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Portable Water Distribution Problems in Kano Municipal, Nigeria: Implications for Urban Agriculture

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ABSTRACT

The aim of this research work was to evaluate and assess the main sources of water and the various factors that affect potable water distribution problems in Kano municipal. The methodology adopted here is primary method and secondary method where the data collected from the 384 questionnaires distributed to six (6) selected sampled areas, namely: Zango, Sheshe, Yakasai, Shahuchi, Zaitawa and Gandu. Institutions that relate to water supply in Kano state were also summoned and investigated. The collected data were analyzed by statistical techniques and presented in the study. Also, the research concluded that the water supply in Kano municipal do not meet the demand due to some problems such as insufficient number of water treatment plant, power failure and shortage of fund and so on. Finally the research suggests solution to the identified shortcoming in water supply in the study Area.

Keywords: *Water Distribution, Portable, Problems, Kano State.*

INTRODUCTION

Kano State is located in the dry zone of northern Nigeria (buffer zone), has for long been suffering from shortage of table water. Water is an essential element in the maintenance of all forms of life and most living organisms can survive only for short period without water. The critical problem in the area is the provision of portable water for human consumption and other domestic uses. The experience of shortage has been on the increase with increase in population growth both by natural increase and immigration. Even during the rainy season portable water seem to be difficult in getting in some wards. Water shortage and pollution are universal problems but are acute in developing countries. The united nation water decade (1980-1990) focused on developing countries and tried to encourage increased investment by the governments and donor bodies on water project. The State is also a beneficiary of foreign aids. From early 1970, Kano state government has tried to invest considerable amount of money on improving the water situation in the state. Also it is estimated by some water bodies that Kano would free from water shortage for the rest of the 20th century and well into 21st century.

However, field observation of the water situation in the city revealed that portable water is still very much a problem. Individual have tried to invest in tap water installation in their homes but most of the time the taps are druid, when water runs it is in trickle and a couple of hours. Apart from some problems of lack of adequate information for projection of needs in the city misappropriation of some of the funds or poor management of some equipment's also hindered the steady supply of water. There is a poor maintenance, culture and callousness of certain individual who damage the pipes and sabotage the government's effort. It is this that the present researcher wishes to investigate (Baba, 1987).

The Tamburawa water works (TWW) is named as old and new Tamburawa, old Tamburawa Water Works commenced in 1986 with capacity of 9.6 million liters (of water) and then it was upgraded to supply 20 Million litres, and New Tamburawa water treatment plants has the capacity to supply 150 million liters of water to the Kano city and its surrounding environs. Some of the Kano state dams located in the state are Challawa Gorge dam, Tiga dam, Thomas dam, Watari dam, and Kussalla dam (Abaje et al, 2012; Biswan, 1978). The two larger rivers

found in Kano contain water throughout the year and most of the streams are seasonal in nature. Tiga and Challawa dams are among the largest dams in Africa. These two dams were constructed by Kano state government in the 1970s. These rivers are dammed to stored huge amount of water in surface reservoirs for various purposes.

Statement of Research Problem

With urban industrialization, social development and population increase water consumption is growing. At the same time water pollution and improper utilization are causing depletion of the water resource. The daily average water use per resident of Kano municipal L.G.A. is greater than national average which is 35 gallon in (1998-2001). Already the consumption greater than 50 is grossly inadequate. Kano is now one of the top five largest cities in Nigeria with a population of about 9,383,682 million people census 2006. Thus it is surprising that Kano municipal is facing serious shortage problem of portable water supply. Yet, there is water in the Tiga reservoir, again Challawa Gorge Dam has been proposed. Can we assume that there will be no shortfall at all? Presently can it be said that the Tiga Dam does not have sufficient water for greater Kano.

