VOL. 08 NO. 4,
MAY, 2025
E-ISSN 3026-9210
P-ISSN 3026-815X

African Scholar Publications & Research International
www.africanscholarpub.com

Journal of Built Env. & Geological Research (JBEGR)

Assessment of Factors Influencing Domestic Waste Water Management in Suleja, Nigeria

Bashirat Abdul-Azeez Mustapha[1]; Mohd Hisham Rasidi[2]; Oluwaseun Olowoporoku[3]; Babatunde S. Akinbami[1]; & Oluwadara Latifat Isola-Muyideen[1]

[1]Department of Urban and Regional Planning, University of Abuja, Abuja, Nigeria. [2]Department of Landscape Architecture, Universiti Teknologi Malaysia. [3]World Bank Group.

Corresponding Author: babatunde.akinbaami@uniabuja.edu.ng

DOI: https://doi.org/10.70382/ajbegr.v8i4.039

Abstract

The urban planning system for effective domestic wastewater management in most developing countries is highly constrained. Attempt to meet these challenges in Nigeria motivates the government to create institutions to plan and control domestic wastewater management. Despite these efforts and agencies, the domestic wastewater management problem persists in urban neighbourhoods of Nigerian cities. It is against this backdrop that this paper deems it necessary to critically examine the factors that hinder domestic wastewater management in Nigeria. For the purpose of this study, six factors were identified from the existing literature. The identified factors include; Household behaviour, Awareness, Infrastructure, Finance, Natural factor and Urban planning. The considered factors were based on the expert's opinion. These factors were thereby subjected to the perception of households and concerned agencies using survey questionnaires, interviews, and focus group discussions on ascertaining the most contributing factors. The qualitative data were analyzed using content and thematic analysis, while the quantitative data sets obtained were analyzed using

frequency tables. The level of significance of the variables and dependency was analyzed using SEM (Structural Equation Modelling)**.** Findings revealed that all the six identified factors affect domestic wastewater management, but household behaviour and household perception of urban planning system were the most significant factors that hinder domestic wastewater management in Suleja. Therefore, the study posited the indiscriminate disposal/discharge of domestic wastewater in the study area is attitudinal as many residents could afford the modern facility for safe and effective domestic waste water management.

KEYWORDS: Urban planning system, Domestic wastewater, Domestic wastewater management, Constraints, Urban neighbourhood

Introduction

The role of urban planning authorities in developing countries in managing domestic wastewater is increasingly recognized as central to sustainable urban development. However, decision-making around appropriate technologies for wastewater treatment often remains inefficient, which contradicts the general trend toward achieving desirable development outcomes (Bashirat et al., 2020). Fundamentally, the role of state and public urban planning institutions is to facilitate development in an economically, socially, and environmentally efficient direction (Idris-Nda et al., 2013). Yet, despite the long-standing recognition of domestic wastewater management as a basic human need, the sector continues to face persistent and systemic challenges in Nigeria and other developing nations (Dorji et al., 2019). Owei et al. (2010) noted that a lack of political voice among urban and rural poor communities often limits their influence over the resource allocation processes of sanitation institutions. Similarly, Aime et al. (2013), in a survey of informal settlements in Kigali, Rwanda, identified several major constraints to wastewater infrastructure provision: lack of finance, challenging topography, insufficient space, limited access to construction materials and permits, and inadequate technical expertise. In the Nigerian context, Idris-Nda (2013) reported that landlords' unwillingness to improve sanitation infrastructure was frequently cited by tenants in Minna as a significant barrier to sanitation access. Complementary findings by the World Bank (2011) and Mustapha (2013) indicate that socio-cultural factors, low institutional capacity, and weak policy implementation remain core impediments to progress in Nigeria's wastewater sector.

Furthermore, other issues such as the scarcity of trained professionals (Parkinson et al., 2007), outdated sectoral policies (WHO, 2006), and limited public awareness (Cishahayo et al., 2022) further hamper effective domestic wastewater management. Despite marginal increases in coverage levels and improved access to external funding, Nigeria still falls short of both the Sustainable Development Goals (SDGs) and its own national targets outlined in the Growth and Poverty Reduction Strategy (WHO, 2018; Yamauchi, 2022). These persistent challenges led to the establishment of multiple planning and regulatory institutions by the Nigerian government to oversee the control and improvement of wastewater management. Nonetheless, problems related to unregulated discharge, poor sanitation infrastructure, and weak enforcement mechanisms continue to undermine these efforts. White et al. (2017) argue that successful adaptation of wastewater systems remains challenging due to complex uncertainties, interdependent variables, and institutional fragmentation.

While several studies have explored the general barriers to wastewater management in developing contexts (World Bank, 2011; Musa, 2012; Nabegu, 2014; Rouse 2015; Dorji et al., 2019), a significant research gap exists in understanding how regional variations such as settlement patterns, environmental conditions, enforcement capacity, and planning policies impact the effectiveness of planning authorities in Nigeria. Much of the existing literature offers a broad national perspective, with limited attention to localized analysis of how urban planning institutions function under context-specific constraints (Von Sperling & Fattal, 2001; WHO, 2016; Kelova et al., 2021). Moreover, despite increased financial inflow into the sector, Nigeria continues to face absorptive capacity issues, due to poor coordination, obsolete strategies, and limited manpower (Mustapha, 2013; Parkinson et al., 2007; WHO, 2010). Therefore, this study seeks to bridge this gap by critically assessing the operational roles, limitations, and adaptive capacity of urban planning authorities in managing domestic wastewater in Nigeria, with a view to developing spatially relevant, sustainable solutions.

The domestic wastewater management challenges are shaped by both natural and anthropogenic factors, or a combination of the two. Each country and indeed each region within a country presents a unique set of constraints. This necessitates in-depth, location-specific assessments when sanitation programs are planned and implemented (Yamauchi, 2022; WHO, 2017b). To that end, this research aims to examine the most influential factors driving indiscriminate wastewater discharge in Nigeria and evaluate how planning institutions can be repositioned to respond more effectively.

STUDY AREA

The study was carried out in Suleja local government area of Niger State, Nigeria. Suleja is just north of Abuja and located on latitude 9,1758 (910'32.988"N) and longitude of (710'50.988"E), with a total population of approximately (635,314 people) as of 2012. It has an altitude of 339m above sea level. The major reason for the seemingly overwhelming challenges of Suleija is due the non-designation of the city as one of the satellite towns of the Federal Capital Territory, as obtainable in other regions. Over the years, despite the efforts of various agencies, domestic wastewater management problems still persist in Suleija. This is due to rapid urbanization, which is a key motivating factor in the rise of informal settlements at the border of the city centres. This is also due to the consequential constraints associated with making formal approaches to the land administration agencies and control of urban planning in city.

