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# WATER RESOURCE MANAGEMENT IN NIGERIA: ACCEPTABILITY OF TREATED MUNICIPAL WASTEWATER REUSE IN FEDERAL CAPITAL CITY, ABUJA

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**ABSTRACT:** *If well managed, municipal wastewater can be an alternative source of water supply for agricultural, industrial, and domestic purposes especially at a time when climate change and rising population is exerting so much pressure on available fresh water sources. However, the success of such an idea is largely dependent on the perception and acceptability of reclaimed municipal wastewater by the public. This study examined the acceptability of treated municipal wastewater reuse by residents of Federal Capital City of Nigeria. Results of the study revealed that in general, the people have positive perception on the use of treated municipal wastewater in the capital city. Under the domestic category respondents had the most positive perception for using treated wastewater to flush toilet (3.57). Dust control during construction (3.59), watering of parks (3.54), fire fighting (3.47), watering of golf courses (3.40) and lawn (3.41) were the top options of choice. For industrial purpose category, use of treated wastewater for block production, paper mills and paint production came tops with 3.5, 3.41 and 3.39 respectively. Commercial car wash with a mean of 3.32 topped commercial use of treated municipal wastewater. The respondents also consented to using treated municipal wastewater to improve agriculture. However, analysis between the groups showed that the positive perception is more inclined to outdoor use and industrial use. The results showed respondents had least positive perception for domestic use and commercial use of treated municipal wastewater. Meanwhile, respondents rejected the idea that treated municipal wastewater should be used to boost water supply in the FCT. Effluent discharge will be resourceful in improving agriculture and for industrial use as more respondents have no objection to its application in agriculture and industry. Wastewater reuse should be considered as an alternative source for non-potable water use whenever there is a case of water crisis or as a means to prevent water stress in the Federal Capital City and in Nigeria at large. Public knowledge and acceptance is crucial in wastewater reuse, as such, whenever a reuse programme is to be implemented, public consultation and confidence building should be embarked on.*

**KEYWORDS:** municipal wastewater, treated wastewater reuse, wastewater reuse perception, wastewater reuse options, water management.

## INTRODUCTION

As water supplies become scarce, conflicts will arise between individuals or nations in the course for search for water. Water disputes may add to tensions between countries where differing national interests and withdrawal rights have been in conflict. Just as with energy resources today, wars may erupt over water. Growing global demand for water is already creating tensions among communities, between farmers and city dwellers, between people and governments. Tensions are expected to increase as water scarcity becomes a reality for more people. Conflicts arising from water issues is projected to increase mainly due to population increase and climate change. According to World Economic Forum (2018), Gizmodo George Dvorsky reported an intriguing 551 crisis related flare-ups. Water, Peace and Security (WPS) global early warning tool, highlighted hotspots across Africa, the Middle East and Southeast Asia. The tool predicted that conflicts are likely to happen in 2020 in Iraq, Iran, Mali, Nigeria, India and Pakistan (The Guardian, 2020, January 8$^{th}$).

Water scarcity is no longer news to many Nigerians as adequate water supply which is a necessity is grossly lacking in Nigeria. Often times, people resort to source water from streams, rivers, well, borehole or even through rain water harvesting during the rainy season. In arid and semi-arid zones of Nigeria, rainfall is experienced for less than four months throughout the year. The short duration of rainfall makes rainwater harvesting unattractive, coupled with the high evaporation rate in the region caused by intense and prolonged solar radiation. Also, agriculture which is a primary occupation in most rural communities in Nigeria are chiefly small scale operations which rely on rain for production. On the other hand large scale agricultural operations which involve irrigation, impact heavily on the availability of fresh water resource for potable use. Such water stress with the possibility of high quality treated effluent has made treated municipal wastewater an option to be explored mostly for agricultural purpose as well as for industrial and domestic purposes.