Scope and Location of the Study Area

Kano is located on the north-central part of the high plains of northern Nigeria on an elevation of 473M above sea level. Kano municipal is a Local Government area within the Kano urban area in Kano state. It`s headquarters are in Kofar kudu, in the south of the city. It has an area of 17km$^2$ and a population of 365,525 (NPC, 2006; KSGN, 1990) The Kano municipal Local Government areas has co-ordinates 11° 57` 07`` N 8° 32`25`` E / 11°.95194N 8°.54028E (see figures 1 & 2)

Climate and Vegetation

Climate of the area determines the amounts of water available both on the surface and sub-surface at any given time within a year. Climate also controls the regimes and other characteristics of the rivers. In order to meet the challenges of acute water shortage construction of dams were planned in 1969. By 1985 more than 24-25 earth dam have been constructed.

Kano is in tropical wet and dry type of climate (i.e AW Koppen's). Continentality and latitudinal position of Kano determines mostly by climate condition of the area. The temperature of Kano usually ranges between a maximum of 33°c and minimum of 15°.8c although sometimes during the harmattan it falls down to as low as 10°c. It has two seasonal periods, which consist of four to five months of wet season and along dry season lasting from October to April (Adamu et al, 2013; KNSN, 2005).

The vegetation of Kano state is the semi-arid savanna. The sudan savanna is sandwitched by the sahel savanna in the north and the guinea savanna in the south. The savanna has been described as the zone that provides opportunity for optimal human attainment. This is because it is rich in faunal and floral resources, it is suitable for both cereal agriculture and livestock rearing, and the environment is relatively easy for movement of natural resources and manufactured goods (Adamu et al, 2013; Holmberg, 1991). The natural vegetation of the Kano state has been modified as result of several centuries of human activities such as bush cleaning and burning for cultivation and hunting as well as animal grazing (Kankara & Adamu, 2013; Daifun, 1996).

Topography and Soil

Kano state falls mostly within the guinea savanna zones bodering it on the south it is a semi-arid region (see figure 2) Two prominent hills: Dala and Gwauran dutse are the main features. In the natural state, the soils formed on crystalline acid rocks occupy about two fifth of the state to the south, south west and south east, the brown and reddish brown soil and lotosols occur in the north half; the brown and reddish soils are in the north eastern corner; and the juvenile and hydromorphic soils occur along the alluvial channel complexes (Adamu et al, 2013; CNN, 1998). The soil largely reflects the influence of parent materials. Intensive use of the soils and addition of manure and chemicals fertilizers have altered their character, profile, structure and chemical characteristics (Kavanagh, 1967)

Population and Economic Activities

Indigenes of Kano state are predominantly Hausa but there are considerable number of Fulani`s and non-hausa speaking group from north living in the walled city. The 2006 census estimated to be 9,383,682 million people and study area has a population of 365,525 people. (NPC, 2006)

Kano state has been a commercial area and agriculture-driven state, which is known for the production of groundnuts as well as for its solid mineral deposit. The state has more than 18,684

square kilometers (7,241 sqmi) of cultivated land and is mostly extensive irrigated state in the country. Kano state consisted of major market like kwari market, singer market, Sabon gari market, Kurmi market, Dawanau market, etc. Kano municipal is more with commercial activities and less cultivated land, the majority of its people are engage in commercial activities almost 70% of its population.