These limitations have created a multifaceted urban condition owing to the nature of the surroundings and the rapid increase in population since 1982. Consequently, the city is characterised by several urban distress such as unrestrained developments, filthy household wastewater, and management practices.

RESEARCH METHODOLOGY

Sources of Data

Data for the study were sourced from both primary and secondary sources. The primary data were sourced from the administration of questionnaire, interviews and observations. In contrast, the secondary data were sourced from relevant policy documents such as Planning Laws and Ordinance, Master Plan and other official documents from relevant ministries. These documents were used to understand existing policies and laws on wastewater management in the study area.

Instrument for Data Collection

Questionnaire was used to collect large volume of data from selected households in Suleja. This was done at household level, and a total of 407 households were selected using stratified sampling techniques. Meanwhile interviewees were selected using simple random techniques.

Following the formulation of research problem, variables to be measured was outlined. These variables consisted of dependent and independent variables. The independent variables include: Household behaviour, Awareness, Infrastructure, Economic, Natural and Urban planning system. While the dependent variable is, ‘a decent means of domestic wastewater management system’. The selected variables were later used to elicit response

as regards factors responsible for the current practice of domestic wastewater management in the study area. These variables were strengthened by existing studies (McMichael et al., 2003; Cotton and Pielke, 2006; Owei et al., 2010; World Bank, 2011; Musa, 2012; Tsinda et al., 2013; Mustapha, 2013; Idris-Nda et al., 2013; Nabegu, 2014; Rouse 2015; Ugyen Dorji et al., 2019). Also, the identified variables were later subjected to expert opinion in a brainstorming section so as to justify the most appropriate variables to be considered in designing the questionnaire.

The questionnaire was coded and loaded into the open data toolkit. An option of answers at five interval values using Likert scale was used. Repondents were asked to either Stongly agree (SA), Agree (A), Neutral (N), Disagree (DA) or Strongly disagree (SDA). Since the respondents in Madalla area were not that educated, the use of an open data tool kit was of high advantage as questions were interpreted to them in their local dialects and they also gave their answers in their own languages. At some points, some of the languages used were modified to suit the dominant local language. Data were collected offline and submitted when internet connectivity was available. Open data toolkit provides a platform for loading survey questions to the cloud for access while providing a geographical attribute of the collected data and it supports all forms of data collection. It also allows data to be collected offline and submitted when internet connectivity is available.

An interview was also conducted for the collection of data in this study. This involves adopting the use of semi-structured interviews with the key stakeholders in the study area. A purposive sampling technique was used for the selection of 6 household representatives and the two district heads to be interviewed. The aim of these was to complement the qualitative data obtained. The questions asked focused on existing practice of domestic wastewater management within these settlements with useful insights into factors affecting domestic wastewater management. Table 1 shows the selected household representative**.**

Table 1: Selected Household Representatives

	Name 1-8	**Households**
1	H1	Household one (Madalla)
2	H2	Household two (Madalla)
3	H3	Household three (Madalla)
4	H4	Household one (Bakin Iku)
5	H5	Household Two (Bakin Iku)
6	H6	Household three (Bakin Iku)
7	H7	District head of Madalla
8	H8	District Head of Bakin Iku

Data Analysis

The analytical tools employed for the qualitative data collected was descriptive and inferential statistics while content analysis was used for qualitative data. The descriptive statistics employed simple frequencies, percentage, mean and standard deviation using SPSS. Meanwhile, the level of significance of the variables and dependency was analysed using SEM (Structural Equation Modelling).

Sampling Frame

The sample frame for the study was the total population of households in selected neighbourhoods in Suleja town. The selected neighbourhoods are Bakin Iku and Madalla. However, the 2006 National Population Census data available does not capture the neighbourhood or ward population. Hence, it was difficult to determine the population of the selected neighbourhoods. Therefore, since the study is household base, a preliminary enumeration of households in the study area was conducted. The total number of buildings enumerated in Bakin Iku is 1470, while 2231 buildings were enumerated within the Madalla area.

The study area (each neighbourhood) was divided into eight stractas using road networks. The neighbourhood stractas were then superimposed on the satellite image of the study area to identify the structures within each. Three stractas were randomly selected from each of the neighbourhood for household enumeration as shown in figure 1 below.

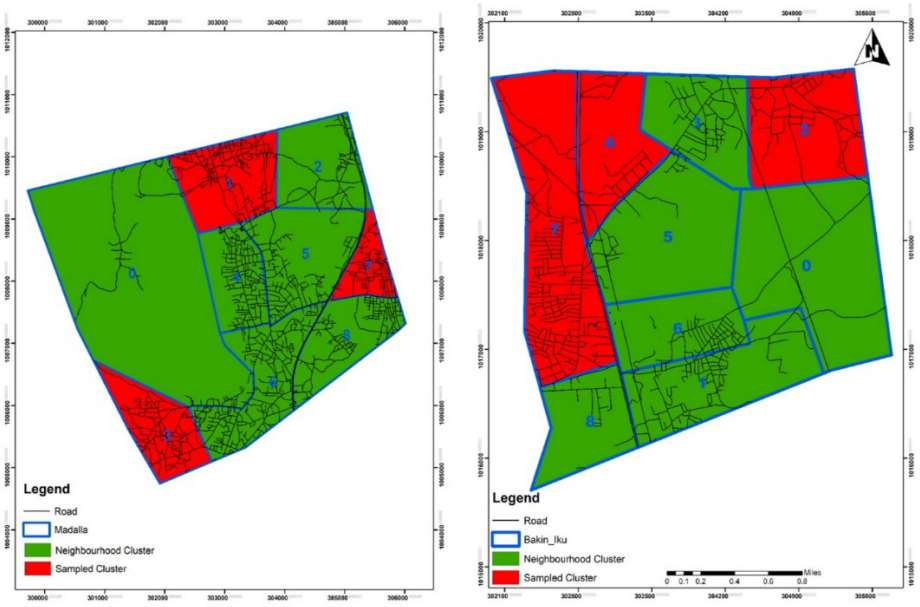


Figure 1: Sampled Clusters

During the enumeration, the number of residential buildings and the number of household within each building was determined. The percentage of residential building within each strata and the average number of household in a building was then determined. Furthermore, the average percentage of residential buildings in the three selected clusters and the average number of households per building was computed (Table 2).

