NIGERIA

IMPROVING THE STATE OF SANITATION

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Centre for Science and Environment

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Introduction

Nigeria, with a population of 191 million, was ranked with the second-highest number of open defecators after India in the world till 2 October 2019, when India declared itself open-defecation free. Fifty per cent of Nigeria's population is poor,[1] and the country is now fighting to pull the country out of poverty and poor water, sanitation and hygiene (WASH) conditions.

With the aim of achieving the United Nations Sustainable Development Goal 6 of ensuring availability and sustainable management of water and sanitation and hygiene for all, the Federal Ministry of Water Resources (FMoWR) and National Bureau of Statistics of Nigeria, along with a few international organizations—which collected data on WASH from the Federal Capital Territory of Nigeria and its 36 states—published the WASH National Outcome Routine Mapping (WASH-NORM) Survey report in 2018 to generate data for decision makers.[2] The report says that only one-third of the country has access to basic WASH services and that the poorest are ten times more likely to lack basic WASH services than the richest population across all the six geopolitical zones of the country (the 36 states and the FCT are divided into six geopolitical zones).

Almost 67 per cent of Nigeria's households live in rural areas,[3] and research data from several studies indicate that basic water and sanitation services are very poor in its rural areas. Data from the Nigerian government shows that only 26 per cent of the rural population has access to basic water and sanitation services while situation in urban areas is slightly better, with 45 per cent of the population accessing such services. The latest WASH-NORM Survey says that 47 million Nigerians—which is 24.4 per cent of the population—practise open defecation. Not only households, schools also face a sanitation and water crisis. Only 15.7 per cent of schools have access to basic water and sanitation services. Around 40.3 per cent of the schools do not have any toilet facility in the premises.

The latest data on the state of sanitation and hygiene in Nigeria says that waterborne diseases have led to the deaths of 100,000 children below the age of five years each year of which 90 per cent are directly caused by unsafe water and sanitation.[4] According to the data provided by the government, the country loses about Nigerian Naira 455 billion (1 USD = 361.5 Naira) every year due to unimproved sanitation. Various research studies indicate that people from rural areas practise open defecation more than those in urban areas. Open defecation takes place near rivers and lakes, which serve as major drinking-water resources.[5] In most cases this practice is deeply tied to the tradition. As per the Joint Monitoring Programme (JMP) report published jointly by United Nations Children's Fund (UNICEF) and World Health Organization (WHO) in 2019, the percentage of people defecating in the open in rural areas has decreased by almost 3 per cent (from 33.1 per cent to 30.6 per cent) while those using unimproved sanitation has increased from 21.9 per cent to 29.9 per cent between 2000 and 2015.[6] Thus, the report reveals, even if the people have started using toilets, excreta is not safely managed.

According to the report, Nigeria uses to a great extent toilets and septic tanks as on-site sanitation facilities. As per the report, the use of toilets in 2015 in rural areas was almost

six times the use of septic tanks, while in the urban areas, toilets and septic tanks were used almost in equal proportion. Local interviews revealed that toilets meant open pits or drop holes with or without cemented slabs, pour-flush pit toilets or ventilated improved pit (VIP) toilets.

But do these on-site facilities help manage excreta? According to the 2019 JMP report, the major problem is that almost 70 per cent of rural and 44 per cent of urban household toilets have never emptied excreta from their on-site facilities in Nigeria. Different research reports as well as data from the government's own study reveal that the faecal sludge emptied from pits and tanks is either buried in covered pits or evacuated to be dumped somewhere—household owners do not know where. Interviews with locals, non-profits, researchers and government officials revealed that sludge emptied from septic tanks and pits is mostly in an undigested state due to wrong technological specifications of the pits and septic tanks. Hence the chance of contamination of underground water and soil with undigested faecal matter is a concern.

In November 2018, Nigerian President Muhammadu Buhari declared a state of emergency in the water, sanitation and hygiene (WASH) sector. This was followed by the launch of the National WASH Action Plan, a 13-year plan of action for revitalizing the WASH sector. In February 2019, the governments of India and Nigeria coordinated a study, with the support of UNICEF and other development partners, to help the African delegates gain insight from the Indian sanitation programme Swachh Bharat Mission (SBM).[7]

According to the 2019 JMP report, in 2017, Nigeria attained only 26.7 per cent improved sanitation, which included cases where faecal sludge was buried in pits. The country is now working towards eliminating open defecation, but it is time to work towards safe toilets, with containment, emptying, transportation, safe disposal or treatment, and reuse. Provision should be made for reuse of the wastewater (black and grey) and faecal sludge.

The sanitation crisis seems not to be only due to technical flaws. Uneven adoption of the policies by the states and fractured governance has also slowed progress in the country. The Federal Ministry of Water Resources has been given the oversight role for water and waterborne sanitation. But the Ministry of Environment and Ministry of Health also looks after general sanitation and hygiene promotion. There is a lot of confusion about the responsibility of sanitation at the state and local levels as it is shared among health, water sources and environment. Nigeria also faces a challenge in the question of promoting water and sanitation policies at the state level as water and sanitation is a state responsibility. According to African Ministers' Council on Water (AMCOW), Nigerian states have shown uneven adoption of national water supply and sanitation policy guidelines. This is reflected in the water supply and sanitation services across different states. The WASH-NORM 2018 report shows the disparity of sanitation services due to such uneven implementation of policies—the state of Katsina shows over 81 per cent basic sanitation services and Ebonyi around 10 per cent. Similarly, people living in the state of Rivers are three times more likely to use basic water supply services than those in Sokoto.

Nigeria is under great pressure to meet the development goals as well as other safe-sanitation commitments. The country failed to meet the United Nations' Millennium Development Goal (MDG) 7 (which had a 2015 deadline) focussed on water and sanitation. In 2013, African heads of state and government launched the African Union (AU) Agenda 2063 for action to all segments of African society to work together to build a prosperous and

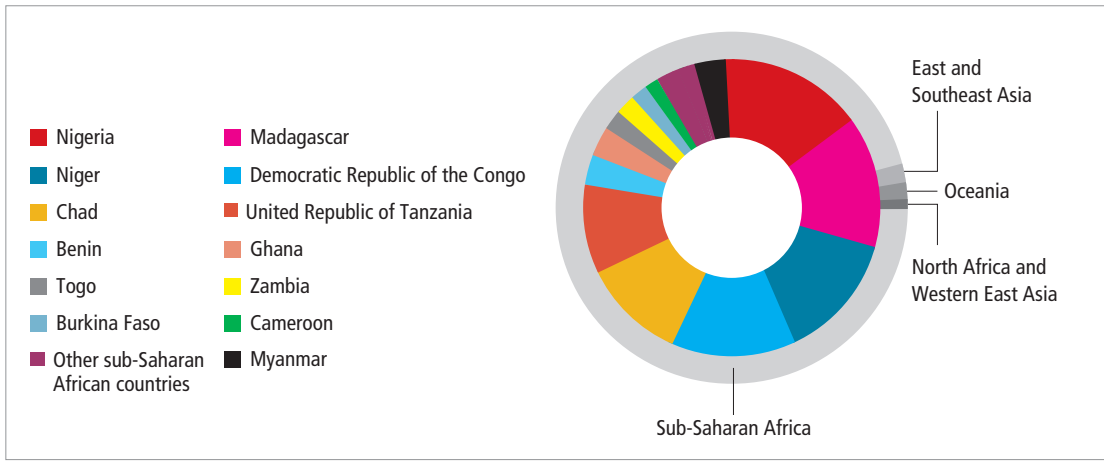
united Africa based on shared values and a common destiny, with water and sanitation as among top priorities.[8] The country was part of Ngor Declaration of 2015 whose vision is to achieve universal access to adequate and sustainable sanitation and hygiene services and eliminate open defecation by 2030. In May 2015, African Ministers responsible for sanitation and hygiene adopted the Ngor Declaration on Sanitation and Hygiene at the AfricaSan4 conference held in Senegal. The commitments were made in recognition of the fact that the gains made in sanitation access since 1990 had not kept pace with demographic change; the understanding of the centrality of hygiene and sanitation to existing heath, and the economic, social and environmental burden on African countries; and to reaffirm the human right to safe drinking water and sanitation for all. Although made in advance of the Sustainable Development Goals (SDGs)—launched by United Nations in 2015 with 2030 as the deadline—the vision of the Ngor Declaration closely aligns to the SDG sanitation and hygiene targets.

Nigeria is working hard to achieve SDG Goal 6.2 for universal access to adequate and equitable sanitation and hygiene facilities. But to reach this, it cannot be business as usual. Not only is a development of a policy aligned towards achieving SDG 6 required, but the development of a transparent Management Information System (MIS) for data sharing is the need of the hour so that policies at the local and state levels are easily implemented. The focus has to be on disparities in access to sanitation in different geopolitical regions and states, between urban and rural areas, and the rich and poor. One needs to understand where such disparities occur and why. Is low funding in the water and sanitation sector, lack of integration between the public and private sectors, inadequate coordination of the associated sectors or related ministries, poor institutional arrangement, lack of technological know-how or lack of reliable data responsible? It is crucial to find the impediments to Nigeria achieving the SDG goal on WASH so that appropriate steps can be taken to pull out the country out of the crisis.

1. How many Nigerians have toilets?

According to the 2019 JMP report, between 2000 and 2017, 39 countries—or 49 million people—recorded increases in the number of people defecation in the open. According to the report, most of these countries are in sub-Saharan Africa, which had experienced rapid population growth since 2000. The data clearly shows that Nigeria is one of the leading countries among these 39 countries (see *Figure 1: Increase in number of people defecating in the open between 2000 and 2017).* The WASH-NORM Survey of 2018 says that 47 million of the Nigerians defecate in the open.

Figure 1: Increase in number of people defecating in the open between 2000 and 2017



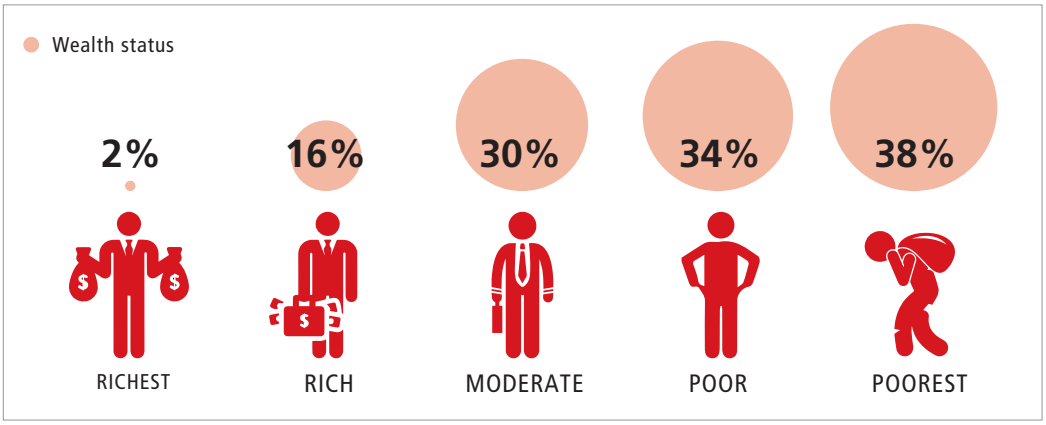
Source: JMP, 2019.

An interesting pattern arises in the prevalence of open defecation in the country as per the WASH-NORM Survey, 2018. For example, 30 per cent of people in rural areas do not have toilets while in urban areas only 11 per cent do not have toilets. The report adds that 38 per cent of poorest people and 2 per cent of the richest go out for defecation (see *Fig. 2: Prevalence of open defecation in different wealth quintiles).* A geopolitical disparity is also observed in the access to toilets. Around 54 per cent of the population in the north central area defecates in the open. The minimum per cent of people going out for defecating is from northwest *(see Map 1: Prevalence of open defecation in different geopolitical zones of Nigeria).* Such differences are mainly due to level of affordability to construct toilets or availability of private spaces, forests etc. for defecation.

A. STATE OF SANITATION IN NIGERIA

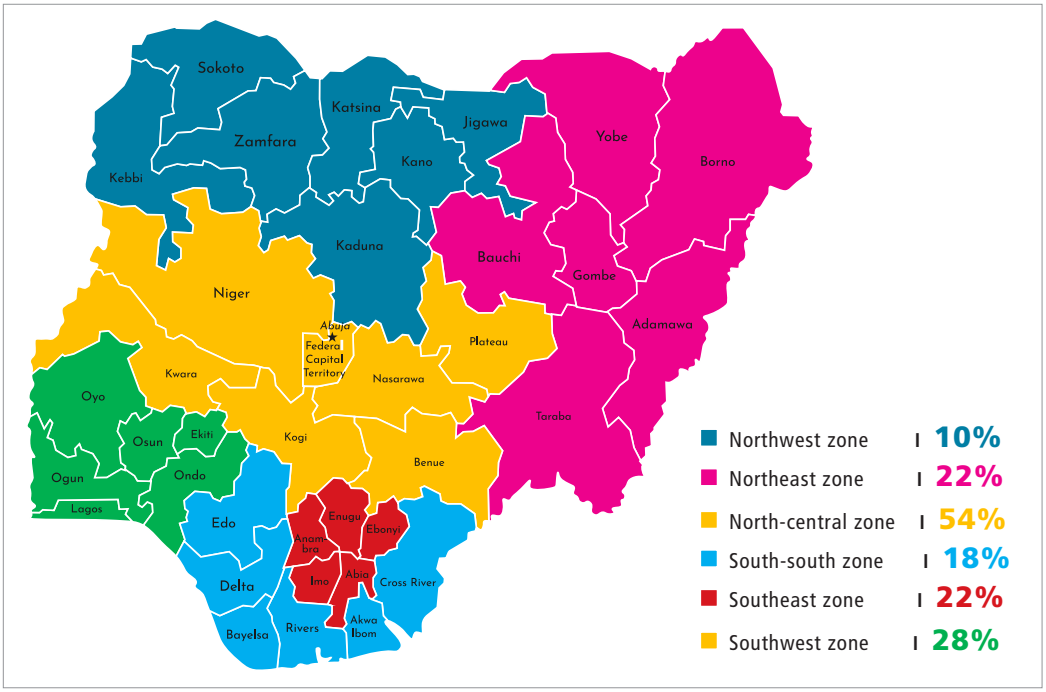
In November 2018, President Muhammadu Buhari declared a state of emergency on Nigeria's water supply, sanitation and hygiene sector. According to the President's speech, the declaration of emergency had become crucial to the country due to the high prevalence of waterborne diseases in the country.[9, 10] As per the President's statement, piped-water

Figure 2: Prevalence of open defecation in different wealth quintiles



Source: WASH-NORM Survey, 2018.