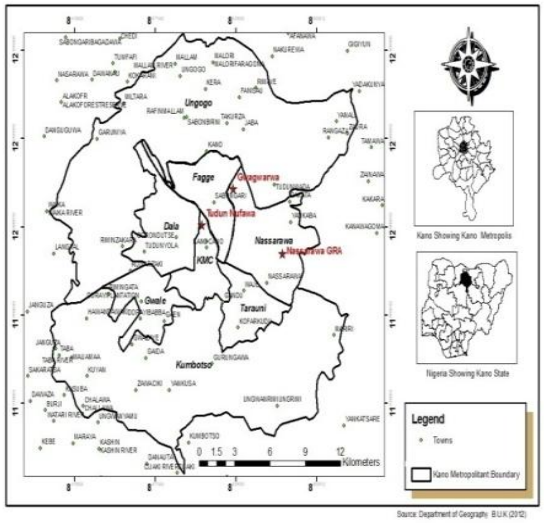

Fig.1 *Map of Kano Metroplitant Showing study area.*

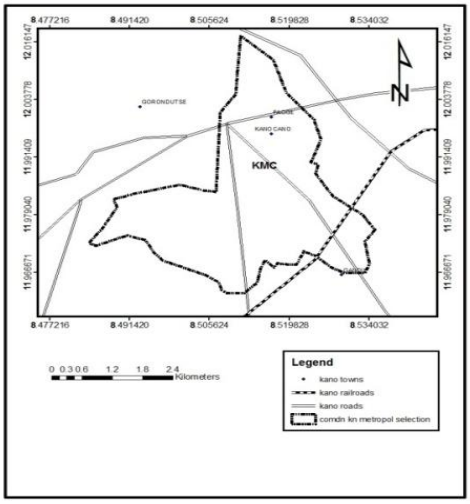

Fig.2 *Map of the study area.*

Population

Indigenes of Kano State are predominantly Hausa but there are considerable number of Fulani`s and non-Hausa speaking groups from North living in the walled city. The 2006 census estimated that the population of Kano State was estimated to be 9,383,682 million people and the study area has a population of 365,555. 3.2 Population (KSWBM, 1996)

METHODOLOGY

In this research work of evaluation of potable water distribution problem in Kano State particularly Kano municipal area, primary data is the major concern. Primary data for this research work on potable water distribution problem were sourced from questionnaire, oral interview, and field observation. While the secondary source of data includes the use of relevant literature concerning the subject matter and other published data. After successful completion of data collection from the study area on potable water distribution problem, descriptive statistics were used to analyze collected data. The total water demand in Kano municipal is obtained by finding the product of population figure of the area and the average daily per capita water consumption.

The primary source of data includes the use of questionnaire, oral interview, and field observation. While the secondary source of data includes the use of relevant literature concerning the subject matter and other published data. Questionnaire- open ended questionnaire has been used in conducting this research study. Also hundred numbers of questionnaires have been distributed within the study area. Oral interview- this source of information has helped in making good analysis. Field observation- this field observation has looked into the problems limiting portable water distribution in the study area.

On Secondary Data, Relevant literature concerning the subject matter and other published data those will help in bringing good information and understanding the causes of portable water distribution problem in the study area.

SAMPLING AND SAMPLING TECHNIQUE

Size of Sample

This research work focused on the portable water distribution problems in Kano municipal, the sources of portable water in the study area, the nature of distribution and the presence of shortfall and suggestions for addressing the issues. The size of this sample is determined by the population size, degree of precision and type of sampling design. 78: 76: 79: 59: 40: 52 respectively. Krecie and Magon (1995) sample size distribution table was adopted to pick the number respondents from the population picked was 384.

Sampling Frame

The sampling frame is drawn from the theoretical population to reduce the cost, cover a greater scope, speed, accuracy and accessibility

the sampling frame covered six major divisions (Zango, Shahuchi, Yakasai, Sheshe, Gandu, and Zaitawa). Population density of geographical location covering the 4 cardinal points are the criteria considered while selecting the sample areas, they provide a vital information covering every corner of the Kano municipal.

The questionnaires have been distributed according to the number of population of each selected sample area. Shahuchi has the highest population in the selected sample area with population number of 40681 and number of questionnaires administered are 79, follow by the others selected sample areas as follow: Gandu with population of 40271, number of administered questionnaires are 78, Zaitawa with population of 39119, number of administered questionnaires 76, Sheshe with population of 30779, number of administered questionnaires 59, Zango with population of 27196, number of administered questionnaires 52, Yakasai with population of 20650, number of administered questionnaires 40.