Unfortunately, the systems for the management and useful integration of treated municipal wastewater into the urban water cycle is grossly neglected or totally lacking in Nigerian cities. Adesogan (2013) revealed the abysmal lack of wastewater treatment facilities in Nigerian cities, which would be a clog in the sustainable use of treated wastewater in combating population pressure on fresh water. Municipal wastewater reuse is practiced in a lot of countries as exhibited by the works of Adewumi, and Oguntuase (2016).However, there seems to be a dichotomy in the acceptability of treated municipal wastewater.

Ma (2003), assessed public attitude towards wastewater in Knoxville, USA and discovered that respondents were positive to applications not involving close personal contact (such as fire fighting, car washing, lawn irrigation and agricultural uses), while uses of wastewater for possible consumption (released into potable surface supply or groundwater supplies) or applications involving close personal contact (laundry) were unfavourable.

Lamnisos, et al (2013) investigated public awareness, attitudes and health risk perceptions of water reuse among the general public in Cyprus. As many as half of the participants did not know where recycled water comes from, 35% were unaware of the existence of treatment plants while a vast majority were not certain if they have ever consumed products produced with recycled water. While as many as half are unsure whether to agree that coming to contact with recycled water can be harmful for health, a large majority accepted recycled water for landscape irrigation and reported that they would visit parks or send their children to a school which practices it. Acceptance dropped sharply to 58% for crop irrigation and as many as 70% agreed or are unsure whether consuming fruit and vegetables produced with recycled water can cause disease while 90% believe that products produced with recycled water should be labelled. Only 20% believe that there is adequate quality control, paralleling the fact that only 30% trust the authorities.

A comparative analysis by Dolnicar and Schafer (2009) on knowledge, perceptions, and acceptability of wastewater reuse was carried out in Australia. Their findings revealed that the Australian population once perceived desalinated water as environmentally unfriendly, and recycled water as a public health hazard. After nearly five years of serious drought, accompanied by severe water restrictions across most parts of the country, and subsequent media attention on solutions to water scarcity, Australians now show more acceptance of desalinated water for close-to-body uses, and less resistance to recycled water for garden watering and cleaning uses.

Alhumoud and Madzikanda (2010) research result on public perception on water reuse shows that the overwhelming majority of the respondents (77.91 percent) objected to using reclaimed water for drinking and only 16.83 percent said they might consider drinking it. The majority of respondents (75.28 percent, 66.80 percent and 55.60 percent) did not object to using the reclaimed water for agricultural irrigation, car washing and house washing respectively. In addition, the research result of Alhumoud and Madzikanda (2010) shows that most of the respondents, even the ones that possessed enough knowledge about wastewater reuse, strongly opposed using reclaimed wastewater for human use (showering/bathing - 60.03 percent, clothes washing - 52.40 percent and cooking - 78 percent), regardless of its quality and cost.

Despite the accruing advantages of municipal wastewater reuse on climate change impacted water resources, public acceptance is key to any wastewater reuse scheme. Dolnicar and Schafer (2009) reiterated that water sources in many countries are limited in both quantity and quality. While measures are being taken to ameliorate this problem through engineering solutions from wastewater recycling and desalinating water from non-potable sources at a relatively low cost, the general public is sceptical about adopting these alternative water sources.

Abuja, which doubles as the federal capital city of Nigeria is one of the few Nigerian cities with a functional wastewater treatment facility. The city has experienced a heavy upsurge in population between the years 1990 to 2020, this has placed enormous stress on water supply facilities. The city also lies in what could be called the transition zone of northern (arid and semi-arid) and southern (tropical monsoon) climate. The northern region of the country is not adverse to water scarcity and is therefore necessary that steps are taken to combat the issue of negative impact on

fresh water sources in the light of sustainability. It is on this premise that this research set out to study the acceptability of treated municipal wastewater reuse in the FCT.