Map 1: Prevalence of open defecation in different geopolitical zones of Nigeria



Source: WASH-NORM Survey, 2018.

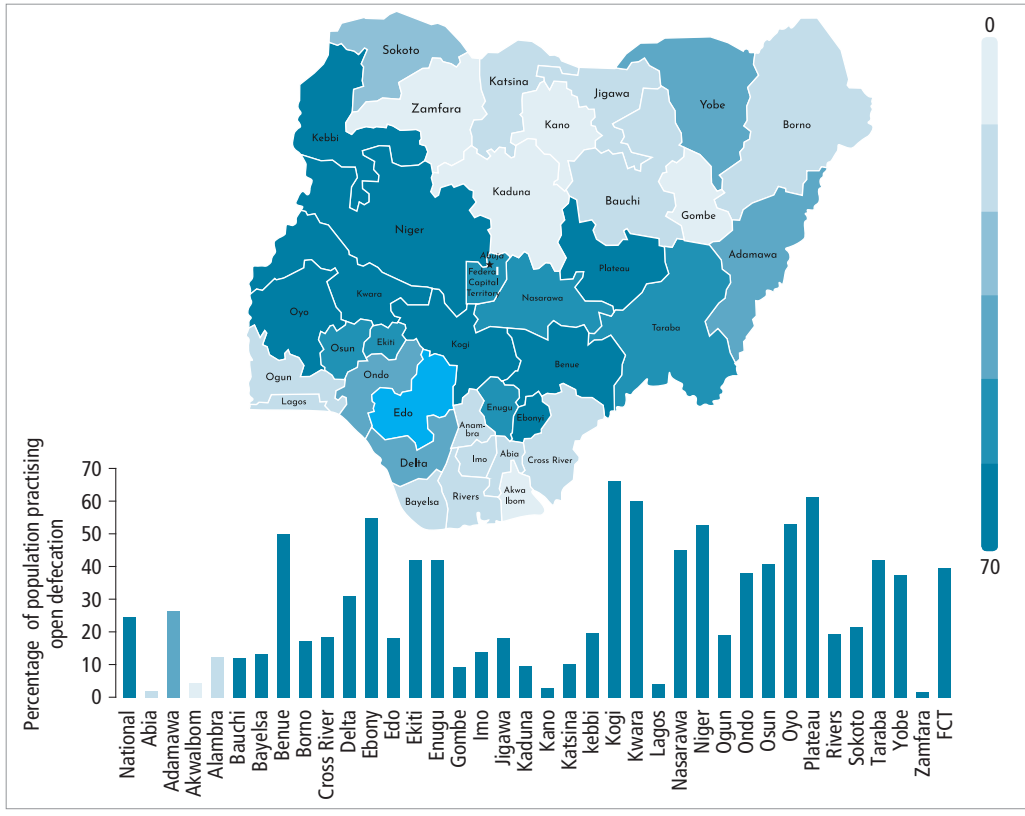
services fell by 25 per cent between 1990 (32 per cent) and 2015 (7 per cent) and access to improved sanitation also fell by 9 per cent between the same time period (38 per cent was recorded in 1990). The president also declared that 46 per cent of all the water schemes were defunct and the country's expenditure in the WASH sector fell from 0.70 per cent of Gross Domestic Product (GDP) to 0.27 per cent of GDP between 1990 and 2015. The President officially launched the National Action (WASH) Plan. The National Action Plan commences with an 18-month emergency plan, followed by a five-year recovery plan and a 13-year revitalization strategy, helping the country to move towards the 2030 deadline set by the SDG.[11]

The Agence Francaise de Developpment (AFD) and the United States Agency for International Development (USAID) will implement the National WASH Action Plan through their support to project states' water boards in the states of Enugu, Ondo, Plateau, Ogun and Kano by 2022 (by AFD) and in ten states of Abia, Delta, Imo, Niger, Sokoto and Taraba by 2023 (by USAID). The Africa Development Bank (AfDB) will contribute to the internationalization of the WASH Action Plan in Yobe, Osun, Adamawa, Bauchi, Borno, Gombe and Taraba states, while the World Bank will support 13 states in the implementation of the Water, Sanitation and Hygiene (WASH) Action Plan. The Department of International Development (DFID) and UNICEF will support the preparation of sub-national state-specific WASH plans of action in the eight states—Benue, Bauchi, Jigawa, Katsina, Kaduna, Kano, Yobe and Zamfara.[12] Thus the national campaign will strengthen the country's commitment to make it open defecation free by 2025.

B. BEST- AND WORST-PERFORMING STATES:

According to the WASH-NORM, 2018 report, Kagi in central Nigeria shows the maximum household members practising open defecation (65.8 per cent), while Zamfara in the northeast shows a minimum, with of 1.6 per cent of the population practising open defecation *(see Map 2: State of open defecation in different states of Nigeria)*. The states belonging to different geopolitical zones show disparity. The highest proportion of open defecation was found in the north-central zone while lower proportion in the northwest as per different research studies.[13, 14] The researchers pointed out that the high prevalence of open defecation in the north-central zone is because of the availability of forestlands here. The northwest on the other hand has grasslands and hence has the lowest incidence of open defecation.

Map 2: State of open defecation in different states of Nigeria



Source: WASH-NORM Survey, 2018.

C. SANITATION PRACTICES ACROSS GEOPOLITICAL ZONES

Nigeria uses pour-flush toilets (in which excreta goes from the pour flush to the pit or septic tank), pit toilets with or without slab and ventilated improved pit (VIP) toilets along with hanging, bucket, compost and other traditional toilets. An analysis of the level of sanitation services across the country shows that while 24.4 per cent of the population defecate in the open, only 19.2 per cent have safely managed sanitation or improved sanitation services *(see Figure 3: Levels of sanitation in Nigeria)*. As per the 2019 JMP report, the annual change in open defecation between 2000 and 2017 was only 0.39 per cent in spite the improvement in basic sanitation in the country—47 million people still defecate in the open.

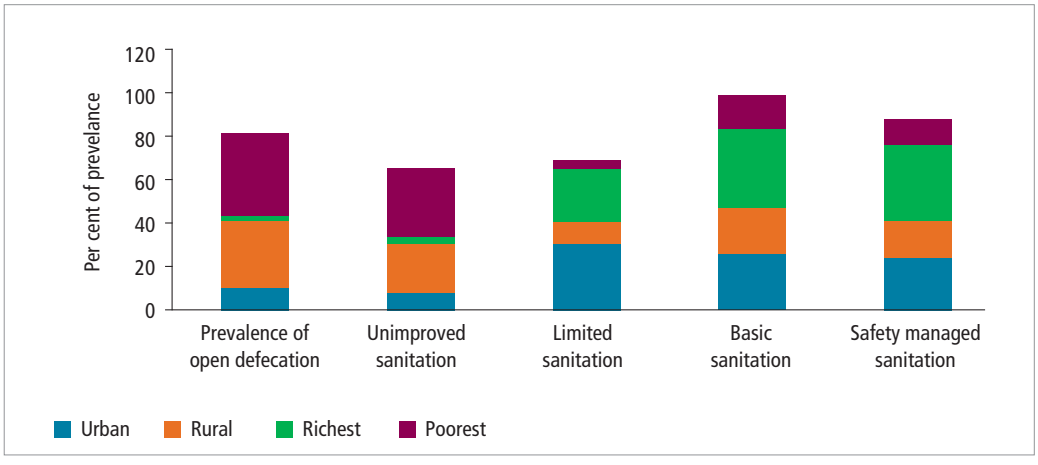
Figure 3: Levels of sanitation in Nigeria

Open defecation 47 million	Unimproved sanitation 35 million	Limited sanitation 30 million	Basic sanitation 43 million	Safely managed sanitation 37 million
31.6 per cent rural 11.6 per cent urban	• Unimproved toilets—No hygienic separation of human faeces from human contact. E.g. pit toilets without slabs/platforms	• Improved toilets • Shared by 2 or more household • Functional • Accessible	• Improved toilet • Private (not shared) • Functional • Accessible	• Improved toilet • Private • Functional • Accessible • Focal sludge managed
24.4%	18.2%	15.9%	22.3%	19.2%

Source: WASH-NORM Survey, 2018.

Disparity in the levels of sanitation is seen between the rich and poor and between urban and rural areas in the country[15] (see *Fig. 4: Sanitation facilities in different sectors in Nigeria)*. Open defecation is practised, for example, more by the poorest than the richest. Also, rural areas have more people going out to defecate in open as compared to urban areas as rural areas have more open spaces. The richest population use toilet technologies that can manage the excreta more safely than the poorest population due to easier available funds. The urban areas use more safe technologies to manage the excreta than the urban areas, pointing towards awareness and fund availability.

Figure 4: Sanitation facilities in different sectors in Nigeria



Source: WASH-NORM Survey, 2018.

WaterAid, Nigeria

Open defecation and unmanaged black water flows through Mabushi village, an unauthorized settlement in Abuja

The type of toilet facility also shows a correlation with whether the setting is urban or rural (see *Table 1: Sanitation facilities in urban and rural areas of Nigeria)*—modern technologies are seen to be used by the urban population while the rural more often practise open defecation. For example, flush to sewer system or septic tanks were used more in urban than in rural areas (the JMP report of 2019 also confirms this). It was also seen that modern toilet technologies were used more by the affluent *(see Table 2: Sanitation facilities and the status of household wealth in Nigeria).* As per the WASH-NORM Survey, flush or pour flush to septic tank is predominant in urban areas while pit toilets (drop holes) with slabs are common in rural areas.[16]

Table 1: Sanitation facilities in urban and rural areas of Nigeria (values in per cent)

Sanitation facility	Urban	Rural
Flush to piped sewer	4.10	1.20
Flush to septic tank	8.47	1.84
Flush to pit toilet	4.11	1.44
Flush to somewhere else/no idea	0.19	0.09
VIP toilets	7.64	11.39
Pit toilet with slab (drop hole)	6.04	6.30
Pit toilet without slab (drop hole)	2.18	10.64
Open defecation	7.52	23.78
Hanging toilets	0.85	2.01
Composting toilets, bucket toilets and others	0.09	0.13

Source: Ismaila Rimi Abubakar, 2017. Access to Sanitation Facilities among Nigerian Households: Determinants and Sustainability Implications. Sustainability, *9, 547*

WaterAid, Nigeria

A drop hole with slab in Mabushi village, Abuja

Table 2: Sanitation facilities and status of household wealth in Nigeria

Sanitation facility	Poorest (%)	Poorer (%)	Middle (%)	Richer (%)	Richest (%)
Flush to piped sewer	1.00	0.01	0.11	0.95	4.23
Flush to septic tank	0.00	0.01	0.21	1.60	8.50
Flush to pit toilet	0.02	0.07	0.40	1.70	3.36
Flush to unknown place	0.00	0.01	0.04	0.08	0.16
VIP toilets	0.00	0.01	0.04	0.08	0.16
Pit toilet with slab	0.56	1.42	3.44	4.95	1.96
Pit toilet without slab	4.24	4.04	2.65	1.52	0.37
Open defecation	6.82	8.44	9.41	5.64	0.99
Hanging toilets	0.08	0.44	0.92	0.98	0.44
Composting toilets, bucket toilets and others	0.04	0.03	0.05	0.04	0.05

Source: Ismaila Rimi Abubakar, 2017. Access to Sanitation Facilities among Nigerian Households: Determinants and Sustainability Implications. Sustainability, 9, 547;

According to a 2008 study carried out in Ogbogu, a small semi-urban community in Rivers state, it was observed that not owning any toilet was not due to choice but due to lack of space and money.[17] As older community dwelling units were built very close to each other and small pieces of land are generally shared by extended families, lack of space was cited as the top reason for not having toilets or safe toilets. Although having a sanitation facility in Nigeria is a prerequisite for every approved building plan, according to the authors of the 2008 study, the plans were often not enforced. A WaterAid study in 2016 in Enugu (in the southeast zone), Ekiti (in the southwest zone) and Jigawa (in the northwest zone) also confirms that cost is the main deterrent to communities building toilets.[18]

Not just expensive construction materials, but complex purchasing processes also prevent household owners and artisans from estimating actual costs. Further, changes in behaviour in communities with regard to building and using toilets may not be sustainable as many revert to open defecation after their toilets collapse.