Table 2 revealed that 87% of the buildings enumerated within the three randomly selected clusters in Bakin Iku were residential buildings, while the average household size recorded is 1.39. While in Madalla, 75% of the buildings are residential, with an average household size of 3.77 households per building. The result recorded was used to generalize on each of the neighbourhood. The estimated number of residential households within the two neighbourhoods is presented in Table 2. The Table shows that the estimated number of households in the study area is 8,085. Bakin iku has a total of 1778 households, while Madalla has a total of 6307 households. Therefore, the sample frame for the study is 8,085 households in the selected neighbourhoods. Additionally, youth leaders, women leaders, neighbourhood heads, planning officers, NISEPA officers in charge of the selected neighbourhoods were interviewed.

Table 2: Enumerated buildings

Neighbourhood Cluster	**No of Buildings Enumerated**	**% of Residential Building**	**Average Household Size**
Bakin Iku			
Cluster A	142	87% (124)	1.42
Cluster B	156	83% (129)	1.51
Cluster C	134	91% (122)	1.23
	Average	87% (125)	1.39
Madalla			
Cluster A	178	79% (141)	3.4
Cluster B	215	74% (159)	4.1
Cluster C	189	73% (138)	3.8
	Average	75% (146)	3.77

Table 3: Estimated number of households

Neighborhood	Number of Buildings Enumerated (N)	Proportion of Residential Building (P)	Average No of Household/ building (H)	Estimated No of Households= N*P*H
Bakin Iku	1470	0.87	1.39	1778
Madalla	2231	0.75	3.77	6307
Total	3701			8085

Sample size

To arrive at a sample size that will serve as a good representative of the population in the study area, the Krejcie and Morgan (1970) sample size tabulation was adopted. The study arrived at a sample size of 370 at 95% confidence level and a margin error of 5. In order to account for shortfalls that may arise as a result of wrong filling or missing result, 10% of the sample size (370) which is 37 was added to arrive at a sample size of 407 households in the study area. The sample size of 407 households is distributed according to the proportion of each neighbourhood to the total population of households in the study area (Bakin Iku and Madallaa). Table 4 shows that 90 households were sampled in Bakin Iku and 317 households in Madalla, to arrive at a total of 407 households in the study area.

Table 4: Sample size

Neighbourhood	% of the Total population	Sample Size
Bakin Iku	0.22	90
Madalla	0.78	317
Total	1	407

RESULTS/FINDINGS

The factors considered for this research include socio-cultural behaviour, awareness, infrastructure, finance, urban planning system, and natural factor. The perception of households and concerned agencies on these factors is discussed in this section. Findings indicate that current method (onsite system) is inefficient (Bashirat et al., 2020) and this opposes the general trend for desirable development. However, there is a growing trend among developing countries to initiate improved domestic wastewater management by exploring its challenges and barriers. Identifying the most barrier will play a significant role in in helping urban planners in facilitating development towards socially and economically efficient domestic wastewater disposal among other functions in urban

environments. Therefore, the question needed to be addressed here is: what are the most significant factors that hinder domestic wastewater management in neighbourhoods of Suleja, Nigeria?

Socio-Cultural Behavior

The behaviour and cultural differences of residents have both direct and indirect influences on societal organizations. In broader parlance, culture and societal norm plays a significant role in the determination of attitude, orientation, and perception towards the provision of facilities for wastewater management.

Table 5: Socio-Cultural Behaviour

SOCIO-CULTURAL BEHAVIOUR										
	SA	**%**	**A**	**%**	**N**	**%**	**DA**		**SDA**	
Household attitude affects domestic wastewater management	217	58.3	110	29.5	27	7.3	12	3.2	6	1.7
Norm influence pattern of waste management	164	44.2	110	29.6	51	13.7	33	8.9	13	3.5
Household culture contributes to the way they manage their domestic wastewater	87	23.3	125	33.6	123	33.1	30	7.8	8	2.1

In a bid to examine how socio-cultural behavioural attributes affect domestic wastewater management in the study area, three variables were considered; subjective norm, culture and attitude, this is shown in table 4 above. When these three variables were subjected to individual household opinion, most of the respondents strongly acclaimed that household attitude is a major contributing socio-cultural behavioural factor that affects domestic wastewater management in urban neighbourhoods of Suleja. This is consistent with the results from the interviews conducted, which revealed the poor attitude of most of the residents towards wastewater management. Though subjective norm and culture were found to be a contributing factor, thus, it can be concluded that the attitude of households to domestic wastewater management in Suleja is shaped by their cultural belief and morals, which is evident in the observation made in the central area of Suleja town (Anguwan Sarki, a district in Suleja).

Anguwan Sarki is dominated by the indigenes of the Hausa ethnic group. This ethnic group has a strong attachment to their cultural belief and have high regard for their

traditional rulers. The wastewater management activity in this neighbourhood is controlled by Dogaris (the palace security). As such, any household that refuses to comply with the informal rules on water and sanitation as directed by the Dogaris is sanctioned or punished. Weekly cleaning of the drainages by households in the neighbourhood occurs every Sunday. Despite being the oldest neighbourhood in the study area, Angwan Sarki has the best domestic wastewater management protocol and indeed the cleanest environment. This observation is due to the influence of culture and traditional norms, although the neighbourhood covers a small portion of the city.

In this study, the households in Bakin Iku and Madalla have their own separate identities but share similar problems. Despite having the means to provide the basic facilities for domestic wastewater management, they tend not to. A discussant noted:

> *"The real problem here is attitudinal. Many residents here have soak-away, but they still pollute the environment without caring about the consequences; I don't know why they behave like that, maybe it is because they don't belong here".* (H5)

Another angrily said:

> *"Don't mind them, they have bathrooms yet they develop an attitude of bathing their children outside. This water you are seeing here is from that house". (H1)*

It was deduced that despite having the basic facilities residents tend to dispose their wastewater indiscriminately. It was uncovered that many of the residents in the study area build houses without provision for drainage since there is no government agency, organized traditional or neighbourhood institutions that compels them to do so. Hence, drainages are disjointed and spasmodic in some places, a participant explained that:

> *"They are less concerned about maintaining a clean environment … They play a passive role in domestic wastewater sanitation activities … And this attitude is also evident among some educated and enlightened citizens".* (H1)

Similarly, another discussant expressed that:

> *"I think it is wickedness because even uneducated people know that reckless discharge of wastewater is disastrous to public health and the environment. This habit is quite bad and must be stopped".* (H2)

Though a person's knowledge is influenced by education (Afon 2012, Akpabio 2012, Daramola and Olowoporoku 2016), this isn't so in the study area because despite being averagely educated, their attitude and behaviour to domestic wastewater management did not change. However, it is expected that education should have played an important role in their daily activities.

