International Journal of Multidisciplinary and Current Research

Research Article

ISSN: 2321-3124
Available at: http://ijmcr.com

Population Increase and Water Supply in Nigerian Cities: Case Study of Jos in Plateau State, Nigeria

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Accepted 10 Jan 2015, Available online 01 Feb 2015, **Vol.3 (Jan/Feb 2015 issue)**

Abstract

This study aimed at establishing a relationship that exists between population increase and water supply in the city of Jos. The approach was based on the analysis of ten (10) years data on population and water supply in Jos, coupled with the use of well structured questionnaires to generate data from the field. The ten year data on population and water supply where gotten from the National Population Commission and the Plateau State Water Board respectively. The data were used to determine the population trend and the trend of water supply in the city for the past ten years, by eliciting respondents' views to determine government's contributions to the improvement of water supply in the city as well as to determine the kind of relationship that exists between population increase and water supply in Jos, using various statistical techniques such as trend analysis, Spearman's Rank Correlation and filtering in Time Series. The population of Jos was found to be on the increase for the past ten years at a fluctuating growth rate of between 3.183% and 2.5%, the water supply trend of the city was found to be fluctuating in the past ten years, at a point the supply increases and at some other time it reduces. The State government is really trying to improve the water supply situation of the city but much still needs to be done in the area of intermittent supply. The landmark of the research was reached when it was established that there was a strong relationship (population increase was found to be 62% related to water supply) between water supply and population increase of the city; meaning that, due to the fact that water is an independent commodity population seriously depend on it for its survival at a rate of 62%. Thus, various recommendations were made, which, if properly adopted, will greatly minimize the impact of population increase on water supply of Jos city in particular and other cities of Nigeria, in general.

Keywords: *Population growth, Water supply, Relationship, Infrastructure, Statistical tools.*

Introduction

From the earliest days of creation to this day, man had depended on water, among other things, for his survival. Human population, on the other hand, has continued to grow so much so that today, human population on planet earth is put at a little above 7 billion people (U.S Census Bureau, 2013). This dependence lies not only on the fact that water is a very important commodity or necessity for the existence of life but it is also necessary for the growth of both plant and animals not forgetting other needs like the industrial, commercial and aesthetic uses of water. The exponentially expanding urbanization and development are driving demand for water like never before due to the fact that it has been proven correct to state that urban dwellers consume or need more water than rural dwellers and this is due to some of the practices being carried out by the urban inhabitants which includes; watering of lawns, operation of parks, presence of industries and the assumption that educated people tend to consume more water due to enlightenment (on the part of these educated people) on the health importance of water etc.

Water use has been growing at more than twice the rate of population increase in the last century according to reports by Jenkinson (2013). The use of water or demand for water is expected to increase to an alarming 50% by the middle of the twenty second century, just between 2010 and 2025 in developing countries and 18 percent in the developed countries of the world. There has been increased use of water in the poorest countries of the world. Due to unsustainable use of the water resource being practiced in developing countries of the

world and due to the massive immigration of people from rural areas of developing and poor countries to the urban areas or cities in search of better life (Jenkinson, 2013).

By the middle of the twenty second century it is estimated that the world's population will increase to about 9 billion with most of the population based in the cities or urban areas – thereby making the cities or urban areas the greatest in terms of need for water supply or demand for water – but the sustainability of water use is in doubt especially in the developing countries of the world, where the issue of sustainable practices in the use of water in order to ensure replenishment of these sources, is still in its infancy stage of development and also the level of educational development in these countries is very low (Vivan, Ali, Antipas & Danjuma, 2014).

Watson and Davis (2011) conducted a research to examine the general equilibrium implications of economic and population growth on a fixed (or exogenously determined) total supply of available water in the South Platte River Basin in Colorado. The study utilized an 18-sector Computable General Equilibrium (CGE) model, where water is incorporated as a primary factor of production for agricultural operations and for a municipal water supply sector, but as an intermediate input for all other sectors. It was determined that, by allowing for water transfers with a fixed supply of water, the projected 50% increase in population from 2002 to 2030 will result in a 5.7% shift in water allocation from agriculture to other sectors. However, the total real value of agricultural sales is expected to increase slightly over this same period. The price of municipal water is expected to increase by 8.4% and the price of agricultural water is expected to increase by 10.4%. This result is contrasted to a scenario where significant barriers to water transfers are enacted. In this case the price of municipal water increased by 25% and agricultural water prices remain constant.