The analysis of the state of improved sanitation also showed geopolitical disparity in the use of improved sanitation. While southeast Nigeria recorded the highest percentage of household members with improved sanitation, the northwest recorded the least percentage. With regard to basic sanitation, people in the southeast have access to maximum basic sanitation while those from the north-central have the lowest access. It was also seen that one-third of households in the southwest used limited sanitation.[19] A 2017 research article published in the journal Sustainability confirms that preference for the type of toilet facility is influenced by sector, region and wealth quintile[20] (see *Table 3: Sanitation facilities in various geopolitical zones).* The author used the 2013 Nigeria Demographic and Health Surveys (NDHSs) household dataset for which approximately 39,000 households were studied.

Table 3: Sanitation facilities in various geopolitical zones

Sanitation facility	GEOPOLITICAL ZONES					
	Northwest (%)	Northeast (%)	North-central (%)	Southwest (%)	Southeast (%)	South-south (%)
Flush to piped sewer	0.23	0.29	1.53	0.76	1.11	1.37
Flush to septic tank	0.28	0.19	1.38	4.4	2.42	1.64
Flush to pit toilet	0.46	0.44	1.26	1.58	0.38	1.43
Flush to somewhere else/no idea	0.03	0.05	0.06	0.02	0	0.1
VIP toilets	7.88	4.17	2.51	1.16	1.68	1.68
Pit toilet with slab	2.75	1.69	1.22	2.93	2.09	1.66
Pit toilet without slab	5.32	1.6	0.84	0.49	0.93	1.63
Open defecation	3.56	4.3	8.8	6.52	3.84	4.25
Hanging toilets	0.07	0.01	0.03	0.16	0.49	2.1
Composting toilets, bucket toilets and others	0.03	0.06	0.01	0.03	0.04	0.04

Source: Ismaila Rimi Abubakar. 2017. Access to Sanitation Facilities among Nigerian Households: Determinants and Sustainability Implications. Sustainability, *9, 547.*

According to this research, the maximum usage of hanging toilets is from the south-south because of the dominance of riverine areas in the zone. A hanging toilet is one built over a waterbody so that human waste is disposed of in the water. It is also clear from the WASH-NORM Survey, 2018 that the southwest has maximum access of basic water supply (81.8 per cent of the population) while the northwest scored lowest in this (58.4 per cent). Hence flush toilets are minimum in the northwest as compared to the southwest.

In January–June 2014, the KIT Royal Tropical Institute carried out an impact evaluation on the Nigerian government's WASH programme (2009–13), with support from UNICEF, with six Nigerian states (Bauchi, Benue, Katsina, Jigawa, Cross-River and Osun) and one Local Government Area (LGA) selected for primary data collection.[21] The key objectives of the programme were to increase access to safe-water sources, improve sanitation and promote hygiene practices, especially in rural areas and among vulnerable populations. Based on secondary data, a before-after analysis was carried out to analyse trends and changes over time (mainly the Demographic and Health Survey of 2008 and 2013, and the Multiple Indicator Cluster Survey, 2011) to overcome the lack of a baseline study in some LGAs. It was seen that not only did more households in the south construct toilets than households in the north, but the toilets were improved, better maintained and more expensive as the richest quintile lived generally more in the south than the north.

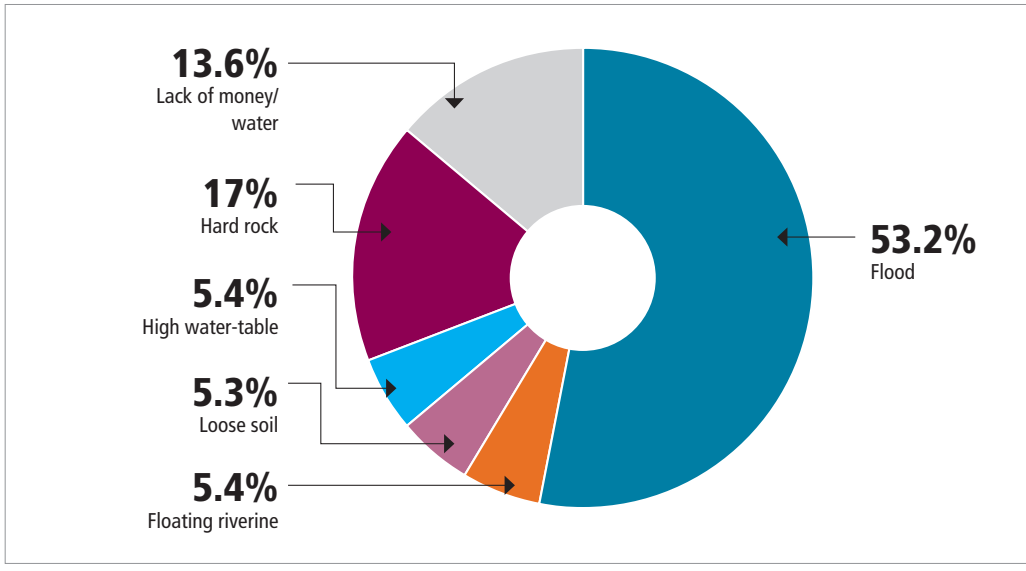
According to a review of existing sanitation technologies published in 2014 in Global Journal of Human Social Science, Nigeria is still to solve the problem of sustainable sanitation.[22] The country needs good technologies to solve this problem and the communities simultaneously need provision of water in toilets at affordable prices. The author suggested that the communities be made aware of safe technologies through public health workers. The study analysed ten states of the country, which said that existing toilets faced problems of leakage, high water-table and also collapse. Maximum leakage in toilets in Kogi (in the north-central), high water-table in Imo (in the southeast) and maximum collapsing toilets in Yobe (northeast) were seen *(see Table 2: Sanitation facilities and the status of household wealth in Nigeria).* Yobe showed collapsing toilets due to weakly developed soil in the area. According to the author, the northern zones preferred traditional toilets due to cultural and religious beliefs. Imo, where high water-table is a problem, prefers traditional toilets (see *Table 4: Problems in toilet technologies in different states and their preferences of technologies).* This indicates that areas prone to soil collapsing or with a high water-table or having flawed toilets need immediate attention for suitable toilet technologies. The author also cites floods, floating riverine, loose soil, high water-table, hard rock, no water supply and lack of funds as the main reasons for not constructing of toilets, flood being the top reason *(see Fig. 5: Reasons for communities practising open defecation in Nigeria).* From different analyses it becomes clear, that the country needs to think about sustainable toilet technologies in soft soil (or where the soil collapses easily/water logged areas/areas with shallow groundwater).

Table 4: Problems in toilet technologies in different states and their preferences of technologies

State	Geopolitical zone	Problems of existing toilets			Preference for toilet technology			
		Leakage in toilets (%)	High water-table (%)	Collapse of toilets (%)	Pour flush (%)	Improved toilet (%)	Water closet (%)	Traditional (%)
Kogi	North-central	24.3	8.1	8.1	12.5	25.0	20.0	Not studied
Cross River	South-south	6.3	3.1	6.3	14.3	5.7	54.3	Not studied
Niger	North-central	0.0	0.0	4.8	15.8	31.6	7.9	Not studied
Bayelsa	South-south	9.5	4.8	9.5	38.7	16.1	38.7	Not studied
Yobe	Northeast	16.7	8.3	20.8	Not studied	Not studied	Not studied	86.0
Lagos	Southwest	5.6	16.7	0.0	19.4	Not studied	77.8	Not studied
Kebbi	Northwest	6.5	6.5	6.5	Not studied	2.8	11.8	86.3
Sokoto	Northwest	12.5	12.5	12.5	Not studied	Not studied	5.0	96
Imo	Southeast	Not studied	36.1	Not studied	Not studied	Not studied	Not studied	100.0
Delta	South-south	2.5	5.0	Not studied	Not studied	Not studied	Not studied	90.2

Source: Abogan, S.O. 2014. Appraisal of existing sanitation technology in Nigeria: A critical review. Global Journal of Human Social Science: B, Geography, Geo-Sciences, Environmental Disaster Management. *Vol. 14. Issue 1. Version 1.0 Year 2014.*

Figure 5: Reasons for communities practising open defecating in Nigeria



Source: Abogan, S.O. 2014. Appraisal of Existing Sanitation Technology in Nigeria; A Critical Review. Global Journal of Human Social Science: *B, Geography, Geo-Sciences, Environmental Disaster Management. Volume 14 Issue 1 Version 1.0 Year 2014*

D. MANAGEMENT OF GREY, BLACK WATER AND FAECAL SLUDGE:

As per the WASH-NORM Survey, 2018, around 16.5 per cent of the households reported wastewater leakage or overflow from their household toilets in Nigeria. Most of the cities report either no wastewater treatment plants or defunct treatment plants.[23] As a result, wastewater is dumped directly into the waterbodies. For example, Lagos state generates around 1.4 trillion cubic centimetres of wastewater. Densely populated areas like Badagry, Mushin, Oshodi, and Ikorodu in Lagos have septic tanks that are in a state of disrepair, resulting in groundwater contamination.[24]

Faecal sludge *(see Box 1: How faecal sludge is different from sewage)* has never been emptied from more than 50 per cent of the household toilets. Further, according to the 2018 WASH-NORM Survey report, 26.5 per cent had no idea where the sludge was disposed of after they emptied it. Around 8 per cent emptied the faecal sludge in uncovered pits and waterbodies. Around 40 per cent of the sludge in the country is buried in covered pits and 12.5 per cent is carried to treatment plants.

Nigeria considers excreta to be safely managed if the excreta is emptied and buried in a covered pit (only in cases where the toilet facility is not shared). This is practised twice as much in urban areas as in rural areas *(see Fig. 6: Treatment and/or disposal and emptying of faecal sludge in rural and urban areas of Nigeria).* It is also seen that in rural areas, maximum households did not have clue where the sludge was emptied. Burial of excreta in pits can cause health disaster very often by contaminating the soil and groundwater *(see Box 2: Passo village suffers from waterborne diseases as the faecal sludge is not treated).*

NEWSAN, Nigeria

Wastewater flows uncontrolled in Passo village, near Abuja

BOX 1: HOW FAECAL SLUDGE IS DIFFERENT FROM SEWAGE

Sewage is untreated wastewater that contains faeces and urine and gets conveyed through the sewerage system. Generally, grey water from kitchens and bathrooms also becomes part of sewage. The Biological Oxygen Demand (BOD) of sewage is 150–350 mg/l and all sewage treatment plants are designed for this load.

Faecal sludge on the other hand is slurry that is emptied from on-site sanitation systems. It is the solid or settled contents of pit toilets and septic tanks and is much more concentrated than sewage, with BOD ranging from 1,000 to 20,000 mg/l. It is raw or partially digested slurry or in semi-solid form and results from the storage and/or partial treatment of black water, with or without grey water. It differs from sludge produced in municipal wastewater treatment plants. The characteristics of faecal sludge can differ widely from household to household, from city to city, and from country to country. The physical, chemical and biological qualities of faecal sludge are influenced by the duration of storage, temperature, soil condition and intrusion of groundwater or surface water in septic tanks or pits, performance of septic tanks, and tank-emptying technology and pattern.

Source: Suresh Kumar Rohilla et al., 2019, Integrated Wastewater and Faecal Sludge Management for Ghana: Draft Guidelines, *Centre for Science and Environment, New Delhi*

BOX 2: PASSO VILLAGE SUFFERS FROM WATERBORNE DISEASES AS THE FAECAL SLUDGE IS NOT TREATED

In Passo village, about 120 km from Abuja, Nigeria's capital, several people have stopped using toilets as pit emptying is difficult for them. The village, with almost 1,600 households, is headed by 60-year-old Jousha Madaki. Around 50 per cent of the households have individual toilets and a very small fraction use shared toilets (that are rarely maintained). The toilets comprise drop holes without a slab and are designed and constructed by unskilled contractors. Household owners who have built toilets say that their children suffered from diarrhoea and fever when they defecated in the open and that they would have to spend almost 4,000–5,000 Nigerian Naira on each child three to four times a year. This was too much for households that earned 8,000–9,000 Nigerian Naira per month.

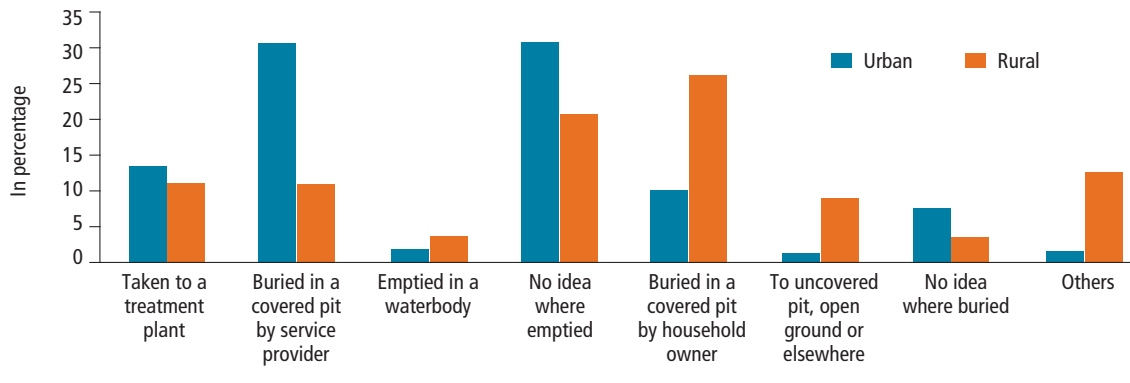
But building toilets did not provide relief to the villagers. After just two to three years, the pits got filled, and the villagers were unable to call the service provider to empty the pits. The cost of emptying was too high for the villagers (around 15,000 Naira), who are mostly farmers with an annual income of 100,000 Naira. Household owners prefer to bury the undigested excreta in the ground and abandon the toilet and start defecating in the open. The residents said that the undigested excreta affects the soil and groundwater and breeds flies. They also complained of contaminated groundwater causing diarrhoea, mostly during the monsoons as the village depends solely on water from a borewell—not a deep one—for drinking water. During the monsoon, the local medicine shop sells three times the medicines for waterborne diseases than what it sells in normal months.

