Wastewater Usability in Abuja Municipal, Nigeria

[1]Yusufu A. Bature, [2]Paschal U. Ogar, [3]Samson A. Adejumo and [4]Vincent Choji

[1]Department of Urban and Regional Planning, University of Jos.
[2]Service Policies and Strategies Office, OHCSF, Abuja FCT, Nigeria.
[3]Department of Urban and Regional Planning, University of Ibadan.
[4]Department of Geography, Plateau State University Bokkos, Plateau state. Nigeria
Corresponding Author: yusufualamba@yahoo.com

Abstract

Urbanisation in Nigeria cities has affected to a great extent the water and sanitation. The urban sprawl has increased wastewater generation whose management constitutes a great challenge in achieving urban sanitation. Abuja as a fast growing modern capital city is experiencing a high urbanisation at 3.4% growth rate without a commensurate development in its wastewater management infrastructure. This study examines the issues of wastewater utilization in Abuja, with the aim to proffer solutions to some of its challenges. The research used primary data through questionnaire method administered to 2393 households within the 10 randomly sampled districts and also secondary data on Wastewater Treatment Plants (WWTPs) capacity utilisation. The urbanisation has over stretched the existing infrastructure beyond the design capacity thereby posing an eminent threat. A study of the Wastewater Management (WWM) of 10 Districts in Abuja Municipal Area Council (AMAC) revealed the existence of a total of fifteen (15) WWTPs with a capacity of 900,000 litres per day (lpd) installed capacity Population Equivalent (PE). However, a volume of 230,000 lpd pe of the existing operational capacity is being utilised. A proportion of 29.54% of Wastewater (WW) generated is treated while 70.46% is untreated due to underutilization and the state of disrepair of the existing treatment plants. This under utilisation capacity affects 13 out of the 15 Treatment Plants (TPs). This research urged maximum utilization, prompt funding and deployment/employment of skilled manpower. The recommendations centred on Abuja Environmental Protection Agency (AEPA) to ensure the profitability in the functionality of WWTP's such as: WWM should integrate water supply usability and staff capacity building to its maximum stage to cope with the urban utilisation trend.

Keywords: Wastewater Plants, Management, Service satisfaction and Urban Planning

INTRODUCTION

"Clean freshwater is necessary for drinking, washing clothes and dishes, bathing, swimming, providing, for fish and wildlife habitat, sustaining plant life, irrigating crops, processing food and enabling a number of manufacturing processes" (Daniel, 2014;181). Konikow (2013) asserted that water quality problems are a product of limited supplies of freshwater, poor storm water management and inadequate Wastewater Treatment Plants (WWTP's). The latter in particular releases raw sewage into waterways during major storm. This has caused water managers in adopting integrated water resource engineering and planning to protect water supply, better manage storm water and WWTPs (Tereck and Adams, 2013).

The water sector in Nigerian cities is in need of both intensive and extensive improvement. Abdul (2008) posited that between 60% and 70% of the population of urban dwellers are without well-established wastewater infrastructure/services. Most households (>70%) residing in these cities who receive pipe-borne water are supplied by state water corporations, all of which are owned by the governments of the states within which they operate. Only an estimated72% of the urban population has access to reliable water supply of acceptable quality, the coverage is estimated at only 48%. Except for Abuja, the Federal Capital Territory (FCT) and a limited area of the Lagos City, no urban community in Nigeria has a central or well-established sewerage system. This work sets out to appraise wastewater management in Abuja; FCT, Nigeria. Abuja has witnessed a rapid economic growth and urbanisation which has placed intense pressure on the capacity of the urban environment, its facilities and households to cope with the projected demands. This situation has not only compounded the challenges of urban wastewater management (WWM) but has led to sudden decay of the facilities provided.

Abdul (2008) explained that from the period of 1980- 2006, the urban population grew at an estimated average of 5.5 percent a year, compared to 2.9 percent nationwide. However, this growth rate in population size is not accompanied by a commensurate growth in the city's infrastructural needs of the populace. World Health Organisation (WHO) estimated 21 % (8.5 million people) of the cities' population still live below the poverty line, thus suffer the impact of the breakdown with respect to poor health, urban pollution and ineffective management of municipal waste- sewage and refuse (WHO, 2000).