## MATERIALS AND METHOD

### Study Area

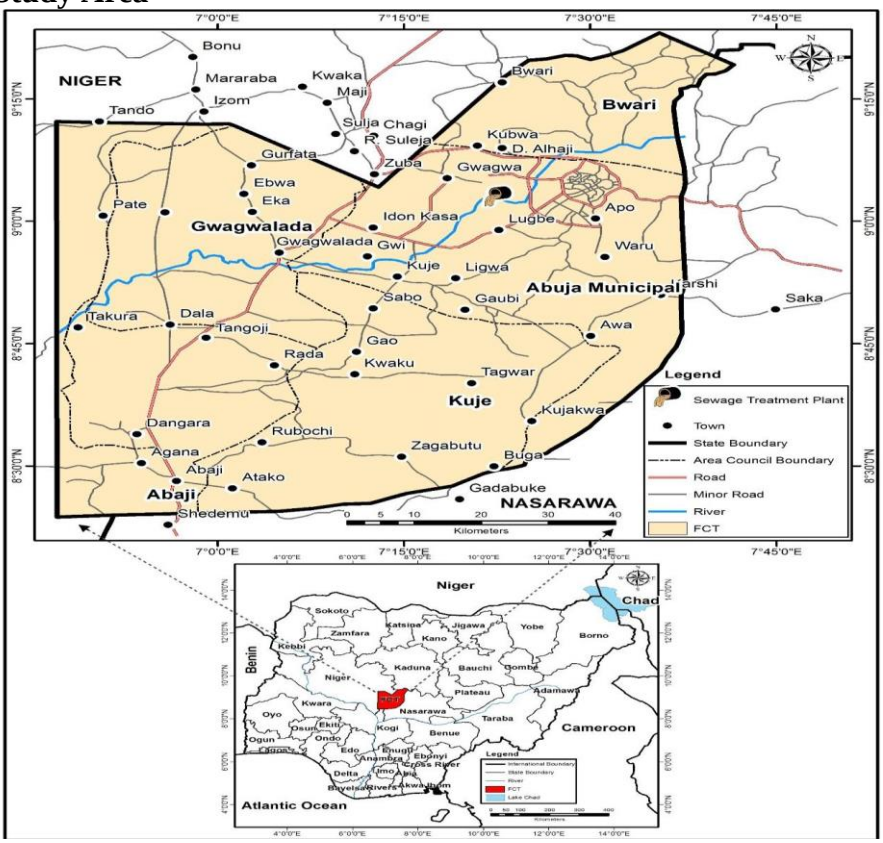


Figure 1: Federal Capital Territory, Abuja.
Source: Audu (2016)

The Federal Capital City of Nigeria, known as Abuja was created in 1976. Abuja is located on Latitudes 8°21′N to 9°18′N and longitude 6°46′E to 7°37′E. Abuja has a total landmass of about 8000km$^2$. Abuja is bounded in the east by Nasarawa State, north by Kaduna State, west by Niger State and south by Kogi State. The city is divided into six area councils which are Abuja Municipal, Gwagwalada, Kuje, Abaji, Kwali and Bwari Area Councils. Amoo, et al (2017) revealed that the Abuja master plan is projected to cater for 3.1 million people in the land of about 8,000 square kilometres when fully developed.

The city experiences two seasons, the rainy and dry seasons which begins from April to October and from November to March respectively. The area records its highest temperature of about 34 ℃ during the dry season, during the rainy season the maximum temperature drops to about 24℃

(Dan-Hassan, Olasehinde, Amadi, Yisa, and Jacob, 2012). The annual total rainfall is in the range of 1100mm to 1600mm (Dan-Hassan et al, 2012). The indigenous people of Abuja are originally known to be farmers and hunters. With adequate treatment of municipal wastewater and well-integrated system of urban water cycle, treated effluent can be used amongst other things for agricultural irrigation and specific industrial purposes.