NEWSAN, Nigeria

An abandoned toilet in Passo village

Source: Local interviews

Figure 6: Treatment and/or disposal and emptying of faecal sludge in Nigeria



Source: WASH-NORM survey, 2018.

In the southern zones of the country, most of the households clearly had no clue where the sludge was emptied while in the northern zones (excluding the north-central, where service providers buried sludge in a covered pit), the households buried the faecal sludge in a covered pit. This may be due to the fact that the population in the northern zones (excluding the north-central zone, where the middle-income group was the highest as per WASH-NORM) cannot call a service provider to empty the tanks and pits due to unavailability of funds (see *Table 5: Emptying, disposing of and treating faecal sludge in different geopolitical zones of Nigeria).*

Not only is managing sludge important but safe disposal of child excreta is equally important as it effects the health and economics of the country. According to the 2018 WASH-NORM Survey, there are problems with regard to the disposal of children's faeces. While about 79 per cent of the households dispose of child faeces safely in toilets, the report does not explain how much of this is disposed of into improved sanitation facilities. The report adds that faeces is thrown into the garbage, buried or flushed in drains or ditches. A 2014 World Bank analysis says that in 2013, about half of the households (53 per cent) surveyed in Nigeria reported that the faeces of their youngest child under age of three was safely disposed of.[25] According to the 2013 Nigeria Demographic and Health Survey (DHS), only 23 per cent of households in Nigeria reported that their youngest child's faeces was disposed of in an improved sanitation facility—this figure is much lower than that for safe disposal *(see Table 6: Safe disposal and improved disposal of child (under the age of 3 years) faeces in Nigeria).* The prevalence of risky disposal of children's faeces in Nigeria is higher among households without access to sanitation facilities (see *Fig. 7: Relationship between disposal of children's (under the age of three years)* faeces and sanitation facilities in Nigeria in 2013), probably among dwellers in rural areas and urban slums. This is where poorer households, and those that practise open defecation, predominantly live.[26]

Table 5: Emptying, disposing of and treating faecal sludge in different geopolitical zones of Nigeria

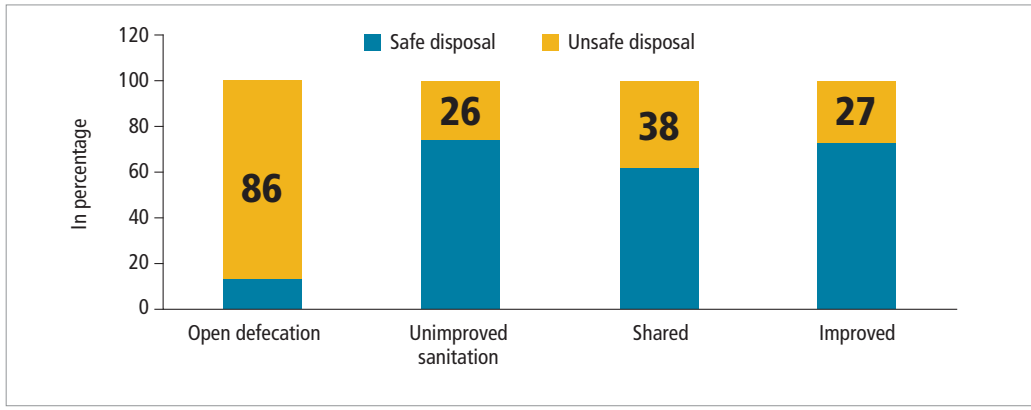
Process of emptying, disposing of and treating faecal sludge	North-central (%)	Northeast (%)	Northwest (%)	Southeast (%)	South-south (%)	Southwest (%)
Taken to a treatment plant	5.2	7.3	14.1	2.5	5.9	18.7
Buried in a covered pit by service provider	44.5	13.8	8.2	12.4	15.1	36.8
Emptied in a waterbody	1.0	0.7	4.8	1.0	8.5	1.4
No idea where emptied	22.1	18.8	16.8	53.6	43.0	28.2
Buried in a covered pit by household owner	10.5	51.2	21.9	5.0	21.3	6.9
To uncovered pit, open ground or elsewhere	2.0	5.7	13.1	1.4	0.4	0.5
No idea where buried	10.5	1.6	2.0	19.5	4.9	7.2
Others	4.2	0.9	19.1	4.7	1.0	0.3

Source: WASH-NORM

WaterAid, Nigeria

A household owner in Mabushi village explains that her family buried their sludge under the soil when their pit was full and they reverted to practising open defecation.

Figure 7: Relationship between disposal of children's* faeces and sanitation facilities in Nigeria (2013)



*Children denotes those under the age of three years
Source: Child faeces disposal in Nigeria. Report 2014. UNICEF, WSP, World Bank

Table 6: Safe disposal and improved disposal of children's* faeces in Nigeria (2013)

S. no.	Safe disposal	Improved disposal	Percentage
1.	Children used toilet and household used improved sanitation	Yes	2
2.	Children's faeces put/rinsed in toilet, with households using improved sanitation	Yes	21
3.	Children used toilet and household used unimproved sanitation	No	1
4.	Children's faeces put/rinsed in toilet and households used unimproved sanitation	No	29
	Total safe disposal (sum of 1, 2, 3 and 4)	–	53
	Total improved disposal (sum of 1 and 2)	–	23

Source: Child faeces disposal in Nigeria. Report 2014. UNICEF, WSP, World Bank

**Children denotes those under the age of three years*

2. Impacts of unsafe sanitation

According to the data provided by the Federal Ministry of Water Resources, Nigeria, more than 100,000 children below the age of five die each year due to diarrhoea, 90 per cent of which is attributable to unsafe water and sanitation. The ministry's data also confirms that the country loses 1.3 per cent (455 billion Nigerian Naira approximately) of GDP annually due to poor sanitation which results in illness, low productivity and loss of learning.

A. HEALTH IMPACT

Unimproved sanitation and open defecation have a negative impact on health. Diseases like diarrhoea, cholera, dysentery, typhoid and hepatitis A occur when such unsafe sanitation contaminate the drinking water sources or soil and result in environmental degradation of the area (see *Box 2: Passo village suffers from waterborne diseases as the faecal sludge is not treated).* The 2018 Nigeria Demographic and Health Survey (NDHS) was designed to provide data for monitoring the population and health situation in Nigeria. The 2018 NDHS is the sixth survey of its kind to be conducted in Nigeria since 1990, with a representative sample of approximately 42,000 households.[27] The study found that diarrhoea occurred in children below the age of five years where unimproved sanitation and open defecation were practised. The occurrence of such incidents was highest in the northeast (21.1 per cent) followed by southeast (10.3 per cent) and northwest zones (9.2 per cent). Open defecation was the lowest in northwest (see *Table 3: Sanitation facilities in different geopolitical zones).* VIP toilets, which are considered safe, were the most prominent in the northwest. It is also seen from a different analysis *(see Table 1: Sanitation facilities in urban and rural areas of Nigeria)* that open defecation is lower in urban areas. This is aligned with the results of NDHS, 2019, which finds fewer cases of diarrhoea in urban children below the age of five years (10.8 per cent) than in children in rural (9.2 per cent) areas. NDHS's stunting data, which again is an impact of poor sanitation, can be correlated well with the wealth quintile and sectors.[28] According to NDHS, 2019, urban areas have fewer stunted children (27 per cent) compared to rural areas (46 per cent) due to the smaller prevalence of open defecation. Even the highest wealth quintile (16 per cent), who use more safe technologies *(see Table 2: Sanitation facilities and the status of household wealth in Nigeria),* have fewer children with stunting than the number of children in the lowest quintile (58 per cent).

Apart from the study on the impact of unimproved sanitation on the quality of groundwater (which directly affects health), several other small-scale studies establish the link between health and water. The studies pointed out that whenever toilet pits are located close to groundwater wells (i.e. at less than 15 metres away, the distance prescribed by researchers/ scientist), faecal coliform affects the quality of groundwater.

In Nigeria, in the absence of safe piped-water supply for rural households, non-improved sources, such as unprotected wells, unprotected springs and surface water, are the predominant sources of drinking water. A 2019 *International Journal of Medical Sciences and Public Health* analysis shows how poor sanitation affects the water resources and eventually the health of the community.[29] The study was done in Tunga Magaji, a rural community in the Wamakko local government area, one of the Metropolitan Local

Government Areas of Sokoto state. Out of 1,262 households in Tunga Magaji, around 31 per cent of households were aware on the effect of poor sanitation on health. The bore well and dug well water was highly contaminated with coliform bacteria (*Escherichia coli*). It is seen that out of different types of toilets used, pit toilet with slab is 67 per cent but the next prominent is the bucket toilet. People defecating in the open throw their excreta in polythene bags in bushes and waterbodies. It was seen that 71 per cent of children below the age of five years suffered from diarrhoea and abdominal pain related to stomach problems. A 2011 study that examined the pollution effects of pit toilet on shallow wells at Isale-Igbehin, Abeokuta, Nigeria, published in the Journal of Geology and Mining Research, confirmed that leachate from pit toilets was one of the major sources of this pollution in Nigeria. The results showed that shallow wells were polluted by pit toilets.[30] A 2014 study in densely populated settlements of the Dala local government area of Kano state, Nigeria, published in the International Journal of Microbiology and Application also confirmed the pollution of groundwater by sanitation pits located close to the groundwater sources. Only one sample (from Adakawa) was within the Nigeria Standard for Water Quality (NSDWQ) (see *Table 7: Contamination of groundwater in Kano state, Nigeria due to close proximity of wells near toilet pits).* The high coliform count indicated that water from different wells was polluted and could be contaminated with faecal matter. The water samples from Kaigama, K/Ruwa and Madigawa had the highest coliform count. This finding was not surprising, considering the high population and close proximity of the wells to pit toilets. The study indicated that sewage can slowly seep into underground water, thereby polluting it.[31]

Table 7: Contamination of groundwater in Kano state, Nigeria, due to close proximity of wells near toilet pits

Sample site	Distance between groundwater source and pit (m)	Depth of pit (m)	Groundwater level (m)	Infiltration layer (m)	Coliform (MPN/100 ml)
K/Ruwa	1.3	5.1	5.2	0.1	2,400
Kantudu	1.5	8.5	10.6	2.1	240
Kaigama	2.2	7.3	7.6	0.3	1,100
Madigawa	3.5	6	6.2	0.2	1,100
Kabuwaya	3.8	6.5	9.4	2.9	15
Bakin Rawa	4.2	6.5	7.1	0.6	460
Gobirawa	4.5	5.8	7.8	2	93
Dala	5.1	7.2	8.2	1	150
Yalwa	5.5	6.7	8.8	2.1	75
K/Mazugal	7.5	8.1	13.4	5.3	15
Gwammaja	8.2	6.8	8.2	1.4	210
Adakawa	9.3	7.5	11.2	3.7	7

NSDWQ standard: 10 MPN/100 ml; MPN = Most probable number

Source: Abdulkadir R.S., Mahmoud A.M., Adnan A., Shamsuddeen U., Adamu R. T., Yunusa I. 2014. Effect of Pit Toilet Leaks on Shallow Well Water. International Journal of Microbiology and Application. *Vol. 1, no. 5, pp. 46–51.*

NEWSAN, Nigeria

The village head discusses the high incidence of diarrhoea in Passo village

A 2014 study published in *IOSR Journal of Environmental Science, Toxicology and Food Technology* carried out in Isara-Remo, Ogun State, Nigeria, analysed how water in hand-dug wells can be polluted by toilet pits at a distance of less than 15 m. *Escherichia coli* and salmonella spp. were present in higher proportion (0.46 x 104 and 0.84 x 104 cfu/100 ml respectively), which indicated that the wells were faecally contaminated. Epidemiological data revealed that the reported cases in clinics of waterborne diseases like diarrhoea and typhoid fever were high, with infections through consumption of contaminated water from the hand-dug wells. The study revealed high faecal contamination in well water in Isara, which showed high possibility of the presence of disease pathogens. There were many cases of water-related diseases and infections reported in the health centre and private clinics visited during the study, showing that many people drank from contaminated water sources. *E. coli* O157:H7, a strain of *E. coli* bacteria identified to cause kidney failure, could jeopardize the health of young children and those with challenged immune systems. In this study, diarrhoea and gastroenteritis were more prevalent among 10-year-old schoolchildren while several adults were down with typhoid fever. It is evident that most hand-dug wells in the study area were contaminated with faecal matter that leached from nearby pit toilets.[32]

In another study published in 2018, a survey in Akure, the capital city of Ondo state in south-west Nigeria, the comparison of the total coliform counts and faecal coliform counts of the well water samples based on their orientation to sewage pit showed that water samples from wells sited down-gradient in orientation to sewage pits had a higher mean total and faecal coliform count than the wells sited up-gradient in orientation to sewage pits in both dry and rainy seasons. Ringed wells, which comprised 90 per cent of the observed groundwater wells, had higher mean total coliform and faecal coliform counts than the unringed wells in both dry and wet seasons. Wells with uncemented well areas had higher

mean total coliform and faecal coliform counts than wells with cemented well area in both dry and rainy seasons. Wells in sandy soil areas had a higher mean total coliform and faecal coliform count than those sited in the clay soil area in the dry season as sand allows the contamination to travel due to high permeability. Contrariwise, in the rainy season, water samples from wells sited in clay soil area had higher total and faecal coliform counts than samples from wells sited in sandy soil areas as clay, being non-permeable, allows the coliform to stand at one place. The research said that aside from the distance between wells and sewage pit and topography, other factors such as seasonal variation, inadequate hygiene and sanitation, well disinfection and well characteristics played a significant role in the level of well-water contamination.[33] The study also revealed that soakaway pits built at the end of septic tanks pollute the groundwater where the groundwater levels are shallow, and hence care should be taken in siting septic tanks in such areas.