In the context of this study, the researcher observed that perceived idea and belief that other households in the neighbourhood (Norm) will disposed of their wastewater indiscriminately happens to be one of the reason why they practice indescriminate discharge of domestic wastewater to the environment. Hence, the subjective norms of residents in Suleja appear to be supportive of the intentional indiscriminate discharge of domestic wastewater into the environment. It was also observed that most residents seem to lack behavioural control over the act. Thus, attitude, subjective norms and perceived behavioural control determine the behavioural intention of the residents to recklessly discharge their domestic wastewater into the environment. This agrees with the theory of planned behaviour developed by Icek Ajzen (1991).

Awareness

The level of awareness of households regarding effective domestic wastewater management is discussed in this section (Table 6). The ignorance and lack of basic awareness negatively affected domestic wastewater management in the study area. The study observed that most households (83%) did not admit to domestic wastewater management problems in their neighborhood. This was despite channelling the sink drain to bare land and stagnant water around the neighborhood, which was considered normal. In addition, 74% believed that the mode of wastewater management is a problem, while 81% are not even aware of the opportunity attached to the product of domestic wastewater. These differing views were attributed to their level of awareness.

Table 6: Awareness

AWARENESS/EDUCATION										
	SA	%	A	%	N	%	DA	%	SDA	%
Do not have problems of domestic wastewater mng	179	48.4	94	25.2	67	18.0	24	6.5	7	1.9
Channelling the sink drain to bare land is an indiscriminate act	190	51.1	125	33.6	36	9.7	18	4.8	3	0.8
Improper practice of wastewater management is risky	187	50.3	123	33.0	39	10.5	18	4.8	5	1.3
Unaware of Wastewater Value	205	55.3	105	28.0	37	10.0	19	5.1	6	1.6
Do not have knowledge of Wastewater Reuse	207	55.6	106	28.6	28	7.5	25	6.7	6	1.6
Awareness	**194**	**52.1**	**111**	**29.7**	**42**	**11.2**	**21**	**5.6**	**5**	**1.4**

Most of the households were not aware that their wastewater management practices were poor. One resident noted that:

> *"As you can see, we have soak away for our dirty water and we have sinks for washing plates in the kitchen. No dirty water in my household".* (H1)
> *"No, we don't have problem of domestic wastewater management".* (H4)

It was surmised by the researcher that despite channelling the sink drain to bare land and having stagnant water around the neighbourhood, they still consider it normal. This attitude to domestic wastewater management has degenerated into a habit due to a low level of awareness. The manifestation of this is a littered environment and smelling water. Though the majority (84.9%) claimed that a habit is an indiscriminate act, also 84.1% admitted that the act has adverse effects on human health and the environment. Despite this acknowledgement, they still practice the act.

If awareness has been raised by enlightened residents and at all levels of governments in the study area, households would have known the importance of communal cooperation to attain a clean environment. The importance of educating households on effective wastewater management practices would have been appreciated. One environmental expert argued that:

> "*Lack of awareness and Ignorance of health implications of indiscriminate disposal of domestic wastewater, as determined by the level of education, is one of the factors responsible for poor management of domestic wastewater in Suleja*" (H16).

Another participant stressed that:

> "*While it is expected that residence in the area should be aware of the implications of reckless disposal of domestic wastewater; the reality is that many of them show no and a little level of awareness*" (H2).

Similarly, one aged participant argued that;

> *"Households with a high income level and education are more likely to be aware of health implications of poor disposal of domestic wastewater than those residents with minimal education and low-income level ... But, unfortunately, even residents with high or middle-level education and income seem to be ignorant of the implications of poor disposal of domestic wastewater*". (H6)

It was discovered that many households are ignorant of the fact that such practices are unsustainable and inimical to public health. As the relevant agencies have failed to mobilize the residents and educate them on the proper ways of handling their domestic wastewater. Presently, no campaign has been raised by the state and local environmental sanitation regulation agencies and planning authorities in Suleja about the dangers and opportunities of domestic wastewater management. Likewise, no efforts have been made to communicate with the wide range of stakeholders and specifically the community on the dangers associated with indiscriminate domestic wastewater management.

From the above results, it is obvious that a low level of awareness on the effective ways in which wastewater can be managed and the implications of its poor management have led to the practice. Wastewater can be considered as nothing but valuable materials managed indiscriminately. All over the world, materials or commodities considered as waste are useful to some other people. It is due to the ignorance of neighbourhood dwellers in the study area that some things are considered waste. As development in the opportunity of wastewater value increases, people's attitudes have not changed. Community participation was identified to have a direct impact on the domestic wastewater management plans in Suleja.

Since residences do not know the value and opportunity of the by-products of their wastewater, they dispose of their wastewater indiscriminately without consideration for environmental and human health. Awareness about the embedded cultural practices and behavioural norms that waste has no value, which is a challenge for effective reuse, is lacking in the study area.

Infrastructure

Inadequate infrastructure is one of the factors affecting domestic wastewater management in the study area, as confirmed by 90.6% of the respondents. This implies that lack of infrastructure was a significant factor in domestic wastewater management in the study area. This result is consistent with the result of the interviews. It was revealed that:

> *"Sewage collection is very limited in Suleja, and this is a serious problem. There is no adequate connection from individual houses to central drainage system".* (H2)

The abandonment or breakdown of existing wastewater management infrastructure is a major concern as most households lack access to both public and private domestic wastewater management treatment infrastructure, as shown in Table 7.

Table 7: **Infrastructure**

INFRASTRUCTURE										
	SA	%	A	%	N	%	DA	%	SDA	%
Use of soakage pit	106	28.5	157	42.2	74	19.9	22	5.9	13	3.5
Drainage not connected to the central sewage	123	33.0	164	44.2	60	16.1	18	4.8	7	1.9
Blocked drainage	114	30.7	158	42.4	70	18.9	19	5.1	11	3.0
Disconnected drainage	194	52.1	131	35.3	27	7.3	10	2.7	10	2.7
Used concrete materials	164	44.1	126	33.8	40	10.8	22	5.9	20	5.4
INFRASTRUCTURE	**140**	**37.7**	**147**	**39.4**	**54**	**14.6**	**18**	**4.7**	**12**	**3.3**

The practice of environmental sanitation in Nigeria introduced during the Military Regime of 1984 was aimed at encouraging environmental consciousness. The yielding result was not satisfactory in Suleja due to the poor disposal of human and material resources. A challenge faced in the study area is that infrastructure for wastewater management is not readily available. Hence, the study area has no operational self-owned, mini-treatment or central domestic wastewater treatment plant installed or in use. The existing public drainage was observed to service only the central area, and even in the central area the facility is not adequate and maintenance practise is poor.