As the urbanisation trend continues, urban environmental management has become a challenging issue. Among the challenges faced by urban planners and city administrators is the need to ensure ongoing basic human services, for example the provision of water and sanitation to households (Volkman, 2003). Notwithstanding these crippling challenges, actions and approaches adopted by waste managers in countries of the developed world have succeeded in ensuring of the provision of clean environment and qualitative water supply. Today, developing countries still encounter chronic inadequate, depreciable water supply and unacceptable WWM. The key issue affecting its management in cities is inadequate funds required for the operation, maintenance, expansion and rehabilitation of wastewater facilities. In some cases the facilities are barely available, obsolete, and malfunction. Wastewater facilities are poorly maintained and as such suffer gradual collapse over time thereby leading to the dismal performance of government agencies charged with their operation.

In cities of developing countries, an estimated 300 million urban residents have no access to sanitation with low-income urban dwellers being affected by slums, poor infrastructures, appalling environment and poor shelter. They don't have hygienic means of disposing excreta and likewise lack adequate means of disposing wastewater (Rose, 1999). It is a common practice to discharge untreated sewage directly into stream/dams or agricultural lands. This situation has resulted in the pollution of available water resources, thereby multiplying the danger of the contamination of drinking water and the spread of waterborne disease in urban centres. The number of households with access to drinking water supply has increased (approximately 80% in Latin America and the Caribbean). However, the percent connected to urban sewage collection systems is only 5% (Looker, 1998). In Africa, 80 million people are at risk of Cholera and Dysentery, and 16 million cases of Typhoid fever infections each year, as a result of inadequate clean drinking water and sanitation (WHO, 2006).

Urban Planning for Wastewater Usage

By the year 2015, majority of the global population (over 5 billion) will live in urban environments (United Nations Human Settlements Program; UNHSP, 2003). In the year 2000, there were 23 mega-cities with a population of over 10 million each, 18 of which existed in the developing world. Central to the urbanisation phenomena are the problems associated with providing municipal services, water sector infrastructure, including the provision of both freshwater generated from WWM. Urban planning for social services and infrastructures affect the disposal of effluent, present major challenges to engineers, planners and politicians (Giles and Brown, 1997). It has been estimated that 300 million urban residents in these cities have no access to sanitation and those affected are low- income urban dwellers within the urban poverty or slums neighbourhoods (Forget, 1992). Two- thirds of this population has no hygienic means of disposing excreta and a greater number lack adequate means of disposing wastewater (Sinnatamby, 1986).

The International water decade paid insufficient attention to the issue of sanitation and wastewater reuse in the developing world (Bakir, 2001). While fresh water systems have been developed for the urban poor, urban drainage and hygiene have not been scaled-up; this has led to appalling conditions that threatened emergence of plague and pestilence (WHO, 1989 and Blackett, 1994). The 1992 UNCED Earth Summit and the resultant programme for action or Agenda 21 emphasised the urgency in addressing the urban environmental problems of pollution and hazards endemic to urban centres (Leitman, 1994). Organization for Economic Co-operation and Development (OECD)and Development Assistance Committee (DAC) tagged OECD-DAC (2013) outlined specific actions to environmental

studies urban planning, waste management, maximisation of waste reuse and recycling to uplift human livelihood and environmental aesthetics. Given the technological inadequacies, it failed to evolve methods that would be most appropriate to pursue (Strauss, 2002). Innovative approaches highlighted new methodologies of protecting public health, recovering nutrient resources and protecting water from pollution (Nhapi, 2004). A resounding expression of the need for appropriate and prompt action in sanitary health education and awareness on the menace of urban endemic situation is been made. This has prompted the policy of integrated zero-discharge and wastewater reuse strategies.

Wastewater Infrastructure

Conventional conveyance and treatment strategies, engineered during 19th century sanitary reform contributed to the high degree of sanitation and public health experienced in many cities today. Pathogenic waste is isolated and conveyed away from potential human contact which has decreased the threat of major epidemics less than a century ago. This is not the case in most parts of the developing world. The problem according to Black 1994 appraised that public health engineering solutions based on 19th century precepts of centralised systems built and maintained by subsidised public agencies are inappropriate to the extraordinary pace and character of the contemporary urbanisation process. The initial capital costs of providing effective sanitation services are high. The approximate cost of constructing sanitation systems ranges from $75-150 for a twin pit pour-flush latrine, to $600 - 1,200 for a conventional sewerage system [1990 prices - US$] (WHO, 2000). Grau (1996) expressed countries with a per capita GNP of less than $500 does not have the resources to construct Treatment Plant (TP) facilities nor to maintain them. The water resources consumed in some sanitation systems of dense population is very high. Experience revealed that flush toilets consumed 20-40% of the domestic water resources used in a sewerage city.