Sample Design

The questionnaires designed involve both closed ended and opened ended questions in the opened ended the respondent is given room to provide his own answers the closed ended are the options provided for the respondent to pick. There are four types of response scale for closed ended questions as provided below:

- Dichotomous
- Norminal-polytomous
- Ordinal polytomous
- Bounded or Continous

Questionnaires were administered in the six sample areas. Gandu, Zaitawa, Sheshe, Zango, Shahuchi and Yakasai. Were reformed and used for research. The questionnaires were not equally distributed because differences in their population. The 384 were administered in the ratio of 6: 5: 4: 3: 2: 1: from high to low respectively. Systematic stratified sampling was used along to select every 5th house hold in each sample area.

Techniques of Data Analysis

The data analysis were done by using the descriptive statistics. Table's frequency and percentages were used in the analysis the date generated from the field. Inferential statistics is used in testing the hypothesis. Analysis of variance (AVOVA) test 0.05 or 0.01 significant levels.

Result and Analysis

From the questionnaire data on the family size was determined for the study area. Table 1 show that all the people in all the six wards have large family sizes containing 32% (with family size above 11) only 16% have less than 5 members in the family.

Family Sizes and Number of Respondents per Ward

It`s clear that when there is water shortage or inadequate water supply the area will be badly affected with Zango and zaitawa being the worst in the study area.

The table below shows the family size and number of respondent per and their figures.

Table 1. *Family Size and Number of Respondent Per Ward*

Family size	Number of respondents	Percentages %
Family below 5	64	16.67
6-10	80	20.28
11-20	108	28.13
20 above	142	36.98
Total	384	100.00

Source: *Field survey, 2015.*

The above table show that 16.67 of family size below 5 have respondent, 20.28 of family size 6-10 have respondent the questionnaire, 28.13 of family size 11-20 have respondent and also 36.98 of family size 20 and above have respondent the questionnaire. Which show that family of 20 and above have more respondent the questionnaire.

Table 2. *Main Source of Water Supply.*

Main Source of Water Supply (Centralized)	Numberof respondents	Percentages (%)
Tap in home	153	39.84
Tap nearly	109	28.39
Tap far from home	56	14.58
Well	37	9.64
Others	29	7.55
Total	384	100.00

Source: *Field survey, 2015.*

The above table shows that less 40% is served with tap water in the house, so, the situation in the area is that 28% of the sampled population have to depend on tap water nearby, 10% of population in the sample area have depend on well as their source of water supply, 15% of the population have depend on tap far from home as their source of water supply, 7% of the population have other source as their source of water supply. However, this pie chart have

shown that the main source of water supply in the study area is mainly tap water in home that has the percentage of about 40%.

Table 3. *Regularity of Tap Water Per Day.*

Regularity of tap water (Per day)	Number of respondents	Percentages (%)
Morning	172	44.79
Evening	61	15.89
Night	151	39.32
Total	384	100.00

Source: *field survey, 2015*

The above table indicate that people of this area have to abandon their work and activities in the morning to go and fetch water or they spend the day without water in their houses. However, this pie chart clearly shows that more than half 45% of the respondents have access to portable water during the morning time.

This could be because at that time most of those that are well served with water retired and so water can flow to the scarcity areas. Furthermore from the pie chart is clear that those that have water during the evening and night hours are very small 16% in the evening and 39% in the night of the respondents. The supply is given at morning. The study also show that only very few families can afford good potable water such as tap water in the house (private) or bore hole. However other sources of potable water supply carry with it many social economic and health problems. Among them are time and energy wastage, continuous spending money and infection of water related disease e.g. cholera and typhoid. Based on the observation carried out, on the regularity of portable water being supply to different ward in the verities. Some receives the water during the morning or afternoon while others only have receives during the night time.