**Research Design**

The data for the study were compiled and presented in frequency tables and percentages for easy understanding and interpretation. The researcher distributed a total of six hundred (600) copies of well-structured questionnaire. Out of the 600 copies of the questionnaire distributed, four hundred and ninety-two (492) copies representing 82% were correctly filled and returned. The returned copies of the questionnaire were collated and analysed and results presented in descriptive form such as simple percentages and proportions, frequency tables and charts, weighted mean and standard deviations.

## RESULT AND DISCUSSION

### *Socio-Demographic Characteristics of the Respondents*

The socio-demographic characteristics captured by the researcher include the respondent's gender, age group (or range), level of education, occupation, and years of resident in the study area.

**Table 1** ***Sex Distribution of the Respondent***

| Sex | Frequency | Percentage |
|---|---|---|
| **Male** | 222 | 45.1% |
| **Female** | 270 | 54.9% |
| Total | **492** | **100.0%** |

**Source**: Author's Field survey result

The frequency distribution of the gender of the respondents shows an almost equitable percentage of gender representation. Particularly, the females are slightly higher (54.9%) compared to the male counterpart (45.1%). See table 1

**Table 2** ***Age Range of the Respondents***

| Age group | Frequency | Percentage |
|---|---|---|
| **15-19yrs** | 12 | 2.4% |
| **20-24yrs** | 96 | 19.5% |
| **25-29yrs** | 108 | 22.0% |
| **30-34yrs** | 108 | 22.0% |
| **35-39yrs** | 96 | 19.5% |
| **40-44yrs** | 48 | 9.8% |
| **45-49yrs** | 11 | 2.2% |
| **≥50yrs** | 13 | 2.6% |
| Total | **492** | **100.0%** |

**Source**: Author's Field survey result

The frequency distribution result shows that majority (44.0%) of the respondents are within the age group of 25-34years. 19.5% are of ages 20-24years and 35-39years respectively. About 2.4% of the total respondents are of age group 15-19 years; 2.2% are between 45-49 years while only about 2.6% of fifty years and above. A clearer view is presented in table 2.

**Table 3** ***Educational Attainment of the Respondents***

| Education | Frequency | %age |
|---|---|---|
| **No formal education** | 24 | 4.9% |
| **FSLC** | 0 | 0.0% |
| **SSCE** | 48 | 9.8% |
| **Diploma/NCE** | 36 | 7.3% |
| **B.Sc.** | 312 | 63.4% |
| **PGD** | 5 | 1.0% |
| **M.Sc.** | 62 | 12.6% |
| **Ph.D.** | 5 | 1.0% |
| Total | **492** | **100.0%** |

**Source**: Author's Field survey result

Distribution of educational qualification of the respondents are shown in table 3 shows that about 63.4% of the total respondents are B.Sc. holders, 12.6% are M.Sc. holders, 9.8% are SSCE holders, 7.3% are Diploma/NCE holders, 1.0% each have PGD and Ph.D. respectively, while only about 4.9% have no formal education. A graphical representation is as shown in table 3.

**Table 4** ***Occupation of the Respondents***

| Occupation | Frequency | Percentage |
|---|---|---|
| **Student** | 101 | 20.5% |
| **Artisan** | 0 | 0.0% |
| **Trader/Business** | 60 | 12.2% |
| **Civil servant** | 228 | 46.3% |
| **Private** | 48 | 9.8% |
| **Corper** | 19 | 3.9% |
| **Others** | 36 | 7.3% |
| Total | **492** | **100.0%** |

**Source**: Author's Field survey result...

The occupational distribution of the respondents revealed that a total of 228 representing 46.3% of the total respondents are Civil Servants, 101(20.5%) are Students, 60(12.2%) are Traders/business men and women, 48(9.8%) are Self-employed, 19(3.9%) are Corps Members, while 36(7.3%) are into other employment sections/engagements not mentioned in this study. See table 4.