B. ECONOMIC LOSS

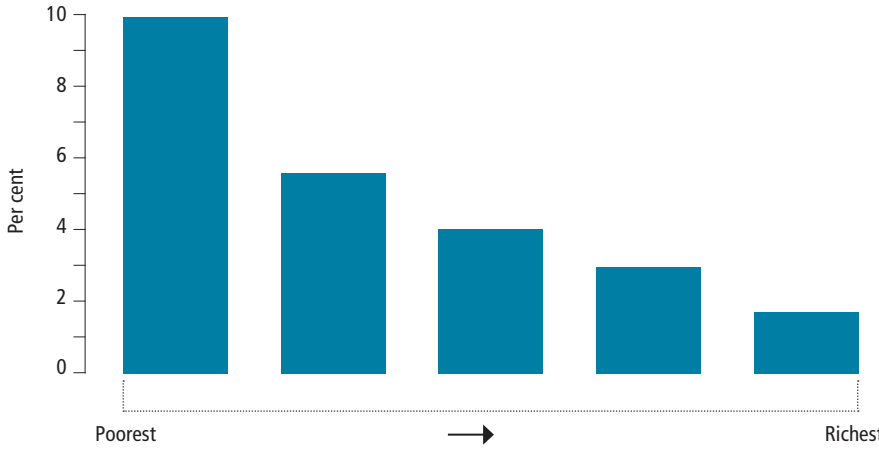
The World Bank's Water and Sanitation Programme in its 2012 report said that Nigeria loses 455 billion Naira every year due to poor sanitation and hygiene.[34] This is equivalent to 1.3 per cent of the annual GDP of the country. The calculation was made in view of the 2010 JMP report, according to which 22 per cent of Nigerians practised open defecation. But according to the 2019 JMP, 24.4 per cent of the people, at least 2 per cent higher than the 2010 figure, were defecating in the open in 2017. According to the 2012 World Bank report, the loss when calculated at per capita level becomes almost equal to Nigerian Naira 3000 (US $20) per year or Nigerian Naira 4400 (US $29.3) per person without access to sanitation. The report also said that open defecation cost Nigeria US$1 billion per year and that open defecation cost more per person than any other type of unimproved sanitation. This is because open defecation requires extra time to find a safe, private location for defecation.

According to the Federal Ministry of Water Resources (FMoWR), Nigeria needs to construct around 2 million toilets per year during 2019–25 to achieve the target of universal basic sanitation. However, the ministry claims that currently the country is constructing around 1.6 million improved toilets.

The economic loss of poor sanitation falls heavily on the poor, who pay a much higher proportion of their income compared to the rich to fight the unimproved sanitation. The average cost associated with unimproved sanitation constitutes a much greater proportion of a poor person's income than that of a richer person adds the World Bank 2012 report (see *Fig. 8: Cost per person of unimproved sanitation expressed as percentage of income by different wealth categories).* World Bank analysis of the economic loss due to unimproved sanitation showed that premature death contributed to maximum loss *(see Fig. 9: Factors contributing to economic losses due to unimproved sanitation).*

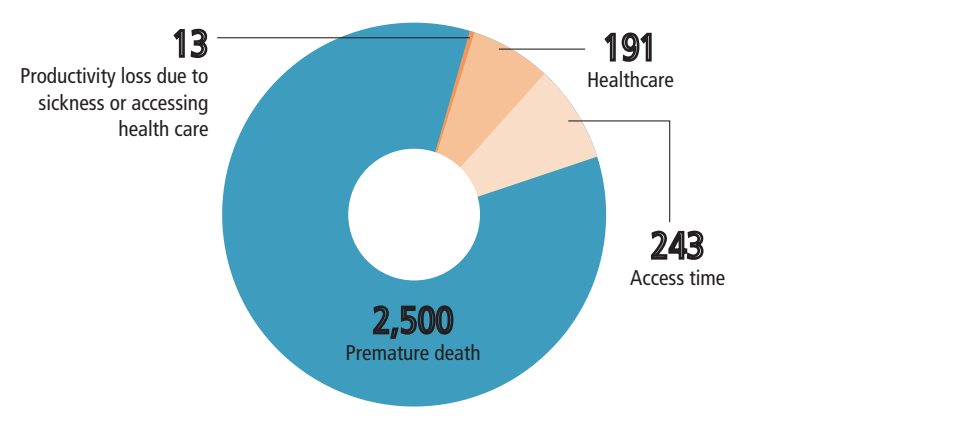
According to government data, every Naira invested in water and sanitation sector resulted in economic benefit ranging from Naira 1080 to Naira 12,240 (US $3–4). The gains occurred due to savings in healthcare, increase in productivity and entrepreneurial opportunities for the sanitation market.

Figure 8: Cost per person of unimproved sanitation expressed as percentage of income by different wealth categories



Source: Water and Sanitation Programme. 2012. Economic impacts of poor sanitation in Africa. Nigeria.

Figure 9: Factors contributing to economic loss due to unimproved sanitation (in US $ million)

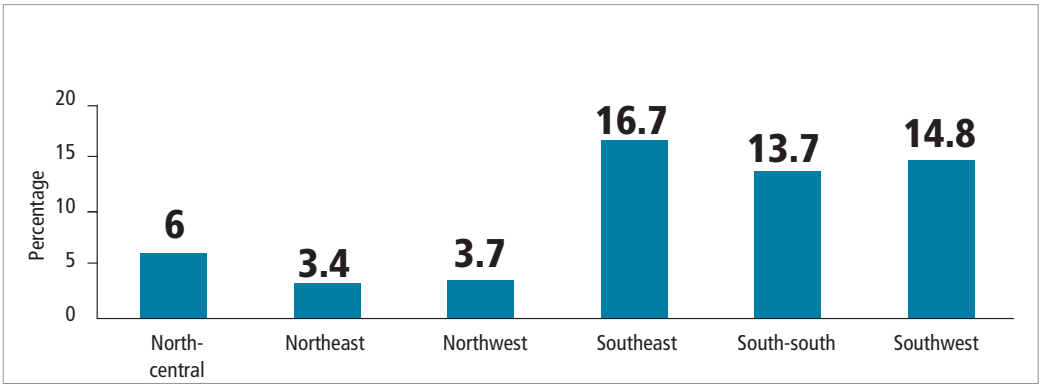


Source: Water and Sanitation Programme. 2012. Economic impacts of poor sanitation in Africa. Nigeria.

C. SCHOOL SANITATION

According to the WASH-NORM Survey, 2018, 40.3 per cent of children do not have toilets on their premises—the figure is higher in rural areas (52.5 per cent) than urban areas (25.9 per cent). As per local interviews, this disparity is related with the availability of space. Flush or pour flush toilets are the most prioritized toilet facility (52.5 per cent). Improved toilets with menstrual hygiene management is most preferred in the southern zones as the richest quintile largely lives there (see *Fig. 10: Improved toilets and menstrual hygiene management in different geopolitical zones).* Also, the preference for improved toilets with menstrual hygiene management occurs almost six times more in private schools (18.3 per cent) in comparison to public schools due to easier availability of funds. It has been seen that at national level, only 10.6 per cent have girls' toilets that have compartments with provision for menstrual hygiene management. However, the disposal mechanism for the menstrual hygiene waste is a concern—almost 79.5 per cent of the schools do not have facilities for disposal of menstrual waste.

Figure10: Improved toilets and menstrual hygiene management in different geopolitical zones



Source: WASH-NORM, 2018.

Around 57.9 per cent of the schools never emptied their faecal sludge. Emptied sludge was mostly buried by the service provider in pits that were closed (36 per cent).

A study published in 2012 in the *Journal of Applied Sciences in Environmental Sanitation* assessed the state of sanitation in primary schools in north-central zone, which, as per the 2018 WASH-NORM Survey, lacks sanitation facilities.[35] It was observed that 23 per cent of the schools had inadequate facilities and 12.5 per cent had no facility at all. According to the survey, only 24.5 per cent of schools had maintained toilets. More than 38 per cent of the toilets surveyed were not used as they were not maintained or risky. The study effectively showed that there should be rise in the quality, quantity and usage of sanitation facilities in schools to meet the development goals. *According to a 2015 study published in the Bulletin of Geography: Socio-economic Series*, investing in clean water, sanitation and hygiene education in public schools should become a priority for governments in developing countries and a School Sanitation and Hygiene Education (SSHE) programme should be adopted and implemented across schools in Nigeria.[36]

3. Existing policies and actions to improve the state of sanitation: Role of government, non-profits and donors

The main sanitation actors in Nigeria are a wide range of stakeholders, including policymakers (top elected government functionaries at different levels including the legislature), bureaucrats in respective Ministry, Department or Agencies (MDAs) of government, the donor community, international NGOs, service providers, the private sector, civil society organizations (CSOs), the media and the communities *(see Box 3: Initiatives by non-government organizations to improve sanitation marketing).* Major existing sanitation and hygiene programmes or initiatives include construction of sanitation facilities as championed by the Water Supply and Sanitation Sector Reform Programme (WSSSRP), UNICEF and other development agencies, and the community-led total sanitation (CLTS) and the mass media campaigns on hand-washing launched in various states by non-profits and private organizations. The coordinating mechanism for sanitation in the country includes the National Task Group on Sanitation (NTGS) inaugurated in May 2002. The National Council of Water Resources (NCWR), comprising ministers and commissioners, is responsible for water resources at the federal and state levels; the Federal Government of Nigeria along with the UNICEF WASH programme aims at scaling up successful sanitation models in Nigeria.[37]

The Nigerian government has worked on the establishment of institutions for water and sanitation since the early 20th century. The National Water Resources Institute (NWRI) and the River Basin Development Authorities (RBDA) were established in 1976 and FMoWR was created in 1977. FMoWR is in charge of policy formulation and advising and NWRI is responsible for research and manpower training. The RBDAs, on the other hand, are responsible for making water available to communities for agricultural, domestic and industrial purposes. In 1988, the government established the Federal Environmental Protection Agency (FEPA), which is responsible for national environmental guidelines, standards and criteria, specifically in the domain of water quality, effluent discharge, and air and atmospheric quality. This institution was transformed into the Federal Ministry of Environment (FMENV) in 1999.[38]

In Nigeria, many policy guidelines for water resource management as well as sanitation exist at the federal level. Some of the policies associated with water resources and sanitation include the National Policy on Environment, 1989, the National Water Supply and Sanitation Policy 2000, National Water Resources Management Policy 2003, National Environmental Sanitation Policy, 2005 and National Water Sanitation Policy, 2006 *(see Table 8: Important policies/strategy/plan/programme in Nigeria in the water and sanitation sector).* Other instruments (acts, edicts, decrees, bills and policies) for the WASH also exist.

Table 8: Important policies, strategies, plans and programmes in Nigeria in the water and sanitation sector

S. no.	Policy, strategy, plan or programme	Key provisions
1.	National Policy on Environment, 1989	Focusses on water quality regulation and standard as well as pollution
2.	National Rural Water Supply and Sanitation Policy, 2000	Focusses specifically on rural water and sanitation through community participation. The programme first targeted at a water supply coverage of 80 per cent in 2010 (from a staggering 43 per cent), then 100 per cent by 2015
3.	National Water Resources Management Policy, 2003	The main features are: water resources management; public health institution; irrigation and agriculture; environmental issues; international riparian issues; institutional responsibilities; sanitation and institutional responsibilities; legal issues; subsectors; change in approach; institutional change, planning; legal changes and implementation requirements
4.	National Water Policy, 2004	This defines the functions and relationships of sector institutions; focuses on this coordination to solve the problem of funds; recognizes water as an economic good and emphasizes decentralization for better performance and stability
5.	National Environmental Sanitation Policy, 2005	Comprehensive nature when compared to earlier policy. Includes issues like solid waste, medical waste, excreta, sewage management, food related sanitation and hygiene, sanitation at public places, potable water supply, urban drainage, hygiene education
6.	Policy guidelines on Excreta and Sewage Management, 2005	Fit into the framework of National Environmental Sanitation Policy, 2005 aims to ensure countrywide access to efficient and sustainable sanitary excreta and sewage management methods and tackle the public health issues associated with this
6.	National Water Sanitation Policy, 2006	It focuses on institutional framework, roles and responsibilities
7.	National Environmental Standards and Regulations Enforcement Agency (NESREA) – 2007	NESREA has responsibility for the protection and development of the environment, biodiversity conservation and sustainable development of Nigeria's natural resources in general and environmental technology including coordination, and liaison with, relevant stakeholders within and outside Nigeria on matters of enforcement of environmental standards, regulations, rules, laws, policies and guidelines (including water and sanitation). The Agency brought out a regulation on sanitation: National Environmental (Sanitation and Wastes Control) Regulations, 2009
8.	National Economic Empowerment and Development Strategy (NEEDS) (2003–07)	Includes water and sanitation issues in defined areas like urban areas, small towns and rural areas. NEEDS targeted to fight poverty and accelerate socioeconomic development through adequate water supply and sanitation services
9.	National Development Plan (NDP), 2007	Subsidies on water and sanitation facilities were planned for the poor
10.	'Making Nigeia Open Defecation Free by 2025: A National Roadmap' and Partnership for Expanded Water, Sanitation and Hygiene Programme (PEEWASH), 2016	In 2016, the National Council on Water Resources endorsed this road map as a mean to eliminate open defecation in Nigeria. The Roadmap provides a guide towards achieving an open defecation free country using different approaches such as capacity development; promotion of improved technology options through sanitation marketing; provision of sanitation facilities in public places; the Roadmap also provides a basis for the development of the Partnership for Expanded Water Supply and Sanitation (PEWASH) programme which aims to establish a multi-sectoral partnership between government, development partners and the private sector to support the empowerment of rural dwellers in Nigeria through the provision of adequate water supply and sanitation services. PEEWASH aims to achieve 100 per cent WASH coverage in rural areas by 2030

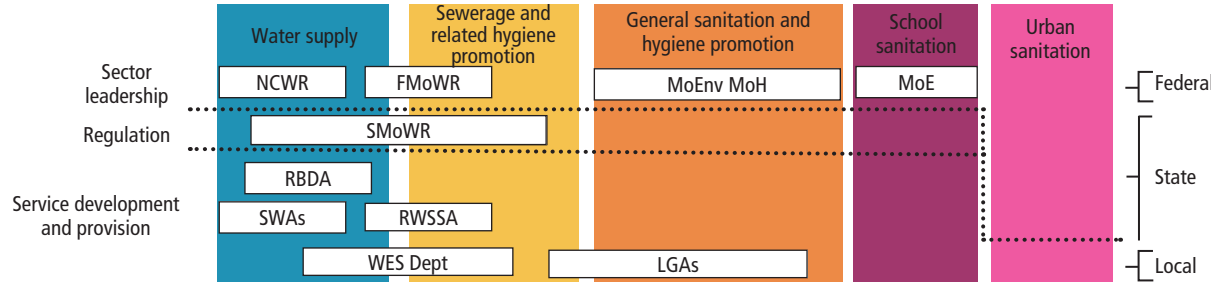
Source: Compiled by CSE.