The problem being investigated in the course of this study is the growing issue of water supply inadequacy in Nigerian cities, due to the increasing demand for the supply of water, and this is as a result of the increase of population in Nigeria especially in the cities of the country where immigration from rural areas to the urban area is becoming massive by the day. This is a problem because of the fact that, if the population increase in the country is not checked and the level of supply of water increased, at a point in time, the population increase becomes unsustainable. This is due to the fact that, the available water supply infrastructure (for example) becomes insufficient for the teeming population in the cities of the country and in turn this continues to affect other sector of the economy like agriculture, industries, education and other relevant aspects of the country's economy.

Aim and Objectives

The aim of this study is to determine and examine the relationship between population growth and water supply in a typical Nigerian city taking the capital city of Plateau State, Jos as a case study. In order to achieve this aim some objectives where put in place as guidelines towards the achievement of this goal which is the aim, those objectives includes the following:

a. To ascertain if there has actually been a significant increase in the population of Jos city in the past 10years, and by extension, the increases or otherwise of this population (2004-2014).
b. To determine the trend of water supply in the city in the last ten years (2004-2014).
c. To determine the relationship between water supply and the population of the city.
d. On the basis of the above to proffer suggestions as to ways and means of improving water supply in the city of Jos.

Hypotheses

The research hypothesis for this study is stated below:
Ho: There is no significant relationship between the population increase and water supply in Jos.
H_1: There is no significant relationship between the population increase and water supply in Jos.

The Study Area

The city chosen for this study is Jos, the capital city of Plateau State, a state located in the North Central Geo-political Zone of the country. Jos is located at the coordinates of $9^0 56^1$N and $8^0 52^1$E respectively with a population of about 900,000 residents based on the 2006 census conducted in the country. The city is located on the Jos Plateau at an elevation of about 1,238 meters or 4,062 feet high above sea level. During the British colonial rule, Jos was an important centre for tin mining. The city of Jos is divided into 3 local government areas of Jos North, Jos South and Jos East. The city proper lies between Jos North and Jos South; Jos enjoys a more temperate climate than much of the rest of Nigeria: Average monthly temperatures range from 21 – 25^0C (70 – 77^0f), and from mid November to late January, night-time temperatures drop to as low as 11^0C (52^0f), resulting in chilly night. Hail sometimes fall during the rainy season, owing to the cool high-altitude weather. These cooler temperatures have meant that from colonial times until the present day, Jos is a favorite holiday location for both tourists and expatriates based in Nigeria.

Jos receives about 1,400 millimeters (55 inches) of rainfall annually, the precipitation arising from both convectional and aerographic sources, owing to the location of the city on the Jos Plateau. According to the Koppen Climate Classification System, Jos has a tropical savannah climate abbreviated "Aw". The Jos Plateau is dominated by three rock types. The Older Granites date to the late Cambrian and Ordovician period of landform development. The Younger Granites are emplacement dating to the Jurassic, and forming part of a series that includes the Air Mass if in the central Sahara area of the

African region. There are also many volcanoes and sheets of basalt extruded since the Pliocene (Morgan, 1983). The younger granites contain tin which was mined during and after the colonial period of the country's development and evolution.

Figure 1.0: Map of Nigeria showing Plateau State

Fig. 1.1: Map of Plateau State showing all the Local Government Areas in the State

Materials and Method

The data needs for this study includes the following; population data of Jos for the past 10 years, responses of people based on their satisfaction as it concerns water supply adequacy or otherwise, publications from different sources especially as it relates to population increase and supply of water in Nigerian cities, information on the reservoir capacity of the different water treatment Plants in Jos. Information on the population variation of Jos city for the past ten years was obtained from the National Population Commission (NPC). The ten years population data is was used in order for the authors to get a clearer view of the population growth of the city for better analysis.

The reservoir capacity of the different water treatment plants in the city was taken for the past ten years.

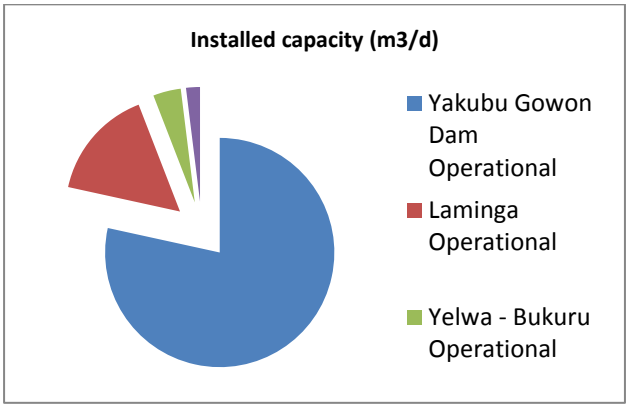

Fig.1.2: Reservoir capacity of water treatment plants of Jos City

This will help the research to determine if there has actually been an improvement in the water supply situation of the State in the past years.