Preventing pollution through engineered solutions is expensive and most instruments implored are inappropriate; depending on the context as their solutions depend on high energy inputs, expert operator skills and continued maintenance expenditures (Edwards, 1985). The implementations of engineered solutions cause external and intangible ecological damage to natural environment and ecosystem succession. Benefits from the local region constitute an advantage to both the society and the environment based on the cost of external impacts (Zhang *et al*, 2005). The hygienic urban water supply, sewerage systems and technologies are now in question with regards to urban environmental sustainability as well as new alternatives to be adopted. The human and socioeconomic costs of unmanaged and under-managed domestic wastewater are very high. Mara (1996) observed in India, the 1994 plague epidemic resulted in a loss of tourism revenue estimated at $US 200 million; in Peru, a Cholera epidemic resulted in an estimated loss amounting to three times the expenditure on water and sanitation for the country over the preceding 10 years; and in Shanghai: China, a major outbreak of Hepatitis ‘A’ was attributed to sewerage contamination.

The economic benefit of reusing, recycling or reclaiming water to put to a set of secondary treatment standard for the anticipated level of human consumption is realised in monitored and planned communities (Frost, 2013). This can be supplemented through the use of inorganic chemical fertilizer which is with reclaimed organic fertilizer derived from bio-waste technology. Reusing organic wastes must be measured against the cost of both the economic and environmental level. Bakir (2001) established that the World Bank (WB) data for the Eastern Mediterranean and North Africa cities showed serious aquatic pollution due to the failures to treat wastewater discharge. Even the discharge of treated sewage has detrimental impact on household consumption and constitutes a great loss of natural resources (Andoh, 2002). This study examines the challenges being faced in wastewater management in Abuja with the aim to provide solutions to some of them

MATERIALS AND METHODS

Study Area

The city of Abuja was created after the decision to move the Nigerian Capital from Lagos to the centre of the country in 1976. The Capital was finally moved in 1981. It is bounded in the north by Kaduna State, in the west by Niger State, in the east and south by Nasarawa State and in the south west by Kogi State. It lies within latitude 07^0 $25^!$ and 09^0 $20^!$ N, longitude 06^0 $45^!$and 7^0 $39^!$ East of Greenwich Meridian. This is shown in Figure 1.

Figure 1 Nigeria showing FCT Abuja and 36 states
Source: Cartographic Unit, Department of Geography, University of Ibadan.

Abuja, the Federal Capital Territory (FCT) is the seat of government, where political policy/decisions are created and subsequently disseminated as it is the abode of the three arms of government-The Executive, Legislative and Judiciary. Abuja local administration is divided into six areas Councils- Abaji, Bwari, Gwagwalada, Kuje, Kwali and Abuja Municipal councils. The Councils are responsible for providing and managing all basic infrastructure and services within their area of administrative jurisdiction.

The city experiences two weather seasons as it is obtainable in the Guinea Savannah where it is located. These are the rainy and the dry seasons. The rainy season is characterised by rainfalls which begins by March and runs through October, while the dry season, is characterised by bright sunshine that begins from October and ends by March. Within the latter period, there is a brief interlude of Harmattan occasioned by the northeast trade winds as conspicuous in the month of December-February. The average annual rainfall is between 121.8 - 183.5mm. Temperatures are high throughout the year, with mean range of 32.9°C to 35.3°C.