Table 4. *Availability of Water*

Availability of water	Number of respondents	Percentages (%)
Wet	347	90.36
Dry	26	6.77
All year round	11	2.86
Total	384	100.00

Source: *field survey, 2015*

The above table show that 90.36% of the population in the sample area have the availability of water during the wet season, 6.77% of the population have the availability of water during the dry season and only 2.86% of the sample population have the availability of water All year round. That is means the highest number of the sample population have the availability of water only during the wet season. (Rainy season).

Table 5. *Seasonal Scarcity of Water*

Seasonal scarcity of water	Number of respondents	Percentages %
Wet	40	10.42
Dry	328	85.42
All year round	16	4.17
total	384	100.00

Source: *field survey, 2015.*

The above table show that adequacy of water from the source are low during the dry season, but a fairly better in wet season, this is because during the wet season water is accumulated in the reservoirs such as dams lake e.t.c. and water is recharged into the underground to rise the volume of well and bore holes. According to the data gathered people of the sample areas have water supply below their demands, this may be related to the population or family size require large volume of water for their domestic uses and vice versa. The bar graph show that 10.42% of the sample population are experiencing the scarcity of water during the wet season, 85.42% of the population are experiencing their scarcity of water during the dry, and only 4.17% of the population are experiencing their scarcity of water All year round.

Moreover areas like Zango, Shahuci and Yakasai which have large size of family demand portable water more than that of Gandu area.

Table 6. *Does the Water Meet Your Daily Need Throughout the Year?*

Does the Water Meet Your Daily Need Throughout the Year?	Number of Respondents	Percentages %
Yes	7	1.82
No	377	98.18
Total	384	100.00

Source: *field survey, 2015.*

The above table show that the water didn't meet the demand of 98.18% of the sample population, and 1.82% the water meet their demand throughout the year of the sample population. Means the water didn't meet the demand of the majority of the respondent throughout the year.

Table 7. *Use of Alternative Source of Water.*

Alternative Source of Water.	Number of Respondents	Percentages %
Boreholes	37	3.64
Well	106	27.60
Vendor	215	55.99
Others	26	6.77

Total	384	100.00

Source: *Field survey, 2015.*

The above table show that 55.99% of the respondent are using vendors as their alternative source of water supply, 27.6% are using well, 3.64% are using boreholes as their source of water supply, only 6.77% of the respondent are using other source as their source of water supply.

The domination well in the area of study could be because the area is more of traditional with lot of low income people. Well are very popular in extracting water and they have been in use for long time , so they are numerous the use of boreholes is also becoming popular and water from deep covered wells and boreholes are suitable for human consumption (Olofin, 1991). The reason behind the small use of borehole could be, because they are expensive to construct and require heavy machines.

Table 8. *How Have People Including Your-Self Responded To This Problem In The Past?*

People Including Your-Self Responded to this Problem in the Past	Number of respondents	Percentages %
Change location	1	0.26
Report to the government	31	8.07
Bear it	305	79.43
Nothing	34	8.85
Others	16	4.17
Total	384	100.00

Source: *field Survey, 2015.*

The above table show that 79.43% of the respondent have bear the situation as their response, 8.85% of the respondent do nothing about the situation, 8.07% of the respondent have report the problem to the government, 0.26% of the sample population change their location and 4.17% of the respondent take other response to the problem, which means more than half of the respondent bear the situation as their response to the problem in the past.

Table 9. *How are you Responding to the Problem Now?*

How You Responding to the Problem now?	Number of Respondents	Percentages %
Change location	0	0.00
Report to the government	93	24.22
Bear it	273	71.09
Nothing	11	2.86
Others	7	1.82
Total	384	100.00

Source: *field survey, 2015.*

The above table shows that 71.09% of the respondent bear the situation now as their response, 24.22% of the respondent have report the problem to the government, 2.86% of the respondent do nothing about the situation, and 1.82% of the respondent take other response to the problem now, 0.00% of the sample population change their location which means more than half of the respondent bear the situation as their response to the problem in the past.