These policy documents and instruments are generally guided by the development goals and development plan (the National Economic Empowerment and Development Strategy [NEEDS], 2003–2007); New Economic Partnership for African Development (NEPAD), 2000 is guided by the objectives and resolutions of various conferences, conventions and meetings. The importance of eradicating poverty and enhancing and improving public health through optimal use of water resources and sanitation for development are the main driving forces of these policies. States in the country also have their own various legal instruments for sanitation and waste management.

Apart from the above policies, laws, plans and strategies, the government of Nigeria started in early 2019 a national Village Level Operation Maintenance (VLOM) strategy, 2019 was launched for managing water supply facilities in all rural communities. Clean Nigeria: Use the toilet campaign was launched in November 2019. The WASH-NORM Survey in 2018 compile data on WASH from different regions, sectors, wealth status, gender, literacy and disability status. All these initiatives were taken by the FMoWR with support from other organizations. By 2018, the software WASH Information and Management (WASHIM) was developed in 21 Nigerian states to ensure sustainable monitoring and evaluation of the WASH sector—the Department of Water Quality and Sanitation worked with key stakeholders to evolve a framework of monitoring at the state level. According to CSOs, there is a need to strengthen the framework and implement it in all the states. However, different non-profits claim that involvement of the private sector will improve the state of sanitation in the country by their involvement in providing low-cost sanitation products. There should also be engagement of more and more Toilet Business Owners to serve more communities and train more masons, which involves stronger partnerships with the Small and Medium Enterprise Development Agency of Nigeria (SMEDAN) for nationwide coverage.

At the various governmental and administrative levels, water and sanitation has no specific institutional domain *(see Fig.11: Institutional roles and relationships in the water and sanitation sector)* in the ministries, which has made the task of implementation of policies difficult.[39] Different goals set out by different ministries on the same sector also cause confusion. For example, the National Water and Sanitation policy in 2004 and the National Environmental Sanitation Policy in 2005 clearly show a contradiction in targets on access to sanitation. The National Water and Sanitation Policy (developed by the FMoWR in 2004) introduced the demand-driven approach into water and sanitation services, the National Environmental Sanitation Policy (developed by the Federal Ministry of Environment, 2005) focused more on public environmental cleanliness and waste management.

Figure 11: Institutional roles and relationships in the water and sanitation sector



NCWR: National Council on Water Resources
FMoWR: Federal Ministry of Water Resources
MoEnv: Ministry of Environment
MoH: Ministry of Health
MoE: Ministry of Education
SMoWR: State Ministries responsible for Water Resources
RBDA: River Basin Development Authorities/Boards
SWA: State Water Agency (or Board)
RWSSA: Rural Water Supply and Sanitation Agency
WES: Water and Environmental Sanitation Departments
LGA: Local government areas

Sources: African Ministers' Council on Water (AMCOW), et al. 2011. Supply and Sanitation in Nigeria Turning Finance into Services for 2015 and Beyond. *p. 36.*

BOX 3: EXISTING ROLES OF MINISTRIES, DEPARTMENTS, COMMITTEES, PRIVATE SECTORS, COMMUNITIES, NGOs AND CSOs

The Federal Ministry of Environment is involved in overall protection of the environment. The state Ministries of Environment oversee environment, including overall sanitation in states.

The Federal Ministry of Health as well as the Ministry of Education work on formulating community sanitation and hygiene, and school hygiene programmes, respectively.

State Rural Water and Sanitation Agencies (RWSSAs) provide potable water to rural areas and help improve the sanitation and hygiene through toilet construction and awareness and education in hygiene. RWSSA supports and facilitate the local government areas to implement water supply and sanitation programmes.

Local government authorities (LGAs) are responsible for providing rural water supplies and sanitation facilities in their areas although only a few have the resources and skills to address the problem. Only a few LGAs have rural water supply divisions.

Water and Environmental Sanitation (WES) Departments are formed within the local governments to oversee the delivery of water and sanitation services in the local government areas and provide support to communities in managing water and sanitation and promoting safe sanitation and hygiene.

Water and Environmental Sanitation Committees (WESCOMs) are responsible for the managing water and sanitation activities in local government areas.

Most international and local NGOs/CSOs work at the level of the state and local governments. WaterAid, one of the most visible NGOs in the water and sanitation sector, has partnered with a few governments at the state and local levels to deliver sanitation and water services to communities, improve hygiene and build the capacities of the water and environmental sanitation departments.

The private sector is generally involved with: (a) construction and drilling works; (b) supplying goods and services and (c) providing water services. In many states, there are several small-scale water and sanitation-service providers.

The involvement of donors, NGOs and CSOs is detailed in Chapter 3.

*Source: African Ministers' Council on Water (AMCOW), et al. 2011. S*upply and Sanitation in Nigeria Turning Finance into Services for 2015 and Beyond. *p. 36.*

The main goal of the National Environmental Sanitation Policy is to ensure a clean and healthy environment by adopting efficient, sustainable and cost-effective strategies, and safeguard public health and well-being in line with the national development objectives. The policy also aims to ensure sustainable environment and poverty reduction. It sets specific targets as follows:

- Increase access to toilet facilities by 25 per cent in public places and 50 per cent in households by 2006; and 75 per cent and 100 per cent respectively by 2010;
- Increase sanitary management of sewage and excreta by 25 per cent in 2006 and 75 per cent in 2010;
- Institute school sanitation programmes in 50 per cent of schools by 2006 and 100 per cent by 2010;
- Extend present water supply and wastewater services coverage to 80 per cent of the population by 2007, 100 per cent by 2011 and to sustain full coverage beyond 2011; and
- Increase private sector participation in environmental sanitation services delivery by 20 per cent in 2006 and 75 per cent by 2010.

On the other hand, the National Water and Sanitation Policy set the following specific targets:

- Review and improve coverage of sanitation to 60 per cent of the population by 2007;
- Extend sanitation coverage to 65 per cent by 2010;
- Extend sanitation coverage to 80 per cent by 2015;
- Extend sanction coverage to 90 per cent by 2020;
- Achieve 100 per cent sanitation coverage by 2025;
- Sustain 100 per cent sanitation coverage beyond 2025

There is obvious contradiction between the initial governmental commitment to full coverage of water and sanitation services in 2015 and the revised targets.

Ministries are without a clear mechanism of coordination. At the state and local government levels, there is further fragmentation and division of authorities to the extent that what emerges is inter-agency competition both between agencies of each state and between agencies of states and the federal government. This consequently leads to parallel drinking water projects in some areas and communities as well as duplication of responsibilities. Allocation of water and sanitation projects is often politicized to favour communities with influential public officials, bureaucrats or politicians.[40] A public attention in the water and sanitation sector in Nigeria has equally been hampered by a lack of policy continuity and regime instability.

The Nigerian institutional environment has not been able to address disparities in the people's access to water and sanitation. Inequitable access is affected by access to water, wealth quintile, geographic and household characteristics. But the difference here is that poor institutional systems compounds the problem, making it severe. In his 2010 analysis, Emmanuel M. Akpabio said that developing effective capacity at various scales of policy and implementation practices through massive manpower training is important in guaranteeing adaptive utilization, translation and implementation of relevant international water and sanitation policies at the national and local levels. It is seen that most policy practices and implementation often narrow down to a technical solution at the expense of appropriate and locally-led intervention. Creating hardware sanitary systems and infrastructures often dominate the policy space while an important factor such as citizen-led initiatives as well as changing the behaviours of the citizens is often ignored. Reforms in the water and sanitation sector beginning from 1999 depended mostly on the conditional loans or its expectation from multilateral financial institutional (mostly the World Bank, International Monetary Fund, African Development Bank, etc.) as well as foreign direct investments.

An analysis of the policies and programmes over the years by different researchers showed that actual implementation of water supply and sanitation services in most cases narrows down to water supply services through sinking of borewells, revival of urban water-service network and a few instances of monitoring of the water quality of private wells. Most efforts at addressing the sanitation challenges are fragmentary and ad hoc, dictated mostly by emergencies and pressures from waterborne, water-washed, water-based and water-related problems and catastrophes.[41] Virtually all the available national policies were framed in response to global policy directives and pressures. While the Rural Water Supply and Sanitation Policy (2004), National Environmental Sanitation Policy (2005) and all other subsequent policies were clearly framed in the direction of achieving the MDG target of

BOX 4: INITIATIVES BY NON-GOVERNMENT ORGANIZATIONS TO IMPROVE SANITATION MARKETING

To strengthen implementation of community-led total sanitation (CLTS), a tool to motivate communities to build and use toilets, UNICEF launched a sanitation marketing and financing pilot project in 2016 under the DFID-funded project Sanitation, Hygiene Water Supply in Nigeria (SHAWN), with the aim to strengthen supply chains and connect entrepreneurs to communities and households. This approach has scaled to 60 local government authority (LGAs) and led to the creation of 600 toilet business owners (TBOs), resulting in construction of 12,423 improved toilets. In 2013–14, UNICEF carried out a study—Users' Experience Survey—to find what types of toilets that people wanted, why they wanted them and whether they were willing to pay for them. Following this research, UNICEF introduced the Sanitation Marketing (SanMark) and SHAWN projects. SanMark entails strengthening sanitation supply chains and connecting entrepreneurs to communities and households desiring improved toilets. SanMark and SHAWN have been effective in helping people from the three lowest wealth quintiles access improved sanitation and stop open defecation.

The financing aspect has directly contributed to almost 4,000 toilets for households that could not afford one-time payments, and has given hope to tens of thousands of other households who look forward to similar opportunities. The programme is becoming a promising platform for supporting the Federal Government of Nigeria to implement their ODF Plan for the country.

SanMark has thus emerged as a field that combines social and commercial marketing approaches to scale up demand and supply of improved sanitation facilities. According to the Institute for Fiscal Studies published in 2019, SanMark involves a more comprehensive demand and supply strengthening strategy that draws on social and commercial marketing as well as behaviour change communication approaches. The report forms a part of a Sustainable Total Sanitation (STS) project (funded by Bill and Melinda Gates) of WaterAid Nigeria, in collaboration with community members in two states (Enugu and Ekiti). The project focused on affordable, accessible and durable sanitation product named the Water Easy Toilet (WET). STS aimed to improve the effectiveness, efficiency, inclusion and sustainability of total sanitation approaches for the poor and under-served in Ekiti and Enugu States in Nigeria and contribute to wider national and regional good practice. The study recommended door-to-door sales agents for better SanMark product sales. It also talks of further development of the SanMark model and looks for the option of subsidies or credits.

Microfinance institutions providing loans at interest of 9 per cent to RWSSA for building toilets are available.

Source:
https://www.communityledtotalsanitation.org/blog/blog-2-3-sharing-shawn-project-experience-nigeria
Abramovsky, L, et al. 2019. The Institute for Fiscal Studies in collaboration with in collaboration with Indepth Precision Consult, Nigeria and WaterAid
Local interviews

halving the proportion of population without access by 2015, the National Water Resources Management Policy (2003) and the National Water And Sanitation Policy (2004) were purely based on the Dublin Principles, which placed economic value on water resources. Most policy tools do not take into consideration the local peculiarities of resource availability and diversities in socioeconomic contexts of the Nigerian population.

Major donors and International NGOs involved in WASH activities in Nigeria include the African Development Bank (AfDB), WaterAid Nigeria, UNICEF, WHO, the European Union (EU), World Bank, Department for International Development (DFID), Japan International Cooperation Agency (JICA), United Nations Development Programme (UNDP), UN-Habitat, German Development Cooperation (GTZ) and the United States Agency for International Development (USAID). Major CSOs and associations involved in WASH activities in Nigeria include the Centre for African Settlement Studies and Development (CASSAD), NGO Network, Nigerian Society of Engineers, National Association of Hydrogeologists, Nigerian Hydrological Association, National Association of Public Analysts of Nigeria, and Society for Water and Sanitation (NEWSAN).