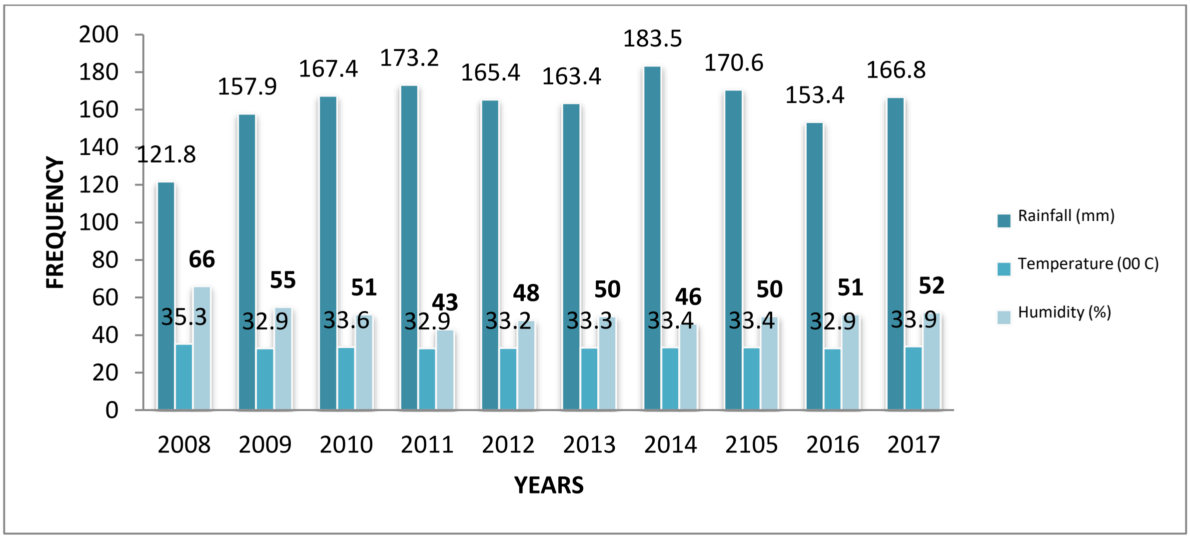

Figure 2 Annual Mean of Rainfall, Temperature and Humidity for Abuja (2008-2017)
Source: Nigerian Metrological Agency, 2018

Figure 2 shows a decade weather mean annual result for rainfall, temperature and humidity of Abuja environs. The highest annual rainfall mean is 183.5mm while the lowest annual rainfall is 121.8mm as recorded. The least is in 2008 with 121.8mm and the highest is 2014 with 183.5mm. The rainfall fluctuates from 2008 to 2007 with a range of 61.7mm (183.5-121.8). Hence, it exhibits rainfall annual increase from 2008-2014 with a subtle fluctuation. The temperature fluctuates within 32.9-35.3^{0}C. The former is the lowest annual temperature in 2009, 2011 and 2014 while the latter is the highest annual temperature in 2017 as recorded. Humidity is very high with the least as 43% in 2012 and the maximum in 66% in 2008. This gives a summation of the weather conditions in the study area.

The primary and the secondary sources of data were employed. The former involved the use of questionnaire. This included both the structured questionnaires administered to a plot occupy which comprised of many households and the wastewater administrators. This ascertained the wastewater accessibility in the study area. The questionnaire had 3 sections as: Socioeconomic characteristics, Wastewater treatment facilities and wastewater usability amongst households.

The questionnaire has section A that includes age, marital status, educational attainment, gender, occupation and income per month (Naira). Section B had questions on WW services, freshwater volumes, coverage corridor and WWTP performance. Section C had questions on household's ownership, WW uses and supply frequency, WWTP service assessment, Household water source and consumption rate per day, residents' satisfaction and remarks. The Focus Group Discussion (FGD) as deemed fitted to the staff (<3) of the Wastewater Engineering Unit of the Abuja Environmental Protection Agency (AEPA). The secondary data was obtained from the internet, satellite imageries and some unpublished reports/pamphlets produced by AEPA.

Abuja municipal council has 55 districts and from it a sample of 10 districts were randomly selected for this research as seen in Table 1.

Table 1 Abuja municipal council sampled households

S/N	Districts	Estimated Households	Sample size (2.5%)
1	Apo	12, 076	301.9
2	Asokoro	22,117	552.9
3	Garki	11,014	275.4
4	Jabi	2,104	52.6
5	CBD	19,967	499.2
6	Katampe	7,622	190.6
7	Maitama	3,024	75.6
8	Utako	8,240	206
9	Wuse	5,224	130.6
10	Wuye	4,316	107.9
	Total	95,704	2392.7

Table 1 showed that a total of 2393 questionnaires were administered to the estimated 95,704 households in the selected Districts. The districts were divided into two sections: Phase 1 and Phase 2. The phase 1 has 8 selected districts of Apo, Asokoro, Garki, CBD, Katampe, Maitama, Utako, and Wuse while phase 2 have Jabi and Wuye Districts. Stratified random sampling was applied in some designated streets and selected households were administered questionnaire during field work. A total of 5 field assistants were recruited for a period of 8 days with set-out - set-in time of 8am - 6pm. Questionnaire was administered in either English Language or vernacular such as *Pidgin* or *Hausa* language to ensure speed and accuracy.

The search for TP location inquiries were made within the Wastewater Treatment Plants (WWTPs), their location and capacities units. The data collected were analysed using qualitative statistical method. This involved simple statistical inference such as tallies, proportions, tabulations and graphs referred to as descriptive inferences.

RESULTS AND DISCUSSION

AEPA coordinates wastewater management as seen in Table 2.