Table 10. *Effort of Kano State Water Boards to Mitigate the Problems.*

Effort of Kano State Water Boards to Mitigate the Problems.	Number of Respondents	Percentages %
Subsided the water rate	6	1.56
More boreholes	32	8.33
Maintenance	205	53.39
Others	141	36.72
Total	384	100.00

Source: *Field Survey, 2015.*

It is shown from the above table it shows that 53% of the population suggested that KSWB'S effort is on the maintenance of the old equipment's and sources of water supply like dam and others while the rest 37% are mainly those that recognize KSWB'S effort in trying to public enlightenment campaign, maintenance of old equipment and others. Areas like Zango, Shahuchi, and Yakasai where the population is dense, have been assisted by hand pump well which is constructed by KSWB. But this type of well does not last longer in the area because of mismanagement by the people and poor maintenance by the KSWB, 8 of the respondent have suggested the KSWB to construct more boreholes and 2% have suggested the government and KSWB to subsided the rate of water.

According to the questionnaire about how best can this be achieved the respondent suggested that the solution is on the neck of the government, (usually more than half) of about 53% see that as only as the only way out of the problem.

Table 11. *What Other Alternative Source Do You Want Government to Improve for You?*

Other Alternative Source of Water Supply Do You Want the Government to Improve for you?	Number of Respondents	Percentages (%)
Borehole	153	39.84
Well	136	35.42
Pound/stream	0	0.00
Others	95	24.74
Total	384	100.00

Source: *field survey, 2015.*

The above table show that 39.84% of the respondent suggested that construction of more boreholes as the possible solution to the problem, 35.42% have suggested that construction of well is the best way to address the problem, 24.74% of the respondent suggested that construction of other alternative source of water supply like vendors and others as the solution to the problem and only 0.00% of the respondent believe pound/stream are not the way of addressing the problem. From the questionnaire information show that construction of more boreholes as the best way of addressing the problem and all the respondent have believe that pound/stream are not the way of mitigating the problem.

Table 12. *Who is to solve the Problem?*

Who is to Solve the Problem?	Number of Respondents	Percentages %
Government	250	65.10
Government/People	100	26.04
Community	34	8.85
Total	384	100.00

Source: *Field survey, 2013.*

Also from the above table, the respondents recognize the importance of combine force between the community and government in mitigating the problem. About 26% of the respondents ask for community and government participation as for instance self-half group in solving the problem. There is a need for people to ensure that the problems is solved, this is accounted for about 9% of the response. And also the government effort is more of importance in mitigating the problem which show that 65% of the response has believe that government effort is the best way in mitigating the problem

Table 13. *Main Source of Water Supply.*

Main Source of Water Supply (centralized)	Number of Respondents	Percentages (%) centre
Tap in home	153	39.84
Tap nearly	109	28.39
Tap far from home	56	14.58
Well	37	9.64
Others	29	7.55
Total	384	100.00

Source: *Field survey, 2015.*

As a rule, once the calculated value is greater than the table value, you reject the null hypothesis and accept the alternative .Since the calculated value (3.342) is greater than the table value (2.759) the null hypothesis is rejected at lower probability level α 0.05 with degree of freedom (4).Thus, there is significant difference in source of portable water in the study area. This indicates that majority of the people in the selected sample area have tap in their home or nearby.

Table 14. *Effort of Kano State Water Boards to Mitigate the Problems*

Effort of Kano State Water Boards to Mitigate the Problems.	Numberof Respondents	Percentages (%)
Subsided the water rate	6	1.56
More boreholes	32	8.33
Maintenance	205	53.39
Others	141	36.72
Total	384	100.00

Source: *Field survey, 2015.*

As a rule, once the calculated value is greater than the table value you reject the null hypothesis and accept the alternative .Since the calculated value (5.004) is greater than the table value (2.759) the null hypothesis is rejected at lower probability level α 0.05 with degree of freedom (4) .

Thus, there is significant relationship on effort in eradicating the problem of portable water distribution in Kano municipal and there is need for maintenance of the water board and equipment from the both parties government and community.