Well structured questionnaires were distributed to some of the inhabitants of the city especially those that have access to the municipal water supply in the State. A total of 133 questionnaires were administered in the course of this study in order to get across to a certain percentage of the people of Jos (0.0001% = 102.56). Simple Random Sampling was used in the distribution of questionnaires in this study.

The data is presented in tables, charts and line graphs, Time Series statistical tool was used in the analysis of data on population increase over the ten year period , MANN-KANDAEL RANK STATISTICS (Ţ) was used to establish if between the beginning and the end there is a monotonic increase or decrease in the values of time series and the Spearman's Rank Correlation was used to establish the type of relationship that exist between the independent variable (water) and the dependent variable (population or customer size)

Results and Discussion

Table 1: Showing Questionnaire Distribution

Distribution of Questionnaire	Number of Questionnaire	Percentage (%)
Questionnaire completed and returned	120	90
Questionnaire not completed but returned	10	8
Questionnaire not returned	3	2
Total Questionnaire Distributed	**133**	**100**

Source: *(Field Work, 2014)*

The table above shows that a total of one hundred and thirty three (133) questionnaires were administered in the course of this research study in the study area (Jos). Out of the one hundred and thirty three questionnaires

administered, 120 questionnaires were completed and returned (90%), 10 (8%) of the questionnaires were not completed but returned while 3 (2%) of the questionnaires were not returned. After the collation of questionnaires, a total of one hundred and thirty questionnaires were answered and returned to the student. These 130 questionnaires were used for the analysis because three of the questionnaires were not returned.

Table 2 shows the pattern of distribution of the questionnaires. The questionnaires were administered based on the three local government areas that make up the city of Jos. Jos-North received 50 questionnaires (i.e. 39%), Jos-South also received a total of 50 questionnaires (i.e. 39%) and finally Jos-East received a total of 30 questionnaires (i.e. 22%).

Table 2: Showing Distribution of Questionnaires by Local Government Area

Local Government Area	Number of Questionnaires Distributed	Percentage (%)
Jos-North	50	39
Jos-South	50	39
Jos-East	30	22
Total	**130**	**100**

Source: *(Field Work, 2014)*

Table 3 Showing Gender Distribution of Respondents

Gender	Percentage (%)
Male	60
Female	40
Total	**100**

Source*: (Field Work, 2014)*

Table 3 above shows the gender distribution of the different respondents. A total of 78 (60%) of the respondents were male while the females constitute the remaining 52 (40%) of the respondents.

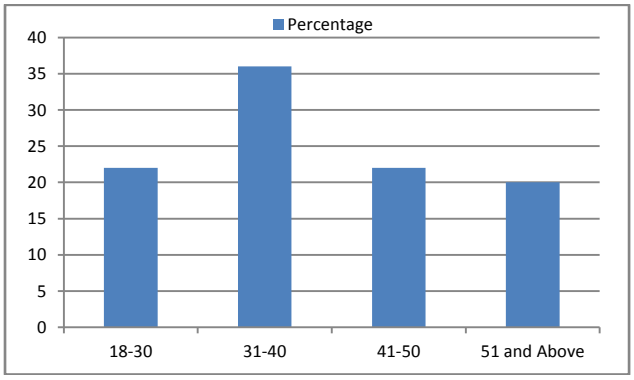

Figure 2: Bar Chart Showing Age Distribution of Respondents by percentage

From figure 2 above, which illustrates the age distribution of the respondents, the following were deducted from the result: 22% of the respondents were between the ages of 18-30 years, 36% of the respondents were between the ages of 31-40 years, 22% of the respondents were between the ages of 41-50 years and 20% of the respondents were between the ages of 51 and above.

Table 4 Showing Marital Status of Respondents

Marital Status	Percentage (%)
Single	30
Married	40
Widow/Widower	15
Divorced	15
Total	**100**

Source: *(Field Work, 2014)*

Table 4 above shows an illustration of the marital status of the respondents. 38 (30%) of the respondents were singles, 52 (40%) of the respondents were married, 20 (15%) of the respondents were widows/widowers and finally, 20 (15%) of the respondents were divorced people.