The financing strategy for sanitation is based on the premise that individual families are solely responsible for paying for the construction of their household sanitation facilities. The focus of the rural water supply and sanitation programme is to generate demand for improved environmental sanitation and thus create a self-sustaining market for widespread construction of toilets. The consolidated expenditure trend of the WASH sector in 2001–08 reveals a growing trend but at irregular intervals. Also, there are donor interventions like the European Union Water Supply and Sanitation Sector Reform Programme (EU WSSSRP) currently providing funds for construction of water and sanitation facilities with co-funding from the three tiers of government and UNICEF. Similarly, UNICEF, WaterAid and EU among others have financed sanitation activities in their respective focal states and LGAs, with counterpart funding from the state and the LGs.

Several studies have sought to estimate how much it costs to improve access to sanitation and water supply. An initiative led by the African Ministers' Council on Water (AMCOW) in 2009–10 also estimated sector financing needs. Annual costs for meeting the water supply MDG target were estimated at US $1,716 million per year (US $1,113 for urban and US $604 for rural areas). Annual costs for meeting the sanitation MDG target were estimated at US $2,276 million per year (US $1,225 for urban and US $1,051 for rural areas).

The majority of sanitation funding is expected from household investment. The gap for water supply is US $839 million for water supply and US $1,181 million for sanitation. Hence, government policy should be not only to increase its own funding, but to catalyse investments from other sources.[42] Nigeria will now require US $2.74 billion per year to achieve the basic water, sanitation and hygiene SDG targets.[43] According to the analysis by NEWSAN on budget allocations in water and sanitation sectors during 2014–17 there is an increase of allocation up to 1.5 per cent for water supply and 1.0 per cent in sanitation annually. However, the report says, a correct estimation for the budget allocation for sanitation is debatable as sanitation cuts across several sectors such as education, environment, health, commerce, labour, gender, agriculture to name a few. The study by Water and Sanitation for All in their report, says that the benefit–cost ratio of investments in water supply and sanitation for Nigeria, which took into consideration health improvements and time savings are estimated to be at least 3.1 times the cost for water supply and at least 2.8 times the cost for sanitation under the most conservative cost assumptions.[44] Remembering the current SDG, the government in its current budget in October 2019 allocated 1.6 billion Nigerian Naira for PEEWASH and 8.20 billion Nigerian Naira for rural roads, water and sanitation which as per the stakeholder group are considerable amounts.[45]

4. Suggested actions to attain the Sustainable Development Goal in sanitation

About 67 per cent of Nigerian households live in rural areas, small towns and areas inhabited by itinerant communities. This document is restricted to sanitation practices in these areas.[46] According to the 2018 WASH-NORM Survey report, on-site sanitation is largely practised in these areas—all three of which are considered rural. According to report, less than 4 per cent of the rural population on average is served by sewer systems. This document focuses on decentralized technologies to address the gaps in sanitation in rural Nigeria.

To meet the United Nation's Sustainable Development Goal for sanitation in 2030, Nigeria is trying to learn from success stories from around the world. This section suggests ways for Nigeria to achieve the sanitation goal. It discusses steps to improve existing policies and technologies to manage and treat or safely dispose of excreta and the wastewater. Success stories with regard to behavioural change in the construction and usage of toilets from the global South will help the country move ahead in the Clean Nigeria: Use the Toilet campaign, launched in November 2019.

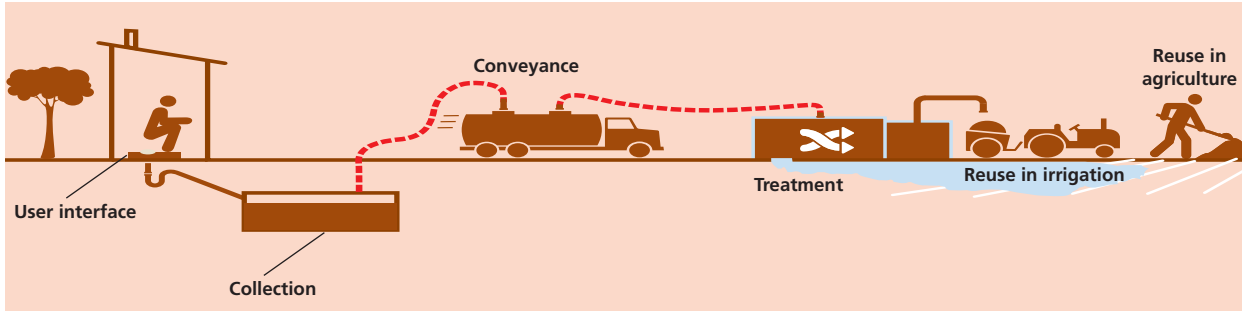
Nigeria has been working with local and private organizations, non-profits and CSOs to motivate people to build toilets. There have been initiatives to strengthen the tools for behaviour changes (to build and use toilets) through availability of sanitation supply chains and financial supports *(see Box 4: Initiatives by non-government organizations to improve sanitation marketing).* There are debates about what the best way is to help Nigerians adopt improved sanitation facilities.

India has worked hard in its latest sanitation programme, Swachh Bharat Mission (Clean India Mission), launched in 2014, to change the behaviour of the communities in adopting sanitation facilities at the household level.[47] The main impediments to adopting sanitation facilities were non-availability of land, water connections to toilets and safe technologies for management of excreta[48] (as per the Government of India, the cost of the toilets was covered to a great extent under government incentives). For the same reasons, communities of Nigeria also do not show much motivation to build toilets and use them.

Moving towards an open-defecation-free state does not mean building any kind of toilet. The whole process of the sanitation chain from safe containment to reuse options for decomposed excreta should be considered *(see Fig. 12: Different components of sanitation value chain).* Availability of safe low-cost on-site sanitation technologies for different eco-regions of the country should be emphasized on.

In the current situation, septic tanks and pits are seen to be the most favourable options for managing excreta in Nigeria. The exercise of management of excreta cannot stop at building pits or septic tanks. Options for emptying sludge from pits and septic tanks in accordance with WHO standards, transporting undigested sludge to treatment plants, and reusing or safely disposing of sludge should also be available.

Figure 12: Components of the sanitation value chain



Source: CSE

Faecal sludge—including black water and grey water—management policies

We have seen earlier that urban areas use more septic tanks, and rural areas use different types of pit toilets (see *Table 1: Sanitation facilities in urban and rural areas of Nigeria*). The 2018 WASH-NORM Survey does not specify whether the septic tanks are with soakaway pits and can digest the excreta to safe standards. Research studies show that in most cases the specifications have not been followed[49]—local interviews with civil society organizations (CSOs) also confirm this. Thus slurry inside tanks remains largely undigested.

The current practice is to dig a trench close to a septic tank—wherever there is a septic tank—shovel slurry into it and cover it with soil.[50] In cases where the septic tank has not been properly designed—leaving slurry undigested—as well as in places where slurry is emptied and buried, flies breed, transmitting pathogens. In the absence of data on design specifications for ventilated improved pit toilets and pour-flush pit toilet in the 2018 WASH-NORM Survey report, it is difficult to state whether the sludge that is emptied from these pits is safe for handling and disposal. But in the case of drop holes, it is seen that people, especially in slums and rural areas, handle raw sludge. They bury the sludge in nearby pits, which they close. Nigeria considers pit toilets (drop hole) with slab as an improved sanitation facility—29.3 per cent of the population in rural areas have access to pit toilets. Septic tanks serve 6.2 per cent of the rural population. A huge amount of undigested faecal sludge is generated in both pits and tanks if they are not properly constructed.

The 2018 WASH-NORM Survey confirms that excreta is not safely disposed of and managed in Nigeria (see *Fig. 6: Treatment and/or disposal and emptying of faecal sludge in Nigeria*). Most of the people evidently did not empty their sludge and those who did were unaware about where it was emptied. A huge amount of untreated wastewater in several states was also seen to be dumped. This clearly indicates the following challenges in the wastewater (grey and black) sector and in faecal sludge management:

(i) Lack of proper regulation;
(ii) Lack of investment in infrastructure;
(iii) Use of efficient technologies; and
(iv) Lack of monitoring and awareness.

A. FIXING GAPS IN POLICY

The 2005 Federal Ministry of Environment guidelines, within the framework of National Environmental Sanitation Policy, identified the role of the private sector and CSOs and outlined how they could participate in managing excreta and sewage. But technical guidelines are needed for better functioning. Faecal sludge and wastewater should be managed in a

holistic manner rather than in silos to bring about safe sanitation in the country. As per the 2018 WASH-NORM Survey, even if on-site sanitation facilities are available, safe disposal (along with treatment) is a challenge (see *Table 5: Emptying, disposing of and treating faecal sludge in different geopolitical zones of Nigeria*). Implementing the policy guidelines of 2005 can bring immediate relief but long-term sustainability remains a challenge as the gaps in the existing guidelines indicate (see Table 9: *Gaps in policy guidelines on excreta and sewage management, 2005*).

Table 9: Gaps in policy guidelines on excreta and sewage management, 2005

Sanitation value chain	Current practice	What the guideline says	Gap and/or need
Containment	Flush to piped sewer, pour flush to pit toilets and ventilated improved pit toilets, flush or pour flush to septic tanks, traditional toilets, hanging toilets, compost toilets, pit toilets with or without slab (drop holes)	Rural areas should have ventilated improved pit toilets, urban areas should have sewers and all other areas should have septic tanks, soakaway pits and pour flush toilets; the local governments are to train local artisans on the technologies. The guidelines also recognize the problem of disposal of human excreta in waterbodies in riverine areas and proposes to provide a solution in the future.	A technological guideline/ manual from the government on cost-effective ecoregion-specific safe toilet technologies and treatment of grey and black water in a decentralized manner is required.
Emptying and transportation	Sludge is emptied mostly by the service provider or household owner. As per the 2018 WASH-NORM Survey, only 12.8 per cent of the sludge is transported to treatment sites.	Emptying may be done by equipment following the National Policy Guidelines on Sanitation Equipment. The environmental sanitation authorities of the local government authority shall inspect and licence all de-sludging vehicles.	The local government authority requires a guideline for framing faecal sludge bylaws.
Treatment and disposal (and reuse)	Most people did not know where the sludge was disposed of (26.5 per cent). The next most-observed practice was for service providers to bury the sludge in covered pits (22.1 per cent), followed by household owners burying the sludge in covered pit (17.8 per cent).	The state or local government authority is to discourage dumping of sewage or sludge on land and waterbodies. The environmental sanitation authorities along with other relevant agencies will determine where the sludge is to be emptied.	Some pilot projects are being implemented across the country on treatment and safe disposal of sludge but these may not follow regulations. A government manual for decentralized treatment of sludge and reuse options is urgently needed. The National Environmental Standards and Regulation Enforcement Agency, in charge of protection of Nigeria's environment, has missed the standard for treated domestic wastewater and treated faecal sludge. Developing such standards is needed.

Source: Compiled by CSE

B. MODIFICATIONS IN INSTITUTIONAL FRAMEWORK

Nigeria is divided into 36 states plus Abuja Federal Capital Territory and further into 774 local government areas. The roles and responsibilities of different ministries for water and sanitation services and policies overlap, often leading to confusion and even competition at the local level (see *Fig. 11: Institutional roles and relationships in water and sanitation sector*).

This chapter aims to provide an additional dimension to the 2005 Federal Ministry of Environment's Policy Guidelines on Excreta and Sewage Management to enable the country to manage excreta and wastewater. As a first step, the roles and responsibilities of different stakeholders should be clearly defined (see *Table 10: Proposed institutional roles for sustainable management of wastewater and faecal sludge in Nigeria*).

Table 10: Proposed institutional roles for sustainable management of wastewater and faecal sludge in Nigeria

Stakeholder	Asset ownership or expertise for improvement of state of sanitation	Sanitation facilities	Supporting capabilities	Functions	
				Step 1: Planning	Step 2: Operation and maintenance (policy and regulatory if any)
Individual household owners	• Technologically safe toilets like pour-flush twin-pit toilets, VIP toilets, septic tanks and other on-site sanitation facilities according to different ecoregions in the country • Toilets will have water supply for handwashing (and self-cleaning if not dry toilet)	• Adequate number of toilets, no contamination of water and soil • No fresh handling of sewage	–	• Showing interest in construction of toilets • Expressing the need for water supply to the toilets (for self-cleaning and/ or handwashing) • Building water and sanitation committees for management of water and sanitation	• Building and using toilets regularly • Paying tariff for sanitation services and water supply to the committees • Putting up issues regarding toilet construction and usage in committee meetings • Reporting issues on emptying, collection and transport of sludge to the committee
Toilet owner association/ water sanitation committees	• Technologically safe community toilets (where more than one toilet unit occurs) like pour-flush twin-pit toilets, VIP toilets, septic tanks and other on-site sanitation facilities according to different ecoregions in the country • Toilets will have water supply for hand washing (and self-cleaning if not dry toilet)	• Adequate number of toilets, no contamination of water and soil • No fresh handling of sewage	–	• Showing interest in construction of toilets • Arranging or planning for resources/ materials for toilet construction • Arranging for water supply to toilets (for self-cleaning and/or handwashing)	• Handling the funds and resources/materials • Monitoring the quality of toilets and their use and maintaining a steady source of water supply to these toilets • Reporting issues on emptying, collection and transport of sludge to the water and environmental sanitation department

WES (Water and Environmental Sanitation) Department	• Collection and transportation equipment for faecal sludge • Open drains for carrying grey water out of single and cluster households • In charge of treatment systems for grey water (decentralized) • In charge of faecal sludge treatment system • In charge of water supply to the toilets	–	• Having a menu of safe technologies available for management of faecal sludge and grey and black water	• Making the community aware of safe technologies • Deciding the type of safe technology suitable for a particular ecoregion • Coordinating with the toilet owner association/water sanitation committees • Taking part in, allocating contract and commissioning projects to private parties • Involving itself in supervision of the implementation of the decentralized systems (for faecal sludge and wastewater) • Involving itself in the sustainability of water sources (through different rainwater harvesting techniques)	• Handling the administrative and financial components • Collecting the tariff for the water and sanitation facilities • Reporting issues on emptying, collection and transport of sludge to the local government authorities
Local government authority (LGA)	• Collection and transportation equipment for faecal sludge • In charge of decentralized wastewater systems and faecal sludge treatment systems	–	• Politically can promote the provision of excreta and wastewater management	• Defining appropriate standards for treated wastewater and faecal sludge • Spreading awareness on faecal sludge and wastewater and sensitizing the community for effective treatment and reuse • Monitoring infrastructures • Coordinating with stakeholders • Building capacity of the artisans in the construction of decentralized systems of culturally acceptable and affordable treatment of excreta, wastewater and water management systems	• Enacting bylaws of excreta and wastewater management • Mandating provisions of such sanitary conveniences in large public gathering. Makes provisions for approvals before such gathering • Setting out the structure of tariff • Monitoring contractors • Monitoring the work schedule of the water and environmental sanitation department • Monitoring performance of the decentralized systems • Developing health and safety guidelines for users, workers, farmers and communities at different stages of the sanitation value chain from user interface to reuse applications (based on guidelines from WHO publications on safe use of excreta and sanitation safety planning) • Enacting reuse regulations based on market demand, application guidelines based on agronomic trials, etc.