Table 15. *How are you responding to the Problem Now?*

How are You Responding to the Problem Now?	Number of Respondents	Percentage (%)
Change Location	0	0.00
Report to the government	93	24.22
Bear it	273	71.09
Nothing	11	2.86
Others	7	1.82
Total	384	100.00

Source: *Field Survey, 2015.*

As a rule, once the calculated value is greater than the table value you reject the null hypothesis and accept the alternative .Since the calculated value (4.039) is greater than the table value (3.009) the null hypothesis is rejected at lower probability level α 0.05 with degree of freedom (3).

Thus, there is significant relationship in adaptation of the problem of portable water distribution in Kano municipal. This indicates that majority of the population bear the situation follow by those who report it to the government.

SUMMARY OF THE FINDINGS

Main Sources of Portable Water in the Study Area

Findings using Anova single ratio showed that there is a significant variation in source of portable water in the study area.

The calculated value was 3.342, while the T-critical at 0.05 level of significant is 2.759; meaning that there is significant variation in source of portable water distribution in the study area. As a result, the uses of alternative sources of water in the form of hand dug wells, boreholes, water vendors, and even streams are indispensable. The findings also reveal that water scarcities are critical in the months of February-April. 85.2% of the respondents said that the amount of water supply does not meet their need throughout the year.

This is true as the researcher during his field observation saw long queues of people, mostly male and female children, searching for water in public taps and boreholes; while some resort to buying from water vendors in which the source of the water is always doubtful.

This finding corresponds to the CNN (1998) estimation that currently only about 50% of the urban and 20% of the semi-urban population have access to reliable water supply of acceptable quality (Abaje et al, 2012).

Besides, Kano has the number of dams with more than 26 reservoirs constructed across its main rivers.

These dams were constructed as a result of the drought that occurred or between 1968 and 1973. The Dams in the State include Challawa Gorge Dam, Tiga Dam, Thomas, Watari Dam, and Kussalla Dam. Tiga and Challawa Dams are among the largest dams in Africa.

Tiga dam was constructed in Kano State in the year 1974. It is 6 km long and constructed along river Kano with carrying capacity of 1,974,000,000 m3 from its catchment area of 6553 km2. The Dam was constructed mainly to provide water for Kano river irrigation project, Kano city water supply, year round grazing and for fisheries production and tourist attraction.

SUGGESTED SOLUTION TO THE PROBLEM

To alleviate the above mentioned problems related with water supply situation in Kano metropolitan there are needs for stakeholders, community and individuals to work together in order to in achieving the following:

- Disbursing enough money to water resources sector so as to improve water supply.
- Improving electricity supply and providing alternative sources of power to supplement electricity in order to pump the water to the consumers.
- Regular maintenances of existing water supply facilities.
- Individuals and organization must paid their monthly water due so that the water board will have enough fund to efficiently supply water to the state,
- Training of man power. The Kano state water board and state ministry of water resources should embark on the training of man power by organizing seminar, workshop to increase their skills in water resources engineering, water resources management, hydrology and other related fields,
- Public enlighten campaign should be embarked in the mass media against misuse and over consumption of water, destruction of public properties and maintaining of existence water supply facilities,
- Alternative sources of water supply should be provided through construction of more water treatment plants, boreholes, well and solar powered driven water supply system.

DISCUSSION

The distribution of Portable water in Kano municipal encountered with a lot of problems. These problems are can be financial or otherwise. These includes

Power Supply

The power is very necessary for efficient working of water treatment plants machinery. There is irregular electrical power supply from Nigerian power holding company which hampers the smooth operation of water supply system. The power supply is erratic and can hardly last for 10 hours, despite the fact that water board has some arrangement with power holding company. As a result of power failure to run the machinery, pumping installation mechanism are not functioning well, as a result of this the water board resort to use diesel as an alternative to supplement power but the cost of diesel is very high too, this drastically affect water supply.