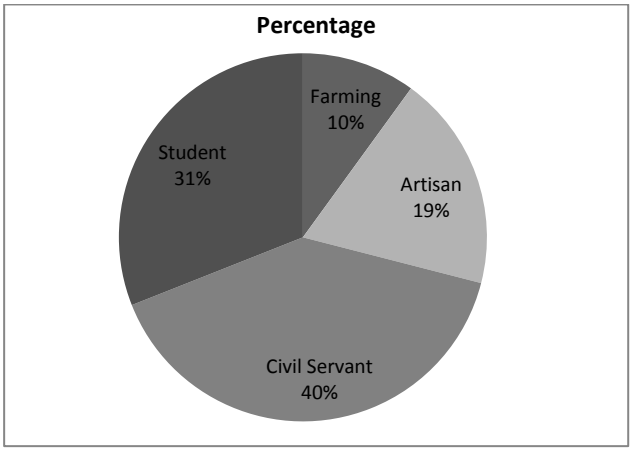

Figure 3: Pie Chart Illustrating the Occupation of Respondents

Figure 3 above shows the distribution of the respondent's occupation. 10% of the respondents were farmers, 19% of the respondents consist of artisans, 40% of the respondents consist of civil servants and 31% of the respondents were students.

Table 5 Showing the Employment Status of Respondents

Employment Status	Percentage (%)
Employed	55
Unemployed	31
Retired	6
Others	8
Total	**100**

Source: *(Field Work, 2014)*

From the illustrations in table 5 and above, 55% of the respondents were employed, 31% were unemployed, 6%

of the respondents were retired while 8% respondents belonged to other category.

Table 6 Showing the Educational Qualification of Respondents

Educational Qualification	Percentage (%)
No formal Education	-
Primary Education	22
Secondary Education	45
Tertiary Education	33
Total	**100**

Source: *(Field Work, 2014)*

From table 6 above, which shows the distribution of educational qualification of respondents, the following was derived: none of the respondents was in the category of 'no formal education' (that means none of them is an illiterate), 30 (22%) of the respondents had their primary education only, 58 (45%) of the respondents stopped at secondary education while about 42 (33%) of the respondents were educated up to tertiary level.

Table 7 Showing the Different Water Sources of Respondents

Water Source	Percentage (%)
Well and Tap	50
Tanker and Well	15
Tanker and Tap	22
Others	13
Total	**100**

Source: *(Field Work, 2014)*

The different sources of water in the city are well, tap (municipal water supply or borehole), tanker (mobile water supply tankers) and other sources (including streams, rivers, lake, flood channels etc.). The sources of water of the different respondents were gathered from the field based on the above mentioned sources, showed that 50% (65) of the respondents get their water from both Well and stand Tap water sources, 15% (20) of the respondents get theirs both from Tanker sales and Well. 22% (30) of the respondents get their water both from Tanker sales and stand Tap while 13% (15) respondents get their water from other sources.

This goes to show that the Municipal water supply is the most dependable source of water supply of the people. This is due to the fact that a high percentage of the respondents rely on water from the municipal supply for domestic purposes especially drinking. This is the situation because most people believe that water from this source is purified and therefore fit for consumption.

Figure 4 shows the response of the people based on their level of satisfaction by the available water supplied by the municipal water Agency. The figures available shows that 15 (13%) of the respondents had high satisfaction with the available water, 57 (43%) of the respondents had a medium level of satisfaction by the water available from the municipal supply and finally, 58 (44%) of the respondents believed that there satisfaction from the water supplied by the municipal cooperation is low. This is visible in the answer of the respondents to the question of water supply satisfaction.

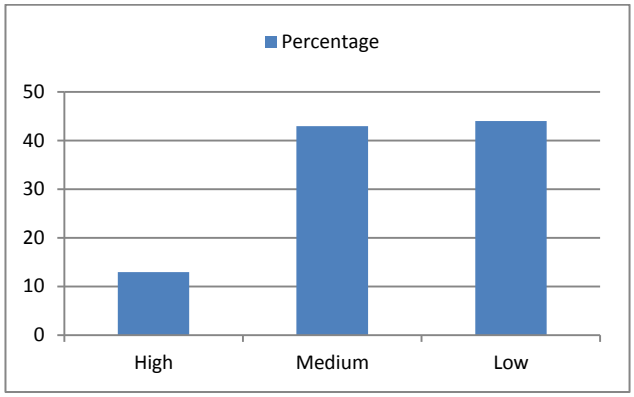

Figure 4: Bar Graph Showing the Level of Water Supply Satisfaction by the Different Respondents in percentage