Table 2: Wastewater Treatment Plants in Abuja (Status and Information)

S/N	Treatment Plant and Location	Usability	Installed Capacity, litres per day; lpd (000)	Operational Capacity (litres per day; lpd)	Usage (%)
1	Wupa	Functional	700	210,000	30
2	Utako	Not functional	100	Nil	Nil
3	Wuye Lagoon	Functional	50	20,000	40
4	Mogadishu	Not functional	10	Nil	Nil
5	Mambilla barrack	Functional	10	Nil	Nil
6	Gudu	Functional	10	Nil	Nil
7	Life camp	Functional	3	Nil	Nil
8	Asokoro suburb	Functional	3	Nil	Nil
9	Asokoro Ministerial	Functional	2	Nil	Nil
10	Mabushi ministerial	Functional	2	Nil	Nil
11	Maitama	Functional	2	Nil	Nil
12	Ainah (NIA)	Functional	2	Nil	Nil
13	Golf course	Functional	2	Nil	Nil
14	Niger cantonment	Functional	2	Nil	Nil
15	Presidential villa	Functional	2	Nil	Nil
		TOTAL	900,000	230,000	29.54

There are fifteen (15) treatment plants in the study area. The sum functional capacity is a sum total of 900,000lpd (Population Equivalent). Wupa town has 2/3rd proportion of 700,000lpd. Though these treatment plants are functioning, they produced 29.54% of the treated wastewater that could be reused by the inhabitants. The treatment plants operational capacity has been underutilised, hence it covered only 230,000lpd (Not 900,000lpd). The under operational capacity resulted to 70.46% of untreated wastewater discharged. From the Table 2, only Wupa and Wuye were functional with an operational capacity of 210,000lpd and 20,000lpd respectively. The other thirteen (13) treatment plants were out of use due to poor maintenance, paucity of fuel to power the machines and subsequent obsolete machines. The under operational function has reduced its role in urban sanitation and hygiene.

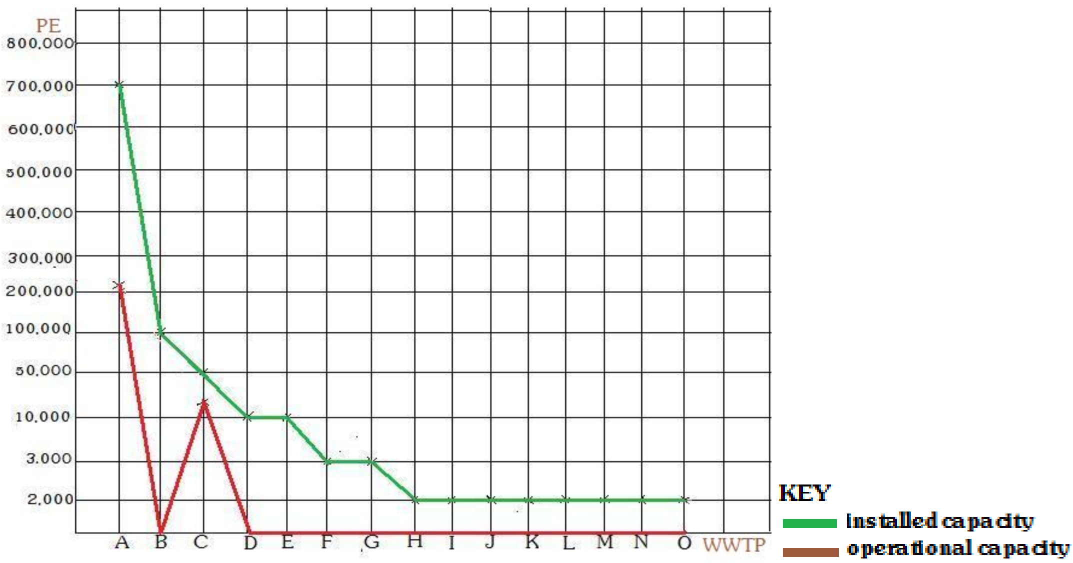

Figure 2 Performance rate of existing wastewater treament plants in Abuja city

The figure2 showed installed and operational capacity of wastewater treatment plants in Abuja municipalities with both installed and operational capacity drifting below threshold designed capacity. The graph above exhibits a general underutilisation of treatment plants. Plants A and B have high underutilisation capacity usage of 500,000 lpd and 100,000 lpd, respectively. The D and E plants had the same under utilisation capacities of 10,000lpd to a depreciable level of 2,000lpd in plants H I J K L M N and O. Although in plant C the capacity utilisation was minimized, it showed minimal difference. The under utilisation has been a persistent phenomenon as achieving maximum threshold utilisation has not been attained in any of the treatment plants. Reason might be either low fuel to power the plants or low manpower capacity of coordinating the treatment plants. In fact, there may be a number of reasons that could be responsible for this underutilization of treatment plants.