Insufficient Fund

Lack of enough capital to efficiently run the water sector in Kano state is a serious problem. The government budgetary allocation to water sector is not enough and the tax and monthly

due paid by consumers to the board is not enough to cater for high electricity bill, high cost of chemical and other miscellaneous expenses in the sector as such potable water supply at full capacity is not realize.

Lack of Autonomy

The Kano State Water Board, Water Resources Engineering and Construction Agency (WRECA) and Ministry of Water Resources have no total freedom to exercise their power in the water sector and recruitment but rather there are some interruption from the higher authority as such they are not capable to meet their expectations. There are also problems with regards to government policies and political instability, when a particular government started a project another government will bring a new policy when steps in without completion the previous projects. This is seriously dragging the water resources agency in Kano state backward in achieving its goal.

Poor Maintenance of Facilities

The water supply facilities are poorly maintain in the state, exposes pipes can be seen in some places, and old age of the water tanks and other distribution facilities which mostly were in used for more than 50 years many tanks and distribution mains are leaking due to over aging as result of its leads to the losses of large quantity of water and also most of these pipes use in conveying water are undersize because they are laid several years when the water demand is not much as its now and uncontrolled population growth and migration into Kano city. Also many mains are over extended beyond their design capacity due to rapid population growth. Similarly the main pipes for water distribution were exposed to surface hence they can easily get damaged. Others are lack of proper maintenance, inadequate skill personnel to effectively manage the system.

Conclusion

For any research to be precise and comprehensive measures for solution of the problems encountered in the research findings and prevention of future occurrence of problem is significant. Otherwise the study may be of little meaning. In conclusion, the vitality of water as an element of the natural environment cannot be over-emphasized. It is a basic necessary of life without which life would have been impossible therefore no amount of capital committed to the provision of this vital commodity should be regarded as social overhead by the concerned authority. Hence, Kano State Government should ensure the regular supply of water in good quality which is of great importance.

In view of what has been said government at local, state and national level should embark on using all available resources when and where necessary to ward. Implementing the above proposed suggestions of possible solutions as part and parcel of combating acute shortage of portable water.

However, the researcher is quite optimistic that this study despite its shortcoming will set a stage for further research in this very delicate field of specialization.

Recommendations

Water supply development will still not keep pace with population growth in third world countries provision of portable water means the quality of water is improve, reliability is high, quality has been improved and its distance from the consumer may have been reduced.

The fact that those problems is pipe borne water regulates (distribution) are militating against the adequacy of water supply for social wellbeing of municipal community of Kano, every sector in the society be it government, public or politically oriented have and have not citizens are hereby recommended to join hands both socially, culturally, financially or whatever it is toward finding lasting solution to the painful problems.

Among the suggestions made by the respondents includes sinking of more boreholes and hand pump wells in a strategic locations particularly where the demand is high but with less supply. Since population is rapidly increasing in uneven distribution there is need for the policy makers to understand the nature and rate of increase, so as to supply the water based on the demand per wards or area, within Kano municipal reliable population data will enable engineer and planner to have fairly accurate projection as how much water is required at any point in time.

Others respondents suggested on public enlighten campaigns, mass media are to be fully utilized so that they propagate rules and regulations for the resources profection to public heighten public awareness and water save. This would have created a sense of discipline in the use of water to discourage mis-use.

Beside, researcher(s) of poor water distributions investigated and come up with other possible

solutions that can reduce the rate of causalities of the problem. Among others are recycling method of the already used water from industries and residence the water from such places is to go back to the water works as raw water, located and then re-distributed. This method is being in application in many developed nation like Japan.

Pricing system is another solution whereby every house or industries using a meter flat rate encourage wastages, but pays should be based on the consumption rate. For instance domestic should pay less than industries and then commercial.

Generally inadequate or irregularity of portable water in our cities is partly a question of insufficient technological expertise but question of inadequate financial allocation and misplaced priorities.

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