**Table 5** ***Respondents' Length of stay in FCT***

| Years of Resident | Frequency | Percentage |
|---|---|---|
| **1-3yrs** | 138 | 28.0% |
| **4-6yrs** | 42 | 8.5% |
| **7-9yrs** | 66 | 13.4% |
| **10yrs and above** | 246 | 50.0% |
| Total | **492** | **100.0%** |

**Source**: Author's Field survey result

The distribution of length of stay of the respondents shows that majority (50%) have lived in the area for 10years and above. 138 respondents , amounting to 28% have lived in the area for 1-3years, 66(13.4%) have stayed in the area for 7-9years, while 42(8.5%) have lived in the area for 4-6years. The implication is that the respondents have stayed for a long time in the area; however, information provided by them can be highly relied upon.

**Table 6** ***Respondents' awareness of existence of wastewater treatment plant in FCT***

| Aware | Frequency | Percentage |
|---|---|---|
| **Yes** | 294 | 60% |
| **No** | 198 | 40% |
| Total | **492** | **100.0%** |

**Source**: Author's Field survey result...

The respondents' level of awareness of existence of wastewater treatment plant in FCT cannot be boldly ticked 'yes' as about 60% are aware while 40% are not.

**Table 7** ***Respondents' awareness of treated municipal wastewater reuse***

| Aware | Frequency | Percentage |
|---|---|---|
| **Yes** | 246 | 50.0% |
| **No** | 246 | 50.0% |
| Total | **492** | **100.0%** |

**Source**: Author's Field survey result

Table 7 shows that the proportion of those who are aware of treated municipal wastewater reuse is equal to the proportion of those who are not aware (50.0% each).

**Data Analysis**

**Public perception on utilization of treated municipal wastewater in the FCT**

**Table 8a** Respondents' perception on utilization of treated municipal wastewater in the FCT

| QUESTION ITEMS | SA | A | D | SD | Mean | Perception |
|---|---|---|---|---|---|---|
| **DOMESTIC USE** | | | | | | |
| Treated municipal wastewater should be used for drinking purpose | 30 | 192 | 144 | 126 | 2.26 | Negative |
| Treated municipal wastewater can be safely used for bathing | 168 | 216 | 72 | 36 | 3.05 | Positive |
| Treated municipal wastewater should be used for house cleaning | 225 | 243 | 10 | 10 | 3.40 | Positive |
| Treated municipal wastewater should be used in flushing toilets | 325 | 134 | 23 | 11 | 3.57 | Positive |
| Treated municipal wastewater can be safely used in cooking food | 60 | 240 | 132 | 60 | 2.61 | Positive |
| Treated municipal wastewater can be safely used for utensil/plate washing | 95 | 300 | 73 | 24 | 2.95 | Positive |
| Treated municipal wastewater can be safely used for laundry | 204 | 252 | 12 | 12 | 3.35 | Positive |
| **OUTDOOR USE** | | | | | | |
| Treated municipal wastewater should be used for watering golf courses in the FCT | 265 | 168 | 48 | 11 | 3.40 | Positive |
| Treated municipal wastewater can be used for watering Parks in the FCT. | 300 | 132 | 23 | 13 | 3.54 | Positive |
| Treated municipal wastewater should be used for watering lawn | 276 | 168 | 24 | 24 | 3.41 | Positive |
| Treated municipal wastewater can be safely used for vehicle washing | 252 | 156 | 36 | 29 | 3.33 | Positive |
| Treated municipal wastewater can be safely used in swimming pools | 103 | 170 | 154 | 65 | 2.63 | Positive |
| Treated municipal wastewater can be safely used for fire fighting | 300 | 137 | 23 | 25 | 3.47 | Positive |
| Water fountains in the FCT should make use of treated municipal wastewater. | 168 | 240 | 48 | 12 | 3.21 | Positive |
| Treated municipal wastewater can be used for dust control during road and other kinds of construction | 348 | 96 | 36 | 12 | 3.59 | Positive |
| Street cleaning requiring water should involve treated municipal wastewater | 288 | 110 | 60 | 24 | 3.37 | Positive |