Table 8 Showing Response based on Perceived Reasons for Inadequate Water Supply

Reason for Inadequate Supply of Water	Percentage (%)
Erratic Electricity Supply	15
Inadequate Facilities	28
Increase in Population	18
All of the Above	39
Total	**100**

Source: *(Field Work, 2014)*

Table 8 above shows the response of people from the distribution of the questionnaires. This response is based on the question of reasons for the occurrence of inadequate water supply in the city of Jos. The responses, after its compilation shows that about 20 of the respondents believe that the reason for inadequate water supply is due to erratic supply of electricity, 37 of the respondents believe it is due to inadequate facilities on the part of the Plateau State Water Board (PSWB), 23 of the respondents believe that population increase is the reason for inadequate water supply in the city and , 50 of the respondents believe that the water supply shortage being experienced in the city is due to all of the other reasons previously mentioned and shortly described as: inadequate supply of electricity, inadequate facilities and population increase. This goes to show that most of the respondents believe that all the aforementioned reasons have contributed, in one way or the other, to the problem of inadequate supply of water in the city.

Table 9 shows the analysis of the questionnaire based on the question of the presence of a functional water tap in their house. 65 percent of the respondents (85) have a functional water tap in their various houses while 35 percent of the respondents (45) do not have a functional

water tap in their various houses. This figure of 45 although low still represents a high number of people who lack a functional water supply tap in their homes.

Table9: Showing the Availability of Functional Water Tap in the Houses of Respondents

Availability of Functional Water Supply Tap in Residence	Percentage (%)
Yes	65
No	35
Total	**100**

Source: *(Field Work, 2014)*

Table 10 Showing the response of People based on the Question of Improvement in Water Supply in the Past Decade

There Have Been Improvement in Water Supply in the Past 10years	Percentage (%)
Agree	42
Strongly Agree	13
Disagree	45
Strongly Disagree	10
Total	**100**

Source: *(Field Work, 2014)*

Table 10 shows the respondents' views on the improvement of water supply service delivery situation of PSWB in the city of Jos for the past decade. The response shows that, 54 respondents (42%) agree that there has been improvement in water supply in the city, 17 of the respondents (13%) strongly agree that there has really been improvement in the past decade, 45 of the respondents disagree with the fact that there has been improvement, while 14 of the respondents strongly disagree with the fact that there has actually been any improvement in the past ten years.

In the course of the study, some statistical tools were used to test hypotheses which led to the achievement of the aim and objectives of the study. The statistical analyses are presented below.

Smoothing or Filtering In Time Series

Table 11 Showing the distribution of population in the city of Jos for the past ten years (2004-2013) and the deviation from the mean

S/N	Year	Population	Deviation from the mean (DX)
1	2004	787700	-111,4671
2	2005	812305	-86,862
3	2006	836910	-62257
4	2007	861515	-37652
5	2008	886516	-12651
6	2009	911516	12349
7	2010	936626	37,459
8	2011	961526	62,359
9	2012	986026	86,859
10	2013	1011026	111,859
		Σx = 8,991,66 **x ≈ 899,167**	

Source: *(Authors' Compilation, 2014)*

The table 12 on population data of the city of Jos for the past ten years (2004-2013) above shows that this population increase in the city has been really going upward in the past decade. This will continue if not checked by government policies or the necessary facilities put in place in order to increase the carrying capacity of the increasing population of the city. The line graph (figure 5) below shows an illustration of the city's population for the past decade. Just like the information in the table, it is also showing a strong trend in the upward movement of population in the city.

Table 12 Showing population distribution of Jos

S/N	Year	Population
1	2004	787700
2	2005	812305
3	2006	836910
4	2007	861515
5	2008	886516
6	2009	911516
7	2010	936626
8	2011	961526
9	2012	986026
10	2013	1011026