Another problem observed is the discontinuity in connection of gutters by households while some are not emptied into the main drainage systems due to the lack of cooperation by neighbouring households. A resident at Madalla lamented about his neighbour not

constructing a gutter for his household which affects him and other neighbours. Initially, people in the neighbourhood contributed money to construct gutters to connect major drainage meant for storm water. But later due to lack of cooperation, people whose land was already connected refused to pay despite enjoying the facility. Therefore, each household head was saddled with the responsibility of connecting their houses to the existing gutter. Nonetheless, some house owners in the areas refused to do so resulting in disconnected gutters (Figure 2). Consequently, the households without drainage systems produce stagnant water, breed diseases pest which affects the wall of their fences and causes a foul smell.



Figure 2: Disconnected Gutter in the Study Area

Another bad habit observed in the study area is the practice of dredging gutters and leaving the debris extracted from the gutters on road shoulders as shown in Figure 5.4. This affects environmental quality and disrupts pedestrian movements.



Figure 3: Dredged Gutters on the Road shoulder Meant for Walking

The size of the study area keeps expanding due to urbanization and little or no effort is made to provide drainages and wastewater management facilities. The few available drainage facilities are blocked by waste, hence interfering with the flow of wastewater (as showm in figure 4). The implication is that some areas get inundated after rainfall, which creates an unsanitary environment.



Figure 4: Blocked Drainages

The inadequate provision of drainages, waste dumping facilities, and poor maintenance habits make some residents turn drainages into waste receptacles with implications on environmental quality and threats of disease recrudescence.

Financial Status

There exists a real relationship between environmental problems and financial status. Most of the households (76.9%) believe that household income influences wastewater management habits as rich households tend to make better provisions for wastewater management compared to poor households. Table 8 presents the effects of finance or economic factors on the management of domestic wastewater.

Table 8: Finance

FINANCE/ECONOMIC										
	SA	%	A	%	N	%	DA	%	SDA	%
Household head income affects domestic wastewater management	137	36.8	133	35.8	74	19.8	20	5.4	8	2.2
Cost of evacuation of soakage pit is high	130	34.9	108	29.0	56	15.1	50	13.5	28	7.5
Can't afford modern facility	159	42.7	110	29.6	57	15.3	25	6.7	21	5.7
Water is availability is not constant	159	42.7	113	30.4	44	11.8	36	9.7	20	5.4
Can't afford to dig a bore hole	137	36.8	115	30.9	52	13.9	51	13.7	17	4.6
Finance	**144**	**38.7**	**116**	**31.1**	**57**	**15.2**	**36**	**9.8**	**19**	**5.1**

It is evident from analysis that poor households do not have the financial capacity to effectively manage the wastewater generated. The areas inhabited by this group are more hit by the incidence of splash flooding and poor environmental quality. The Local Government Reform of 1976 empowers local government areas to provide sanitary and wastewater infrastructure in the headquarters and rural communities within their jurisdiction. The failure of the Suleja local government to carry out this responsibility has galvanized the people to assume responsibility. However, divergent financial and income status has predictably resulted in variation in the provision of these infrastructures.

Meanwhile, some find it difficult to provide modern facilities because of their financial status. Hence, the tendency is to invest in unimproved technological sanitation systems, which involves the construction of traditional drainage systems without blocks or concrete those rely on natural drainage. These drainages are not well planned, open, unlined, and dug with local tools. They are also irregular in shape and size, very shallow and contribute to environmental degradation as shown in Figure 5.



Figure Error! No text of specified style in document.: Traditionally Dug Drainage for Domestic Wastewater

More also, the cost of evacuating soak-away was identified as a problem. The available public evacuation vans are insufficient. Only 10 public evacuation vans are available for Suleja local government. Of these 10, only 1 is available for use by Suleja township hence private evacuators charge high fees (e.g., N40,000.00) which is prohibitive for residents. Due to the high cost of evacuation some household's puncture (Figure 6) their soakage pits during the rainy season and allow the black waster to empty itself into the nearby flowing stormwater. This practice is detrimental to the aquatic life and respondents living around water bodies and drainage lines in the study area.



Figure 6: Emptying of Soak away into the Flowing Storm water

The construction of a public domestic wastewater management facility requires significant capital investment. The major challenges to the provision of infrastructure are the lack of adequate financial resources and space for treatment plants. An environmental consultant stressed:

> *"The price of a sewage treatment plant depends on the size, which costs about N986,000 to N1,740,000 for a 6-household treatment plant, and N1,102,000 to N2,030,000 Naira for an 8-household treatment plant. Fitting costs depend on exactly what work needs to be done to fit it. Likewise, ground conditions can seriously affect the price to fit it in the study area due to high water tables. But this cost is high and cannot be afforded by residents".* (H16)

It could therefore be inferred that the problems associated with of lack domestic wastewater management facilities remain unresolved in Suleja and many other cities in Nigeria due to the cost, and without government or private sector's intervention, household cannot afford it. Meanwhile, the SDG agenda 6 (clean water and sanitation) and 11 (sustainable cities and communities) recognize that ending poverty and other deprivation must go hand in hand with strategies that improve health and spur economic growth. However, in the study area and other parts of Nigeria, the program is hindered by a lack of funding. Therefore, the broad ownership must translate into a strong stakeholder commitment, which is required to implement the global goals, alleviate domestic wastewater management problems, and realize the agenda in the study area.

Natural Factors

The on-site system of disposal is the major means of domestic wastewater management in the study area (as evident from objective one). This is because the sewer system is expensive to install, and the government has not provided sewers to connect homes. The proximity of water sources (well) and the wastewater system in the study area poses significant threats to public health. Likewise, the reliance on poor soil for onsite wastewater disposal and general lack of understanding of soakage pit construction and maintenance by the residents has added challenges. Table 9 shows the effects of various natural factors examined in the study.