| | | | | | | |
|---|---|---|---|---|---|---|
| **INDUSTRIAL USE** | | | | | | |
| Treated municipal wastewater should be used for cooling of machines in industries | 276 | 144 | 48 | 24 | 3.37 | Positive |
| Paint making industries in the FCT should make use of treated municipal wastewater for Paint production | 264 | 168 | 48 | 12 | 3.39 | Positive |
| Paper mills in the FCT should employ use of treated municipal wastewater | 276 | 156 | 48 | 12 | 3.41 | Positive |
| Treated municipal wastewater should be used for construction block production | 337 | 96 | 59 | 0 | 3.57 | Positive |
| Detergent and soap making industries in the FCT should make use of treated municipal wastewater for production | 185 | 233 | 72 | 0 | 3.23 | Positive |
| Food and pharmaceutical companies can use treated municipal wastewater as an alternative source of water | 100 | 125 | 144 | 123 | 2.41 | Negative |
| Treated municipal wastewater will be a better option for production of plastic products | 172 | 265 | 35 | 12 | 3.23 | Positive |
| Treated municipal wastewater should be used for production of insecticides, pesticides, herbicides and other chemicals | 204 | 228 | 38 | 10 | 3.30 | Positive |
| Production of textile, tie and dying activities should make use of treated municipal wastewater | 228 | 192 | 48 | 17 | 3.30 | Positive |
| **COMMERCIAL USE** | | | | | | |
| Treated municipal wastewater should be used in hotels | 48 | 216 | 144 | 84 | 2.46 | Negative |
| Treated municipal wastewater should be used in commercial car wash centres | 228 | 216 | 27 | 21 | 3.32 | Positive |
| Treated municipal wastewater should be used in commercial laundry centres | 204 | 228 | 24 | 36 | 3.22 | Positive |

**Source**: Field Survey 2019

Result in table 8a shows the respondents' perception on utilization of treated municipal wastewater in the FCT. From the result, the respondents have positive perception on the domestic use of treated municipal wastewater in the FCT. They specifically agreed that treated municipal wastewater can be safely used for bathing, house cleaning, flushing toilets, cooking food, utensil/plate washing, and for laundry (with strata means >2.50). Meanwhile, they have negative perception that treated municipal wastewater can be used for drinking purpose (with strata means <2.50).

On the outdoor use, the respondents were of full positive view that treated municipal wastewater should be considered for outdoor usages, which includes: for watering golf courses in the FCT, for watering parks in the FCT, for watering lawn, for vehicle washing, for fire fighting and water fountains, for dust control during road and other kinds of construction, and for street cleaning (with strata means >2.50).

On the industrial usage, the respondents agreed that: treated municipal wastewater should be used for cooling of machines in industries (mean=3.37>2.50), paint manufacturing industries in FCT should make use of treated municipal wastewater for paint production (mean=3.39>2.50). Similarly, the respondents also agreed that paper mills in the FCT should employ use of treated municipal wastewater (mean=3.41>2.50), treated municipal wastewater should be used for construction block production (mean=3.57>2.50), detergent and soap making industries in the FCT should make use of treated municipal wastewater for production (mean=3.23>2.50), treated municipal wastewater will be a better option for production of plastic products (mean=3.23>2.50), treated municipal wastewater should be used for production of insecticides, pesticides, herbicides and other chemicals (mean=3.30>2.50), and that production of textile, tie and dying activities should make use of treated municipal wastewater (mean=3.30>2.50). Meanwhile, they disagreed that food and pharmaceutical companies can use treated municipal wastewater as an alternative source of water (mean=2.41<2.50).

On the commercial use, the respondents opined that: treated municipal wastewater should be used in commercial car wash centres (mean=3.32>2.50), and in commercial laundry centres (mean=3.22>2.50), and thus disagrees that treated municipal wastewater should be used in hotels (mean=2.46<2.50).

