | 33.2 | 50.7 | 64.2 | 74.9 | 84.1 |

Significant loadings are +/- 60 and above. *Component Defining Variables (CDV)*.

**Table 5.** Result of the principal component regression (PCR) and determinants of water demand in the Awka Capital territory.

| Statistics | |
|---|---|
| Multiple Correlation (R) | 0.95 |
| Co-efficient of Multiple Determination | 0.90 |
| Standard Error of Estimates (SEE) | 0.029 |

influence of the independent variables will be noticed. Since this is the case, the planning will be done to ensure a high level of per-capita supply to residents so as to satisfy the requirement of these variables. Finally, urgent steps are needed by the State Government to sign the Awka Capital Territory Development Authority bill into law to enable a single legal body to handle all issues bordering on the provisions of peri-urban infrastructure including water. This is necessary as the authority is expected to play important coordinating role in the development of urban amenities in the entire territory.

## Conclusion

In this paper, we have tried to examine the level of water demand and supply of the peri-urban communities of Awka Capital Territory. We have used statistical analysis to establish that there is a high level of water scarcity in the area as has been revealed by the large demand-supply gap of 48.9%. The statistical model developed will be of help in the prediction of future water demand of the area. Urgent necessary action is needed to supply enough water to these areas as they are now fast assuming urban characters. The policy and planning measures suggested need to be applied to guide development in this already established deplorable water supply condition of the peri-urban communities.

**REFERENCES**


Akabudu CO (2002). "Considerations on Strategies to Control Urbanization in Awka and its Immediate Surroundings". J. Urban Dev. 4(1):18-30.

Anyadike RNC, Ibeziakor MN (1987). "The Spatial Structure of Residential Water Demand in Enugu, Nigeria". Nig. J. Soc. Stud. 4:1-8.

Ayoade JO (1984). Forecasting and Managing the Demand for water in Nigeria. Paper Delivered at the 27th Annual Conference of the Nigerian Geographical Association held at the University of Nigeria, Nsukka.

Emejulu AC, Alabraonye FF, Ezenwaji HMG, Okafor FC (1994). "Investigation into the Prevalence of Urinary Schistosomiasis in Agulu Lake Area of Anambra State". J. Helminthol. 68:119-123.

Ezenwaji EE (2009). Municipal and Industrial Water Demand and Supply in Enugu Urban Area, Nigeria. An unpublished Ph.D Thesis, University of Nigeria, Nsukka.

Ibeke NN (2008). "Urban Growth and Peri-urban Environment in Developing Countries". J. Urban Environ. 8(3):1124-1131.

Ibeziakor MN (1985). Residential Water Demand in Enugu Urban Area of Nigeria. Unpublished M.Sc Thesis, University of Nigeria, Nsukka.

Ibezue TO (2005). Urbanization and Water Quality in parts of Lagos Mainland, Nigeria. J. Urban Ecol. 3:18-27.

Mabogunje AL (1980). The Development Process: A Spatial Perspective. Hutchison, London.

Muoghalu LN, Okonkwo AU (1998). "Effects of Urban Flooding in Awka, Capital of Anambra State, Nigeria". Environ. Rev. 2(22).

National Population Commission (2006). The Population of Nigeria. Federal Government Gazette Vol. 96 No. 2. Government Printer, Abuja.

Ogbukagu IN (1986). "Water Supply of Njikoka and Awka Areas of Anambra State". J. Earth Sci. 5:511-519.

Okoye TO (1979). "Urban planning in Nigeria and the problem of slums". Third World Plann. Rev. 1:71-85.

Orajiaka SO (1975). Geology. In: Ofomata GEK (ed.) Nigeria in Maps: Eastern States. Ethiope Press Benin City.

Oyebande AL (1976). "Planning to March Water Demand in the 2000" A water Inventory of Greater Lagos, 19th Annual Conference of the Nigerian Geographical Association, held at Ahmadu Bello University, Zaria.