Source: *(Authors' Compilation, 2014)*

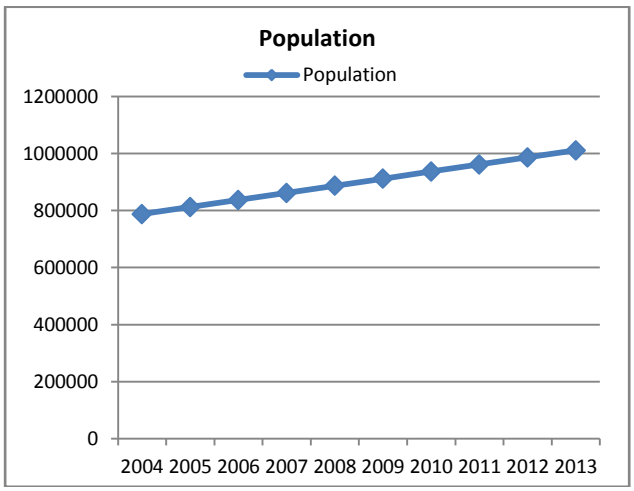

Figure 5: Illustrating the Population Increase in Jos for the past Decade (2004-2013)

The table above (table 11) shows the population of the city of Jos for the past ten years and also the deviation from the mean (899, 167) of the population data.

The formula for calculating the moving average is stated below:

A moving average of the order N is given by the formula: $Y_1\ Y_2 \ldots Yn/N$, $Y_2\ Y_3 \ldots Yn/N$, $Y_3\ Y_4 \ldots Yn/N$ and $Y_4\ Y_5 \ldots Yn\text{-}_3/N$ etc.

In order to really see the trend in the moving time series of the data set on the population of Jos, the smoothing or filtering in time series was used in order to remove the unnecessary fluctuations in the data sequence of the population data collected. This filtering was done using the moving average of three (3), after which the following result was gotten as the moving averages:

812305, 836910, 861647,886516, 911553, 936556, 961393 and 986193

To fit the moving average we calculated the number of data points k, after which the graph for the moving average should start. This is due to the fact that the number of moving average (8) is less than the number of the raw data (10), so the data points should be in equilibrium with the moving average, hence the calculation of the number of data points away from the beginning of the data sequence at which the moving average should begin.

The formula for this calculation is stated thus:
K = N-1 (odd number)
2

Where K = number of data points from which the moving averages starts to appear, N = order of moving average = 3. The answer after the calculation shows that:
K = 1

Therefore according to the result, the moving average of the data in the graph will begin one (1) data point away from the beginning of the data sequence. The graph of the result is plotted below.

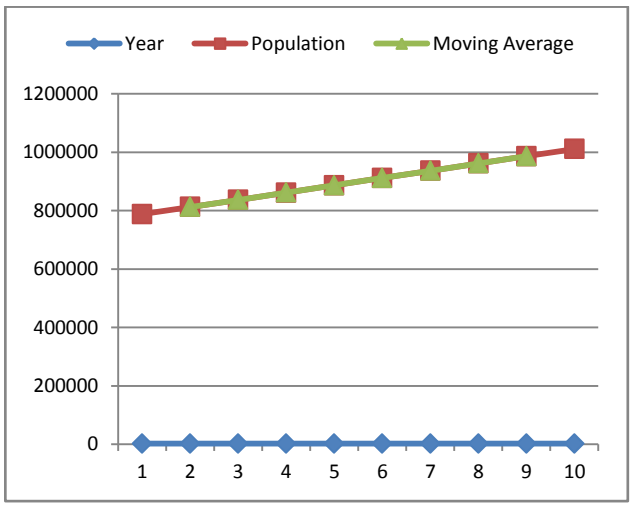

Figure 6: Line Graph illustrating the movement of the population of Jos for the past ten years and the moving averages

With this, it could be clearly seen that the smoothing effect in the above graph is seen in the subdued nature of the constant movement in the population of the city. This shows that the population increase of the city has been constant in the sense that it has been consistent and continuous for the past ten years.

The Spearman's Rank Correlation was used in this study to establish the type of relationship that exist between the independent variable (water) and the dependent variable (population or customer size)

The Table below represents the supply capacity of Plateau State Water Board for the city of Jos and also the estimated customer figure of the Board for the past ten years (2005-2014). The figures were correlated below using the Spearman's rank correlation formula.

Table 13: Showing the Spearman's Rank Correlation Analysis of Water Supply and Customer Population

S/N	Volume of Water supplied in m^3 (X)	Customer population (Y)	Rank X	Rank Y	d	d^2
1	95000	3028	3	1	2	4
2	90550	3510	1	2	-1	1
3	95450	3800	4	3	1	1
4	98000	3985	5	4	1	1
5	98350	4300	6	5	1	1
6	105320	4596	8	6	2	4
7	100750	4800	7	7	0	0
8	110800	5300	9	8	1	1
9	94000	5568	2	9	-7	49
10	114750	5832	10	10	0	0
						Σd^2 = 62

Source: *(Authors' Compilation)*

$$r_ş = 1 - \frac{6\Sigma d^2}{n^3 - n}$$

Where d is the difference in rank of each pair of values, Σ is the summation sign and n is the number of pairs. According to the table 13 above the value of $\Sigma d^2 = 62$ and the value of n = 10. Substituting for the equation above we have our spearman's rank correlation solution as:
$r_ş = 0.62$

Null Hypothesis (Ho): There is no significant relationship between the population increase and the water supply in Jos.