Existing wastewater plan introduced by the Abuja Environment Protection Agency; AEPA have concentrated attention in the usage of Wupa plant with the operational capacity of 210,000 litres per day out of its 700,000lpd installed capacity and Wuye Lagoon plant with an operational capacity of 20,000lpd out of the threshold installed capacity of 50,000lpd. There is a sum loss of 690,000lpd for Wupa and 30,000lpd loss for Wuye Lagoon plants. The total loss for the existing plants is 720,000lpd which represents 29.54% of Abuja city. For this, a continuous deficiency of 720,000lpd per day for all existing daily usage might be in the rise; the threshold designed capacity of 900,000lpd for all wastewater generative plants can provide hygienic environment habitable to the city residents as well as reduce endemic water and environmental diseases.

For this, the under utilisation by the authority revealed the continuous incapability to adhere to threshold capacity incentive to maximize the use of the facilities. Management lopsidedness has manyattached regurgitating effects that centre on the inefficiency/insufficiency of plants usage. For instance, corrupt attitude to keep the plants under use based on no/poor monitoring and evaluation by AEPA to the plant subsector summarised discontinuity in physical planning. It is believed that building a 900,000lpd capacity plants for the modern city covering 15 sites inserted a long-run effect in the futuristic nature of city growth and planning. It therefore, strives to satisfy residents' need and enhance its livability. Conversely, future plan to increase capacity in the existing plants is lacking. Against this backdrop, there is a complete need to maximize utilisation of all existing plants in the sphere of management and to the aspect of enhancing urban planning.

Wastewater Use in Households

Gender

The issues of concern highlighted includes gender, household discharge, domestic freshwater usage, wastewater recycle supply rate and freshwater service satisfaction. Gender the only socioeconomic characteristic that is considered is not the most vital but to ascertain respondents' sex. It is based on male and female as seen in Figure 3.

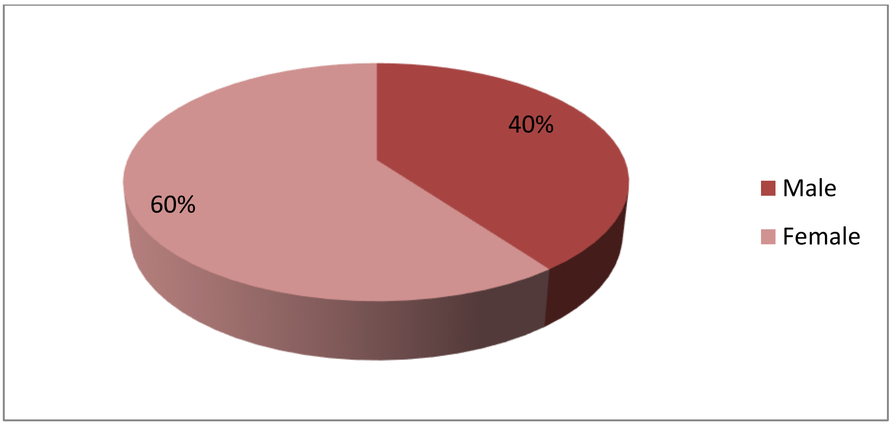

Figure 3 Gender Distribution

Figure 3 showed that male respondents had the highest frequency of 1513 respondents with a proportion of 63.2% while the females were 880 with a proportion of 36.8%.

Household Discharges

Household estimated wastewater discharge was inquired about. According to data collected from respondents, thousands of litres of waste water was released per day (Lpd). This is presented in Table 3.

Table 3 Household estimated discharge (1000's)

S/N	Capacity discharge (1000's)	Freq	Percent
1	1 – 3000	1574	65.8
2	3001 – 6000	599	25
3	6001 – 9000	175	7.3
4	9001 – 12000	45	1.9
	Total	**2393**	**100**

Table 3 showed a high household discharge in the range of 1-3,000Lpd with 1574 respondents (65.8%). This was followed by 3,001-6,000Lpd discharge with 599 respondents (25%). The low discharges were from single households per plot which had 6,001-9,000Lpd and 9,001-12,000Lpd having 175 and 45 respondents with proportions of 7.3% and 1.9%, respectively. The single households had fewer residents, thus, manifesting a low discharge.

Household Freshwater Usage

Household freshwater usage volume is inquired from respondents. This is seen in Table 5.