Table 9: Natural factors

NATURAL FACTORS										
	SA	%	A	%	N	%	DA	%	SDA	%
Soil type affects domestic wastewater management	6	1.6	34	9.1	48	12.9	119	31.9	165	44.4
Topography affects domestic wastewater management	2	0.5	9	2.4	38	10.2	149	40.1	174	46.7
Climate affects domestic wastewater management	16	4.3	15	4.0	20	5.4	114	30.6	207	55.6
Flooding affects domestic wastewater management	12	3.2	25	6.7	74	19.9	158	42.4	103	27.7
Rainfall affects domestic wastewater management	2	0.5	8	2.2	28	7.5	127	34.1	206	55.6
Natural	8	2.0	18	4.9	42	11.2	133	35.7	170	46.0

The soil in Suleja is made up of unconsolidated minerals (Shuaibu and Abdulhakeem, 2017), which shows the effects of genetic and environmental factors (Dada, 2008) conditioned by relief that has acted on the parent material over time. The water holding capacity of soils differs, whereby absorption is influenced by porosity. Sandy soils hold less water than clay and loamy soils and are thus most suitable for the on-site systems. However, most residents (77.9%) denied that soil texture prevents proper wastewater management in their neighbourhood. These responses could be attributed to a low level of awareness of the impact of soil texture in domestic wastewater management. As observation affirms that the soil in the study area is reddish and clay, it does not have good absorption properties, and therefore percolation of wastewater from the soakage pit is a problem. Hence particles and biomass clog the pits which in turn often require evacuation and later deteriorates the performance of the pit.

Conversely, 86.2% of the residents opined that soil moisture hinders domestic wastewater management. Seasonal flooding is one of the major environmental problems the study area is facing, which make the use of a soak pit very frustrating due to the high water table. Climate is also considered to be one of the major challenges to domestic wastewater management systems. More extreme weather leads to heat generation and more water usage, which in turn yields more wastewater generation. In Suleja, the wet season is warm, oppressive, and overcast, likewise, the dry seasons are hot and partly cloudy. These are the primary reasons why a higher amount of wastewater is being generated. The high temperature in the study area increases sewer corrosion, which causes odour problems (Morenikeji *et al*., 2020). Likewise, intensive rainfall causes the soakage pit to overflow and combine with stormwater outflow into the receiving water body. This process typically affects the quality of surface water over time. Increasing evidence indicates climate impacts continue through flood and extreme rainfall events. Hence, the infrastructure and processes for domestic wastewater management are greatly affected.

Finally, there is a wide disparity between households on the effects of soil topography on domestic wastewater. Hence, 52.6% agree, 22.9% take a neutral ground and 24.6% disagree that soil topography deters proper domestic wastewater management. What distinguishes the Madalla area from other settlements in the rocky topographical nature that surrounds and abounds within the neighbourhood. Geology and topography are confirmed to be keys constraints to the location and installation of sanitary systems in the study area.

Topography is crucial to the planning and construction of domestic wastewater management facilities. Residents acquired land for housing in these areas due to its cheap cost. However, the provision of toiletry facilities and soakage pits has become difficult due to the cost of construction. Though some household heads whose buildings are situated on the rocky area (figure 7) acclaimed that provision of soakage pit isn't a problem to them as they provided a soakage pit for their households and since the household density is low (5 persons) they have no problem of constant evacuation. One of them also narrates, that the rock allows water to percolate through its pores, so evacuation occurs only once every three years.



Figure 7: Houses on Rocky Outcrop of Madalla

Therefore, it can be reasonably inferred that the lack of basic domestic wastewater management in Suleja is not solely based on topographical nature, but on the cost of production, household density and household attitude.

Urban Planning System

In Suleja, the centripetal force of overpopulation, ineffective domestic wastewater management, poor environmental quality and health raises various concerns. This is due to the poor conception of the urban planning system by residents. Lack of understanding about the advantage of adhering to proper urban planning regulations by residents has resulted in the current situation of domestic wastewater management. Table 10 presents the effect of urban planning factors on domestic wastewater management.

Table 10: Urban Planning

INFRASTRUCTURE										
	SA	**%**	**A**	**%**	**N**	**%**	**DA**	**%**	**SDA**	**%**
I do not have C of O	182	48.9	157	42.2	29	7.8	2	0.5	2	0.5
I do not have a building permit	150	40.3	193	51.9	29	7.5	0.00	0.00	0.00	0.00
My soak away is not accessible for evacuation	137	36.8	200	53.2	33	8.9	2	0.5	0	0.00
Delay in getting C of O	158	42.4	169	45.4	39	10.5	6	1.6	0	0.00
Planning authority is weak	222	59.7	117	31.4	27	7.3	6	1.6	0	0,00
There is poor communication between planners and households	180	48.6	156	42.0	32	8.6	2	0.5	1	0.3
URBAN PLANNING	**162**	**43.5**	**172**	**46.4**	**34**	**9.2**	**3**	**0.8**	**1**	**0.3**

The findings showed that most households (91%) do not possess the certificate of occupancy (a document that acknowledges the right to land ownership). Several reasons were discovered to contribute to the problem. Firstly, the property owners and landlords are unaware of its importance until the issues of ownership arise. Another reason for its non-possession is cost. Unfortunately, the Nigerian Constitution and Land Use Act do not address the issue of the obtainment costs of the certificate of occupancy. Every state in the country, therefore, fixes different rates and gives different steps towards obtaining it. In Niger State, an initial charge of N50,000.00 (Fifty thousand naira) is imposed coupled with other charges. However, applicants for the document typically spend nothing less than N70,000.00 (Seventy thousand naira), which is quite expensive.

More also building consent is required by a developer from the planning development authority. This is required by law and is designed to protect the interest of the property owner. The Building Act of 1993 and 2018 regulations of buildings state that all building work requires a building permit unless an exemption exists under the Regulations. This is to ensure all development is in the right place and manner as permission is given by the

Suleja planning authority to develop or use the land for construction of a new house, house extension, house renovation, additional dwelling unit on the land. It is to also ensure the provision for domestic wastewater management facilities is included in the design, which will help to maintain the balance between growth and environmental sustainability.

Due to delays in issuing development permits resulting from bureaucratic red-tapism, applicants' files can take up to two years to get the needed approval in the study area. Therefore, developers resort to ignoring the process and erect their structures without a permit. The consequences of erecting these substandard structures are the construction of buildings without wastewater management facilities. Furthermore, residents stressed that part of the document required for application includes three years of tax clearance, which involves income declaration. Consequently, the developers become reluctant because most do not want to disclose their earnings. Since approval was not obtained by most residents in the first instance, planning authorities are unaware of the structures so in most cases, monitoring is not carried out. These attest to the reason why neighbourhoods in the study area are expanding without the proper arrangement of structures.