Alternative Hypothesis (H_1): there is a significant relationship between the population increase and the water supply in Jos.

According to the scale of correlation, a correlation value of 0.62 indicates a strong relationship among the correlated factors. This goes to say that, there is a strong relationship between the increase in population of Jos and the water supply in Jos. Therefore the null hypothesis (Ho) is rejected and the alternative hypothesis (H_i) is accepted. Meaning that, the relationship between water supplies and population in Jos is really strong a one, in the

sense that any significant increase in the population of the city of Jos leads to a chain effect on the water supply of the city and also other sectors of the economy. This really means that water is affected at a rate of 62% by the continuous increase in the population of the city. This value of 62% is really high because it shows that the population factor is highly dependent on water supply.

The volume of water being supplied in Jos by the Plateau State Water Board is really high when compared to the population of the customers, 16.345m³/customer, when it is divided equally by the number of customers. This division could be void due to the fact that, people tend to depend on the water supplied to other people, for their water needs. This shows that the volume of water supplied to customers in the city are not meant for the customers alone because other people also tap into the water supplied to these customers. When compared to the population of the city presently (1,011,026 people), we now have to divide the volume of water supplied by the Board, by the population of the city and it is done below:

Volume of water = 114,750m³ or 114,750,000 liters
Population of Jos = 1,011,026
Solution = 113.5liters/person/day

After the analysis we have a total of 113.5 liters per person. Although this is the value from the mere calculation of the values, which is very high when compared to the United Nation's Standard of 60liters/person/day. But this is not the case in reality due to the fact that some Corporate Organizations and utilities exist and these organizations need better water supply in terms of volume, than what is required by normal individuals for daily activities (60liters/person/day).

Implications of Population Increase on Water Supply

The effects of population increase on water supply cannot be over emphasized due to the fact that it is enormous. Because of population growth and economic development, water resources in many parts of the world are pushed to their natural limits. In turn, the ability of cities and countries to grow and attract investment, meet the fundamental need of populations and ensure environmental protection will be increasingly threatened if water resources are not smartly managed. Unlike oil, there is no substitute to fresh water. Water is the finite resource that enables life and fuels all human activities. It's now essential that the public, industries and policymakers understand the principle and act positively to enforce and implement the related legislative framework and policies by prioritizing and finding lasting solutions and models to teething water issues will ensure the viability and sustainable development of our society, along with the preservation of a healthy environment. The implications of population increase on water supply can be categorized into three as follows:

i. Economic Implications: Like other human activitiess, industrial production is dependent on water for processing, cooling and evacuation of effluents. Water also empowers local entrepreneurs in the production process in creation of food and water consumable goods to satisfy human needs. When access to water is limited to certain hours or days, then business risk is created because it will pose a threat to business especially during production process. This will impact negatively on investment decisions. If we want to grow our economies and create jobs, we must develop the right water solutions that will empower local entrepreneurs to bring clean water to their own communities
ii. Environmental Implications: Growing populations demand more water. Yet people, businesses and ecosystems all draw on the same water resources. A healthy environment requires sustainable water management.
iii. Social Implications: World population is growing and migrating to cities to ensure water supplies for future generations, we need proper management of water resources today for a better tomorrow.

Conclusion and Recommendation

The study aimed at establishing relationship (if any) that exists between population increase and water supply in the city of Jos. The null hypothesis was based on the fact that there was no significant relationship between population increase and water supply. Secondary data were obtained from the National Population Commission and the Plateau State Water Board on the population data of Jos for the past ten years (2004-2013) and also the water supply data of Jos for the past ten years (2005-2014) respectively. Field study with the use of questionnaires was also employed in the course of the research. After the conduction of different types of analysis with the use of statistical tools like the Spearman's rank correlation and time series. It was discovered that there was trend in the time series of population increase in the city over the years, there was actually a really strong relationship between population increase and water supply of the city (62% related), unlike what was stated in the null hypothesis. It was discovered that most of the studied population make use of tap water as their major source of water, there is gross inconsistency in the supply of water (intermittent supply is the order of the day), most customers were highly dissatisfied by the volume of water available for their use. There were various reasons contributing to the epileptic supply of water some of which include but not limited to: inadequacy in electricity supply and available facilities, low water tariffs, lack of autonomy and rising population growth, among others. It was also discovered that, the number of people with functional tap is really low. In conclusion, there has really been a considerable improvement in the water supply of the city in the past

ten years; therefore government is responding really positively to the water supply situation of the city in particular and the State in general and this is really encouraging to the water supply sector of the economy especially as it concerns the population increase being experienced in the city.