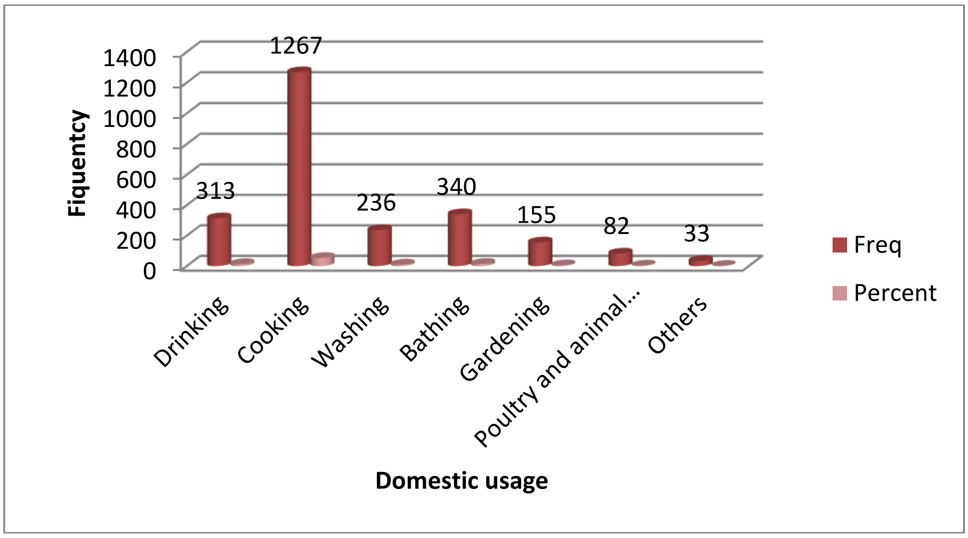

Figure 4 Domestic Freshwater Usage

Figure 4 detailed respondents usage of household freshwater supply. The use of freshwater for cooking had the highest with 1267 respondents (52.9%), while bathing was next with 340 respondents (14.2%). There must be eating and personal clean-up because of the hot humid weather. The sum use of water for cooking and bathing gave a total of 607(1267+340) respondents (67.1%; 52.9 + 14.2), while drinking had 313 respondents (13.1%). The least domestic uses are poultry and animal breeding of chickens, dogs, cats, etc with 82 respondents (3.4%) and domestic activities such as small industrial usage for cakes, buns, catering services etc, with 33 respondents (1.4%). However, the city environmental planning law did not permit poultry and animal breeding roaming but under confirmed area.

The nature of freshwater supply is inquired in the structured questionnaire administered. This is listed in Figre 5.

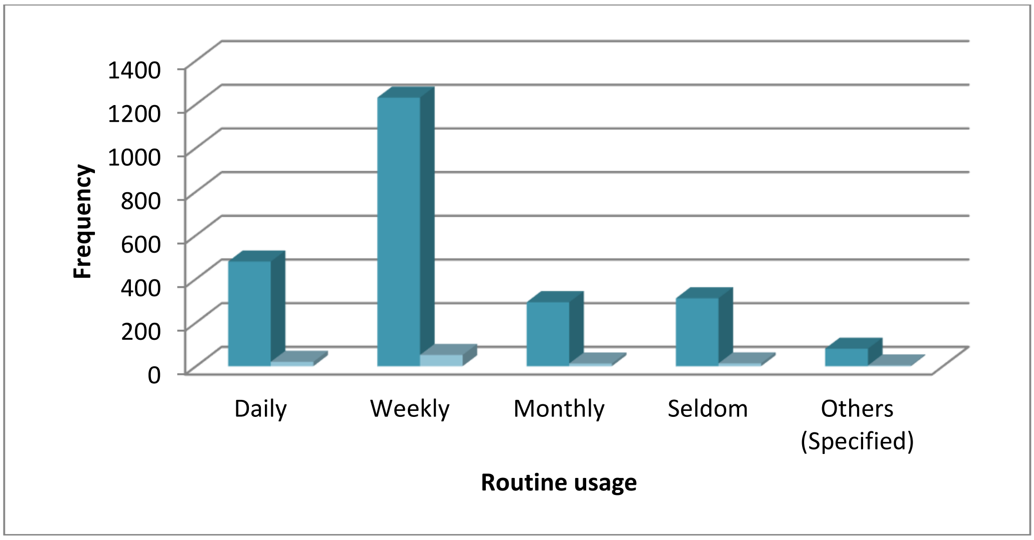

Figure 5 Freshwater Supply Routine

Fresh Water Supply Routine

Figure 5 provided the routine syndrome of the WWTP's household supply. Weekly routine to households had the highest respondents of 1230 with a proportion of 51.4%. This is followed by daily supply routine of 479 respondents having a proportion of 20%. The least routine others specified as erratic supply, repair/breakdown phenomenon during services with 80 respondents with a proportion of 3.4%. This is based on the nature of obsolete machines and insufficient skilled manpower. Supply revealed it routine is 51.4% per week. It warranted households have to build overhead water tank or create a means of consistence water supply; borehole, well, etc.