Whereas in some cases where the household was granted a building permit and due to the financial problems couldn't complete the building within the stipulated time, the residents do not deem it necessary to consult the planning agency before continuing the erecting of structures. Thus, such structures become illegal and the relevant building surveyors are expected to issue a building order to stop building work. Most residents in this study were discovered to be ignorant of all these. Though there exists a layout, the regulatory machinery and enforcement are weak, so residents consume all their plots of land. Consequently, the provision of access roads becomes almost impossible, a condition that makes the soakage pits inaccessible for evacuation in most cases. It is so disheartening to note that even when households without domestic wastewater management facilities are discovered by the authorities, no sanction is imposed, and sanitary inspectors do not visit regularly to ensure no wastewater is flowing within the neighbourhood. Therefore, the poor communication between the developers and the planning authority was the major cause of the problem, as these have opened the way for abuse.

Determining the most contributing and significant factors to the current practice of domestic wastewater management in Suleja

Structural equation model (SEM) was used to estimate a series of dependence relationships between the set of concepts represented by multiple measured variables and incorporated into an integrated model. This is necessary to determine the most contributing and significant factors to domestic wastewater management in Suleja. As

shown in figure 8, each variable was constructed as a linear function of their observed variables. The average values of all observed variables are used to represent a single construct and then used to develop a model that highlights their direct effects on domestic wastewater management.

The social-cultural behaviour (which includes attitude, subjective norm and culture) plays the most significant weight on how the domestic wastewater in the community is been managed. This is followed by the household perception of urban planning system and community awareness on the dos and don'ts of domestic wastewater management. As the sociocultural behaviour, urban planning and awareness increases by a unit scale, the domestic wastewater management scale will increase by 0.89, 0.72 and 0.62 respectively given that all other factors are held constant. Concurrently, finance and infrastructure will increase the domestic wastewater scale by 0.23 and 0.36 respectively.

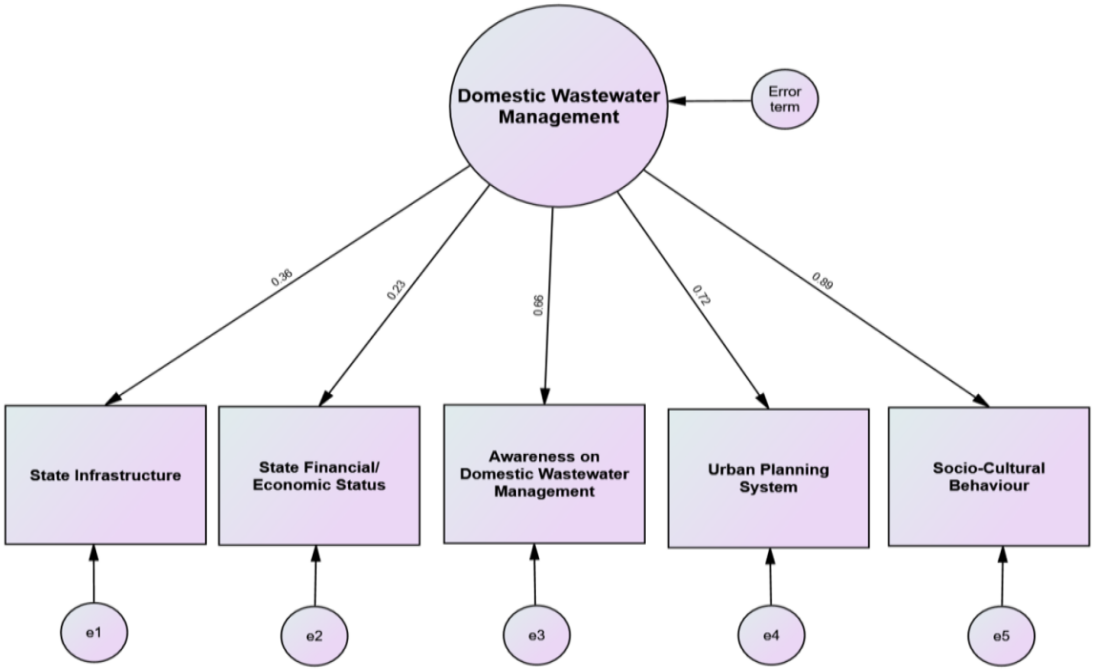


Figure 8: The Most Contributing and Significant Factors to Domestic Wastewater Management in Suleja

Table 11: Model of fitness

Measure	Estimate	Threshold	Interpretation	Fit measures
CMIN	39.472			
DF	5			
CMIN/DF	7.894***	Between 1 and 5	Acceptable	Model reliability
CFI	0.922	>0.9	Fit	Fitness of model
RMSEA	0.074	<0.08	Fit	

Table 12: Latent variable (observed) to its most significant construct variable (measured)

Latent variable	**Most Significant construct Variables**
Socio-cultural behaviour	Attitude
Urban planning	Visit by authorities
Awareness	Low level of understanding
Economic	Poverty and lack of fund
Infrastructural	Availability of facilities

Table 12 shows that, the latent variables finance and infrastructure present the least and insignificant relationship with coefficient of 0.067. Indecent domestic wastewater management in Suleja is not mainly the result of low financial status as even the rich households exhibit similar bad habits and attitudes. More also, poor perception of urban planning by households in Suleja was attributed to habit. This is because possession of the required documents before erecting structures will not change the residents' views on domestic wastewater management. Thus, effective domestic wastewater management in the city of Suleja requires sociocultural (attitudinal) changes among households. The relationship between constructs is presented in Table 13.

Table 13: The relationship between constructs

	Financial/Economic Status	State Infrastructure	Socio-cultural Behaviour	Awareness of Domestic wastewater management	Urban planning System
Financial/ Economic Status	1	.067	.157**	.109*	.339**
State Infrastructure		1	.304**	.203**	.325**
Socio-cultural Behaviour			1	.606**	.634**
Awareness on Domestic wastewater management				1	.433**
Urban planning System					1

CONCLUSION

This study posited that the indiscriminate disposal or discharge of domestic wastewater is attitudinal because many residents could afford the modern facility for safe and effective domestic wastewater management. Even poor households can develop traditional or cost-effective methods for the healthy discharge of their domestic wastewater, as it was affirmed that they have indigenous knowledge for managing domestic wastewater. Nonetheless, both rich and poor households discharge their domestic wastewater indiscriminately. Hence, attitude is the primary factor affecting domestic wastewater management, while others are secondary. This is because attitude was found to traverse all other factors. It has therefore, become evident that household behaviour plays a major role by being affected by the planning system, which leads to the current situation in Suleja. Meanwhile, the urban planning perspective represents an important component in the design of domestic wastewater management policies. Given their concern with the management of land resources and regulation of land uses, the planning system should also be concerned with implementing specific domestic wastewater management options. Unfortunately, in the study area, residents do not have a good understanding of the planning system in Suleja.