Recommendation

The study recommends the practice of sustainability in virtually every aspect of the country's growth. In the issue of population growth, the government should put policies in place to check the population growth of the country just as have been done by other countries of the world like China and India whom are estimated to have the highest population in the world, but are presently experiencing low growth rates due to government policies. The sustainability of water should also be guaranteed through the intervention of government in the provision of portable water supply for the consumption of the teeming population in the cities and the water supply should be managed sustainably in order to ensure continuous availability in the long-run. The migration issue could be reduced by the provision of basic amenities to those who live in the rural areas in order to reduce the rate at which these people migrate to the cities thereby decentralizing population and development in the state.

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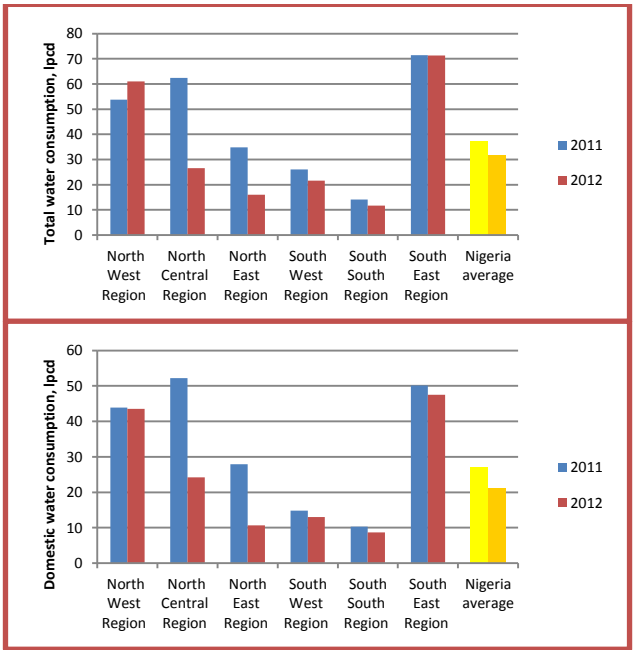
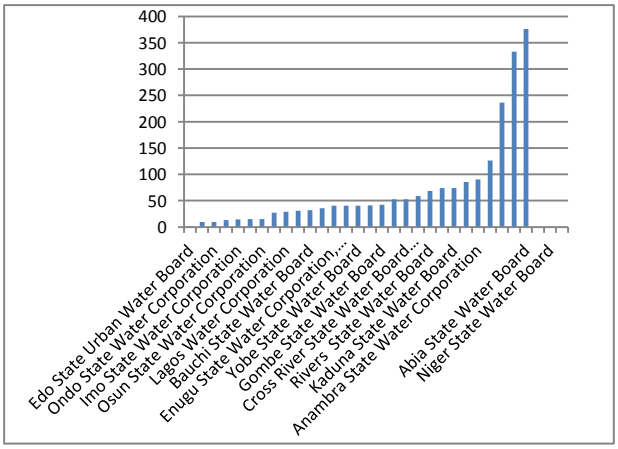


Total and domestic water consumption lcpd per years.
Source: World Bank IBNET **Data from 2011 and 2012 Performance assessment**

Items	Years	
	2011	2012
Number of utilities that submitted data	34	32
Population in the service area	94,238,728	90,280,426
Population served	32,669,209	33,943,449
Coverage	35%	38%
Number of utilities that submitted >75% of data	10	22
Number of utilities that submitted 50% - 75% of data	19	9
Number of utilities that submitted <50% of data	5	1
Regions with data from all utilities	NE, SE, SS, SW	SE, SS, SW
Region with missing utility data	NC (1),NW (2)	NC (2), NE (1), NW (2)

Sample size of some Nigerian water utilities
Source: World Bank IBNET **Data from 2011 and 2012 Performance assessment**



Water consumption per state
Source: World Bank IBNET **Data from 2011 and 2012 Performance assessment**