The services satisfaction was inquired from benefiting respondents. Respondents were required to indicate the performance grade from poor to excellent based on their perception of the services. This is seen in Table 4.

Table 4 Freshwater supply performance

S/N	Performance Grade	Freq	Percent
1	Excellent	128	5.4
2	Very Good	60	2.5
3	Good	910	38
4	Fair	1021	42.7
5	Poor	274	11.4
	Total	2393	100

Table 4 indicated the service satisfaction as summarized by respondents. Fair performance had the highest rate of 1021 respondents with a proportion of 42.7% and is seconded by Good performance having 910 respondents with a proportion of 38%. The least is Very Good and Excellent grade with 60 and 128 respondents with a proportion of 2.5% and 5.4% respectively. It revealed the satisfaction is far below requirement in the capital city. The municipal government which is the legal authority for WW services and their performance is based on bureaucratic policy of the day.

Policy Options and Priorities

Management of wastewater recognises the success of service satisfaction as a function of being able to cover the cost of services. This is only possible if all elements of cost whether hidden or visible, are included in the price of the services (tariff system, turn-around cost, daily routine cost, contingence cost, etc.), taking into consideration that this price does not rise above citizens' financial ability to pay. Attempts to produce the best systems at the lowest cost through capacity building will enhance productivity and service sustainability. This will ensure that the currently underutilized and redundant facilities will be put to efficient and maximum capacity utilisation.

To ensure this twin objectives of efficiency and maximum capacity utilisation is achieved, there is need for the establishment of an autonomous wastewater management outfit, to give satisfaction to the befitting residents. Under this arrangement, the institution will be responsible for the construction, operation and maintenance of wastewater infrastructure. The inspection and monitoring of wastewater facilities is to ensure compliance with regulations, issuing approval for disposal, capacity utilisation and technical assistances in the transportation of wastewater sludge and inspection. This is to ensure that the sludge is managed in an approved and logically planned manner. This arrangement would support co-ordination of wastewater management within the city. Mobilising financial resources to ensure efficiency in the system requires recognising the prudence in the use of allocated funds and creativity in the generation of more funds. This compelsa stringent preference to expenditure needed for urban sanitation and wastewater management.

Wastewater bye product of either nitrogenous, carbonated, etc biotechnology could be applied in farm production. Volumes of induced algae blooms, sewerage sludge created from both contaminated treated algae, bacteria, and other micro-organisms as well as other generated tracts elements such as nitrates, sulphates, manganese, potash, etc. are basic for plant growth. Hence, asserting the significance of wastewater relevance to agro-allied sector.

Recommendations are made to improve satisfaction and environmental aesthetic. First, urban planning for wastewater management should be integrated with planning for other sectors such as water supply, solid waste and land uses, and Abuja weather report to ascertain the extent of need, usage and planning. Second, urban planning should involve maximising the utilization of treatment plants. This will encourage urban hygiene envisaged in both environmental and human aspects. Treatment plant utilisation should be diversified in the aspect of not only maximisation but modernisation and capacity threshold utilization to cope with urban trends in the city. There is also the need for human capacity development. This will involve the training - retraining and employment of staff to cope with the existing challenges.

CONCLUSION

Wastewater management enables appropriate reuse. Good sanitation and hygiene constitutes the fundamental of individual and the general health of the inhabitants of any environment be it urban or rural. Short and the long-run planning processes are meant to produce efficiency in the management of infrastructure. Wastewater generation in developing countries - Abuja, Nigeria is 900,000lpd but only 230,000lpd is treated having a proportion of 29.54%. This under utilisation of the operational capacity can be overcome by human capacity development in specific relevant skill. The operation of treatment plants are constrained by limited capacity, poor maintenance, process malfunction, lack of experienced staff and inadequate funding. It is a common sight at these treatment plants to see raw sewage gushing out of the sewage holding chambers. The entire system is smeared with inadequacies that have culminated to inefficiencies in the management of wastewater in the city. It is therefore necessary for the managers of wastewater to make deliberate efforts to ensure maximization of the existing wastewater treatment plants.

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