In general, the people have positive perception on the use of treated municipal wastewater in the FCT (cluster mean = 3.17>2.50, 95% C. I. = 2.63−3.98). This evidence is statistically significant (t* = 10.387, p=0.000<0.05). Under the domestic category respondents had the most positive perception for using treated wastewater to flush toilet (3.57). Dust control during construction (3.59), watering of parks (3.54), fire fighting (3.47), watering of golf courses (3.40) and lawn (3.41) were the top options of choice. For the industrial use, use of treated wastewater for block production, paper mills and paint production were tops with 3.5, 3.41 and 3.39 respectively. Commercial car wash with a mean of 3.32 topped commercial use of treated municipal wastewater. However, analysis between the groups showed that the positive perception is more inclined to outdoor use and industrial use (Group mean = 3.33 and 3.25 respectively). The result showed respondents had least positive perception for domestic use (Group mean = 3.03) and commercial use (Group mean = 3.0) of treated municipal wastewater.

These results are in line with the findings of the study conducted in South Africa by Bungu (2014) that majority of respondents are willing to use treated wastewater for industry use, fire fighting, washing cars, watering lawns and golf courses and flushing toilets. The acceptance levels decrease as the human contact increases. Robinson *et al*., (2005); Hartley, (2006) and Bungu (2014) states that public acceptance of water reuse is higher when the degree of human contact is minimal. This is also evident in the work of Alhumoud and Madzikanda (2010). Regardless of its quality and cost Alhumoud and Madzikanda (2010) stated that respondents opposed human use of treated municipal wastewater.

**Table 8b: Other Considerations for Utilization of Treated Municipal Wastewater**

| | SA | A | D | SD | Mean | Inference |
|---|---|---|---|---|---|---|
| Treated municipal wastewater should be used to boost water supply in the FCT. | 19 | 101 | 192 | 156 | 1.96 | Reject |
| Treated municipal wastewater should be pumped into the ground. | 37 | 143 | 252 | 36 | 2.39 | Reject |
| Treated municipal wastewater should be discharged into streams and Rivers. | 140 | 148 | 156 | 48 | 2.77 | Accept |
| Treated municipal wastewater should be used for all purposes. | 45 | 171 | 144 | 132 | 2.26 | Reject |

**Source**: Author's field survey, 2019

On a wider note, the respondents accepted that treated municipal wastewater should be discharged into streams and rivers (mean = 2.77>2.50). Meanwhile, they rejected that treated municipal wastewater should be used to boost water supply in the FCT (mean = 1.96<2.50), that treated municipal wastewater should be pumped into the ground (mean = 2.39<2.50), and that treated municipal wastewater should be used for all purposes (mean = 2.26<2.50), as seen on table 8b. This rejection despite the positive perception underscores the fact that respondents will prefer to use treated wastewater by choice rather than integrating it into the urban water supply system without general knowledge and acceptance. The respondents rejected that the treated wastewater be used for all purpose. Rather accepted discharging the treated municipal wastewater into the river from which extractions can be made by those whom intend to utilize it. Respondents are mindful of the standard of treatment as such, low level of treatment will affect use of treated municipal wastewater.

Wastewater reuse has been identified worldwide as a viable option to augment water supplies. While technologies are available to ensure proper treatment of wastewater to even potable standards, many countries have experienced public resistance to wastewater reuse due to negative perceptions of consumers. For wastewater reuse initiatives to be successful public acceptance is imperative.