RECOMMENDATIONS AND FUTURE RESEARCH

Attempts to meet these challenges of Nigeria's built environment necessitate governments' need to create institutions and enact policies aimed at ensuring control of domestic wastewater management. Despite these various efforts, poor disposal of domestic wastewater is evident in the study area. Therefore, it becomes necessary to further assess the effectiveness of the planning system in the domestic wastewater management of Suleja, for a more "comprehensive" approach to environmental planning to be achieved. This will change the residence perception to urban planning in Suleja, which will lead to household attitudinal change to a more decent domestic wastewater management.

REFERENCES

Ajzen, I. (1991). The theory of planned behaviour. Organizational behaviour and human decision processes, 50 (2), 179-211.

Bahri, A., Drechsel, P., & Brissaud, F. (2016, september 28). *https://www.researchgate.net/publication/228659487.* Retrieved from Research Gate.

Bashirat A.M, Hisham Bin Rasidi, Ismail Said (2020). influence of loose urban development control on domestic wastewater management. International Journal of Recent Technology and Engineering (IJRTE)', ISSN: 2277-3878 (Online), Volume-8 Issue-6, March 2020. Page No.: 5781-5786.

Cotton, W. R. and R. A. Pielke, Sr. (2006). Human Impacts on Weather and Climate (2nd edition). Cambridge, UK: Cambridge University Press,

Federal Ministry of Housing and Urban Development. (2006). *Sustainable Urbanisation and Urban development in Nigeria, Challenges and responses.* Abuja: Ministry of Housing and Urban Development.

Hardin, G. (1968). The Tragedy of the Commons. Science, New Series , 1243-1248.

Idris-Nda, Aliyu, H.K. and Dalil, M., 2013. The challenges of domestic wastewater management in Nigeria: A case study of Minna, central Nigeria. International Society for Development and Sustainability, 2(2), pp.1169–1182. Available at: http://isdsnet.com/ijds-v2n2-53.pdf. Institute of Development Studies, 2016. Sustainable Sanitation for All: Experiences, challenges, and innovations.

Jacobsen, M., Webster, M., & Vairavamoorthy, K. (2012). *The future of water in African cities:Why Waste Water.* Washington: International Water Association.

Majic´, A., 2007. Human Dimensions in Wolf Management in Croatia: Understanding Public Attitudes Toward Wolves Over Time and Space. Thesis, Memorial University of Newfoundland, St. John's, Canada

McMichael, A.J. et al., 2003. Climate change and human health RISKS AND RESPONSES. World Health Organisation pp. 100337 Availablhttp://www.who.int/globalcange/environment/en/cc

Musa 2012. Short Report Environmental Appraisal of Drainage System in Minna, Niger State-Nigeria. IJABR Vol. 4(1&2): 85 -93 (2012)

Nabegu, A. baba, 2014. Domestic Wastewater Management In Peri-Urban Settlements Of Kano Metropolis, Nigeria. (June 2014).

Parkinson, J., Tayler, K. and Mark, O., 2007. Planning and design of urban drainage systems in informal settlements in developing countries. Urban Water Journal, 4(3), pp.137–149.

Riffat, S., Powell, R., & Aydin, D. (2016). Future Cities and Environmental Sustainability. *Future city and the Environment*, 1-23.

Rouse, J.D., 2015. Development of environmentally sustainable methods for treatment of domestic wastewater and handling of sewage sludge on Yap Island. Sustainability (Switzerland), 7(9), pp.12452–12464. Reardon, M., 2015. Better Together Holistic Urbanism.

Schultz P.W., Bator R.J., Large L.B., Bruni C.M. and Tabanico J.J. (2011). Littering in context: Personal and environment predictors of littering behaviour. Article in Press.

Strauss, M., Barreiro, W., Steiner, M., Mensah, A., Jeuland, M., Bolomey, S., Montangero, A., Koné, D., 2006. Urban excreta management-situation, challenges, and promising solutions. In: Proceedings of the 1st International Faecal Sludge Management Policy Symposium and Workshop, Dakar, Senegal, pp. 9–12

Aime Tsinda, Pamela Abbott, Steve Pedley, Katrina Charles, Jane Adogo, Kenan Okurut and Jonathan Chenoweth (2013). Challenges to achieving sustainable sanitation in informal settlements of Kigali, Rwanda. International Journal of Environmental Research and Public Health, 10(12), pp.6939–6954.

Ugyen Dorji et al., (2019) Wastewater management in urban Bhutan: Assessing the current practices and challenges. 0957-5820/© 2019 Institution of Chemical Engineers. Published by Elsevier.

UN HABITAT. (2009). *Planning Sustainable cities.* London UK.: Earthscan.

UNICEF and WHO. (2008, May Monday). *who.int/water*. Retrieved from htto://www.who.int/water_sanitation_health/ monitoring.

United Nations. (2011). *World Urbanisation Prospects: the 2011 Revision.* New York, United States: United nations.

UN (2015) Transforming our world: the 2030 Agenda for Sustainable Development, United Nations (UN), New York.

United Nation 2030: https://unsdg.un.org/2030-agenda

Von Sperling M. and Fattal B. (2001). Implementation of guidelines. Practical aspects for developing countries. In: Fewtrell L and Bartram J. (ed). Water quality: guidelines, standards and health. IWA Publishing, 440 pp. [This article analyses a series of constraints to implementing water quality guidelines and standards, with a focus on developing countries]

Water and Sanitation Management Programme. (2008). *Nigeria country summary sheet.* Abuja: Federal Republic of Nigeria.

Water and Sanitation Programme. (2012). *The economics of Poor Sanitation in Africa-Nigeria.* Abuja: Federal Government of Nigeria.

Wemer, C., Huelgas, A., Klingel, F., & Bracken, P. (2005). *Basic overview of composting toilet.* Berlin Germany: Sustainable Sanitation Alliance.

White et al., 2017. Climate Change & Stormwater and Wastewater Systems. Available from: https://www.researchgate.net/publication/321824367 Climate Change Stormwater and Wastewater Systems [accessed May 17 2018].

WHO. (2006). Guidelines for the safe use of excreta and Greywater. Geneva, Switzerland: World Health Organisation.

WHO-UNICEF, 2017b. Progress on Drinking Water, Sanitation and Hygiene: 2017 Update and SDG Baselines

World Bank, 2011. Water Supply and Sanitation in the Democratic Republic of Congo. Turning Finance into Services for 2015 and Beyond an AMCOW Country Status. Available at: https://www.wsp.org/sites/wsp.org/files/publications/CSODRC-En.pdf.