**Perception on patronage of agricultural products irrigated from treated municipal wastewater**

**Table 9** Respondents' perception on patronage of agricultural products irrigated from treated municipal wastewater

| AGRICULTURAL USE | SA | A | D | SD | Mean | Perception |
|---|---|---|---|---|---|---|
| Treated municipal wastewater can be used to improve crop production in the FCT. | 240 | 192 | 47 | 13 | 3.34 | Positive |
| Treated municipal wastewater can be used for watering personal farm crops/gardens. | 228 | 192 | 48 | 24 | 3.27 | Positive |
| Treated municipal wastewater should be used for irrigation of large scale plantations in the FCT. | 264 | 180 | 37 | 11 | 3.42 | Positive |
| Crops irrigated with treated municipal wastewater will be highly patronized by residents of FCT. | 127 | 138 | 109 | 118 | 2.56 | Positive |
| Treated municipal wastewater should be used for animal rearing and aquaculture in the FCT. | 109 | 203 | 124 | 56 | 2.74 | Positive |
| **Cluster result** | **39.3%** | **36.8%** | **14.8%** | **9.0%** | **3.07** | **Positive** |

**Source:** Field Survey 2019

From the survey result in table 9, 39.3% of the total respondents strongly agreed to the positive agricultural use of treated municipal wastewater in FCT, 36.8% submitted to agree, 14.8% disagreed while 9.0% strongly disagreed. The positive perception of the respondents was ascertained to be statistically strong ($t^* = 3.256$, $p=0.031<0.05$).

The respondents consent that treated municipal wastewater should be used to improve crop production in the FCT (mean=3.34>2.50), for watering personal farm crops/gardens (mean=3.27>2.50), for irrigation of large scale plantations in the FCT (mean=3.42>2.50), for animal rearing and aquaculture in the FCT (mean=2.74>2.50), and that crops irrigated with treated municipal wastewater will be patronized by residents of FCT (mean=2.56>2.50). Alhumoud and Madzikanda (2010) research result showed that majority of their respondents in Kuwait did not object to using reclaimed water for agricultural irrigation. In contrast, Kantanoleon, Zampetakis, and Manios (2006) revealed that respondents had negative perception and objected to using treated municipal wastewater for food related applications like animal rearing, crops and greenhouse vegetables cultivations.

Mcheik, et al (2017), presented results of scenarios where secondary-treated municipal wastewater was used for table grapes irrigation in the region of Ablah, Bekaa valley in Lebanon, and fodder crops irrigation (vetch and barley) in the region of Ramtha in Jordan. Based on the production and quality components, table grapes were successfully grown on plots that are supplied with treated wastewater. Fodder crops were successfully grown using treated wastewater with remarkable increase in biomass and grained yield production for the irrigated treatments. Aiello, et al (2012)

evaluated the long term effects of treated wastewater reuse on crops intended for human consumption. The levels of faecal contamination of eggplants and tomatoes irrigated by surface and subsurface drip irrigation with urban treated wastewater were analysed and compared in 2008 and 2009 at the experiment site (in Eastern Sicily, Italy). The study found that Salmonella and helminth eggs were never detected in treated wastewater or on fruit samples. Only two eggplant samples, irrigated by surface drip irrigation, contained 102 CFU/100g of faecal coliform and faecal streptococci. Based on the production and quality components, the tomato crops were successfully grown on treated wastewater supplied plots, with higher yields (approximately 20%) than on plots supplied with fresh water. The analysis of the reuse scenarios confirms that under controlled conditions, treated wastewater can be used as an additional water resource to increase agricultural production in water-scarce environments without health or environmental effects.

## CONCLUSION

Lamnisos, et al (2013) stated that wastewater reuse is becoming imperative in water scarce regions, in addition to evaluation of the extent of potential health risks involved, an assessment of public acceptance is necessary for a sustainable water reuse scheme to be successful. It is recommended that effluent discharge will be resourceful in improving agriculture and for industrial use in the study area. Hence, it should be channelled for that purpose as more respondents have no objection to its application in agriculture (including urban greening) and industry. Wastewater reuse should be considered as an alternative source for non-potable water use whenever there is a case of water crisis or as a means to prevention of water stress in the study area and in Nigeria at large. Public knowledge and acceptance is crucial in wastewater reuse, as such, whenever a reuse programme is to be implemented, public consultation and confidence building should be embarked on.

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