RWSSA (state rural water and sanitation agencies)	• Collecting and transporting equipment for faecal sludge • In charge of decentralized wastewater systems and faecal sludge treatment systems	–	• Can promote politically provision of excreta and wastewater management	• Ensuring the implementation of policy guideline on excreta and wastewater management • Building awareness of the local government authorities about the issues of faecal sludge management (and wastewater) and providing technical support for implementation of pilot projects at local government areas • Supporting public awareness on wastewater and faecal sludge management	• Enabling private-sector involvement by reviewing and updating state legislation for wastewater and faecal sludge management • Supporting financial instrumentation for private-sector participation
Ministry of Environment		–	• Can promote politically provision of excreta and wastewater management	• Sourcing funds • Commissioning research studies and capacity-building programmes on culturally acceptable and economic management of faecal sludge and wastewater • Building awareness on faecal sludge (and wastewater) management of the local government authorities and state representatives and providing technical support for pilot projects, if requested • Approving major decisions in the local government areas and the states • Supporting public awareness on wastewater and faecal sludge management • Getting involved in overall supervision	• Developing, reviewing and updating periodically policy guidelines for wastewater and faecal sludge management • Recommending inputs for the local government authorities' faecal sludge management bylaws. This can be done in coordination with the Ministry of Health and Ministry of Education. • Working with the Federal Ministry of Agriculture and Rural Development to simplify the process for securing license for using and marketing of compost or organic fertilizer produced (if any) at faecal sludge treatment facilities

Private sector (including end-use industries)	• Collection and transportation equipment for faecal sludge • Laboratories to test the quality of the treated faecal sludge and wastewater	--	• Have a menu of safe technologies available for management of faecal sludge and grey and black water • Research capabilities	• Developing partnership with local government authorities in projects • Supporting local government authorities to design appropriate cost-effective technologies for the communities • Helping the local government authorities with research projects for the management of faecal sludge and wastewater • Supporting public awareness on wastewater and faecal sludge management • Supporting the local government authorities on cost recovery of the infrastructure implemented • Buying end products of faecal sludge and treated wastewater (e.g. in agricultural industry)	• Following the mandate of the faecal sludge management bylaw
Civil society organizations/NGOs	• Awareness tools	--	• Research capabilities	• Supporting public awareness on appropriate toilet technologies • Motivating the community to build systems to treat the faecal sludge and wastewater • Promoting strategies of the water and environmental sanitation department in selecting service providers for collecting, transporting, treating and safely disposing of faecal sludge	

Compiled by CSE

As per the 2018 WASH-NORM Survey report, Nigeria has not done much in managing faecal sludge and grey and black water. The main impediment has been weak institutional framework and low capacity of the stakeholders in this sector. Capacity-building and awareness activities should be undertaken for users, government bodies and private players with regard not only to available technologies for treatment of excreta but also emptying pits and septic tanks, collecting sludge, transporting, treating and disposing of both faecal sludge and wastewater (grey and black water). Designs for septic tanks and dual pits/ventilated improved pits should be part of capacity-building programmes for both government representatives and private players. It is also important to make civil society organization (CSOs), non-profits, communities, self-help groups and artisans aware about the safety standards under information education and communication (IEC) activities.[51]

Local government authorities should train service providers on safety norms (during collection and transportation of sludge), vehicle design, de-sludging process, safety gears and safe transportation to treatment facilities. State rural water and sanitation agencies and local government authorities should be trained in implementation of model projects on decentralized grey- and black-water management. The management and treatment of faecal sludge as well as reuse options of treated sludge should be integrated in all ongoing capacity-building programmes. At the state level, fiscal policies and budgeting should address the specific needs of women, adolescent girls and transgender persons.

Regulations for faecal sludge management

According to the 2005 Policy Guidelines on Excreta and Sewage Management, the local government authorities are in charge of bylaws related to faecal sludge and wastewater.

This section details the proper guideline framework for the bylaw. The following points are defined clearly for such purpose:

i. Each step of sanitation value chain—the design, operation and maintenance of the system—should be well defined;
ii. Insanitary toilets should be retrofitted or converted to sanitary ones;
iii. Incentives should be given to communities interested in retrofitting;
iv. Licence should be issued private service-providers; and
v. Incentives should be given for sanitation services, and penalties to service providers for violation of rules.

A. Who will be responsible? The local government authority (LGA) shall be in charge of defining the roles and responsibilities of the stakeholders, developing the institutional framework and enforcing the bylaw of the faecal sludge (and wastewater) management systems.
B. Applicability of the regulation: The regulation has been designed for rural areas, small towns and the areas where itinerant communities reside, with focus on on-site sanitation.
C. Activities proposed under this regulation: The following activities have been proposed:
   - *Retrofitting or conversion of insanitary toilets to sanitary toilets:* The 2018 WASH-NORM Survey gives a database of unimproved and improved toilets at the state, sector and wealth quintile levels. But it does not say whether safe technologies have been followed for improved sanitation (as no mention is made of design specifications). Hence a database of built improperly toilets (i.e. those that did not follow safe norms or failed to take into consideration soil strength, type and hydro-geological condition) should be developed. Geo-tagging of all the existing toilets will be beneficial. Households should be informed about insanitary conditions. Incentive in form of discounts on tariffs on water or any other services provided to the community (or households) should be provided for such retrofitting. Communities, households and neighbourhoods should be made aware about the regular schedule for removing sludge from pits and septic tanks. As toilets will be linked to GIS, de-sludging as per schedule can be regularly monitored.

   - *Emptying and collection of faecal sludge:* Pit toilets (drop holes) with slabs and septic tanks need to be de-sludged by private de-sludgers. (Although drop holes with slabs have not been considered sanitary as per this document, in view of the fact that over 23 per cent of rural areas have opted for them, this document also suggests options for de-sludging these toilets). Twin-pit toilets or ventilated improved

pit toilets should have honeycomb brick walls for degradation of the sludge and absorption of the liquid in the twin leach pit below the ground. As one pit is filled, the other pit gets ample time to decompose the faecal sludge, and the decomposed sludge can be emptied by household owners or toilet-owners association. All the existing septic tanks should have access covers for each chamber so that they can be easily opened during the emptying process. Where covers are not available, it should be made compulsory for all property owners to provide proper covers. New septic tanks need to be designed and constructed.

When private de-sludgers are engaged, they should apply for a licence from the local government authority. The term of the license should be for a maximum of five years. The database of licensed de-sludgers should be made available to the communities through ministry portals, newspaper and even local advertisements. After de-sludging, the operator must ensure cleanliness of the area. Any leaks must be disinfected with bleach solution or by spreading lime over the spillage. It is the collection operator's responsibility to verify that sufficient disinfectant (bleach or lime) is on the truck prior to dispatching it for service. Desludging workers must wear appropriate personal protective equipment,including rubber gloves, rubber boots, a face mask and eye protection.[52] After the pumping activities, operators should wash their hands with soap. Collection should preferably be done when traffic in the area is light. All collection vehicles should have early warning devices and traffic cones should be placed at the back and front of the vehicle during operation. It is the responsibility of the collection operator to check the truck's safety equipment daily prior to dispatching the unit for service. Any safety equipment deficiencies should be reported to the supervisor and repaired before dispatch. The community should directly upload the feedback of the private operator on the web portal of local government authority. The service provider must maintain a record-keeping system about households served and land application as per the local ordinance. Based on the feedback of the community, the service provider will be allotted future contracts; in case of malfunction, the local government authority shall cancel the licence.

- *Transportation of faecal sludge:* The traffic police should keep a track of whether the de-sludgers are plying with a valid license. The operators identified by the government agency must have vehicles for transportation that meet the standards of the local ordinance. The workers shall be trained enough to handle the waste. To avoid any leak or spill from the vehicles during transport, all the inlets and outlets should be constructed with leak-proof materials and maintained regularly; to avoid flooding or spraying at the receiving area, the discharge outlets should be designed accordingly. The vehicle shall be painted to mark very clearly to the public that it is carrying untreated sewage. The trucks shall be tracked through GPS tracking system for monitoring purpose.[53] In the event of accidental spillage of the sludge, the operator should immediately take action to contain the sludge, minimize the environmental impact, and begin clean-up procedures. The operator shall notify the concerned officials about the spillage and the nature of remedial action within 24 hours. Penalties may be imposed on the operators who do not comply with the guidelines.[54]
- *Issuing a licence for collection and transportation of faecal sludge:* Every service vehicle applying for a licence needs to comply with the following:[55, 56]
    a. The applicant shall display the company name, company logo, contact number and business registration number of the transporting vehicle on both sides;

BOX 5: BEST PRACTICE—HOW LOCAL GOVERNMENT INTERACTS WITH THE COMMUNITY IN DE-SLUDGING

The city authority of Marikina, Philippines, in a joint venture with the water utility has organized a de-sludging programme. The government agency partners with private service providers for the following operations:

a) A few days before the service providers are in the neighbourhood, they send out a truck with a loudspeaker to advise residents of the pending service;
b) The day before sludge is removed, the city workers visit homes and pass around informational brochures;
c) The workers identify the households that require the service and provide them with a list of service providers who will provide their service at an economical rate; and
d) On the day of emptying of the sludge, the government agency is present to troubleshoot.

The outcome is 95 per cent compliance with sludge removal requirements as per the local ordinance.

Source: Mikhael, G., D.M. Robbins, J.E. Ramsay and M. Mbeguere 2014, 'Methods and means for collecting and transport of faecal sludge', in Linda Strande, Mariska Ronteltap and Damir Brdjanovic (editors), Faecal Sludge Management *(first edition, pp. 67–97), International Water Association, London.*

BOX 6: GOVERNMENT COMMITMENT IN MALAYSIA FOR IMPROVED SANITATION AND FAECAL SLUDGE MANAGEMENT

Malaysia has developed a strong and effective system for the management of faecal sludge. The system had an inbuilt strong institutional framework. In the early 1990s, the Indah Water Consortium (IWK) was formed under the government that was responsible for the management of wastewater and faecal sludge across Malaysia. IWK was responsible for creating infrastructure, developing collection and transport services and increasing awareness for scheduled sludge collection and wastewater fees. In 2000, IWK was incorporated into the Ministry of Finances in order to increase subsidies and financial control. The Malaysian Sewerage Service Act, 1996 defines the conditions for the construction and the operation and maintenance (O&M) of treatment systems and septic tanks, and for the collection and transport services that are undertaken both by IWK and private operators.

In 2008, the Ministry of Energy created a new regulatory institution, Suruhanjaya Perkhidmatan Air Negara (SPAN), which put out the sanitation strategies and the regulation for the management of water and wastewater infrastructures. IWK follows the strategies of SPAN and the discharge and quality standards defined by the Ministry of Nature and Environment. Committees were created for the control of financial viability and transparency. These committees have the power to structure wastewater tariffs, subsidies and taxes. In 1993, the Water Service Industry Act also allowed the federal government to collaborate with water and wastewater companies, thus supporting the management of water resources from source to disposal for the country.

Such a strong institutional setup has helped Malaysia manage faecal sludge by specific regulations and also helped faecal sludge management to be an integral part of the process of water resource management. Additionally, collaboration with national universities ensures the development of a strong national expertise through research and training programmes. Press releases and dissemination of several booklets have also increased public awareness. Hence, today, 27 per cent of the Malaysian population practising on-site sanitation have a schedule collection of faecal sludge with proper treatment and reuse.

Source: Bassan, M. 2014. Institutional Frameworks for Faecal Sludge Management. Faecal Sludge Management—Systems Approach for Implementation and Operation, *IWA, Editors: Linda Strande, Mariska Ronteltap, Damir Brdjanovic, pp.255–72*

b. The applicant shall display the service area and final point where the sludge will be transported;
c. The applicant shall have vehicles that have leak-proof bodies and a strong locking mechanism to withstand collision with heavy and strong vehicles and structures; and
d. The workers should be well trained and must wear appropriate personal protective equipment (PPE).

Once the licence is received, the copy of the license should be displayed on the transport vehicle.

Financial framework

This section details the relationship between different stakeholders in the service chain (see *Table 11: Proposed stakeholders in financial transfers in faecal sludge management*). It also defines the financial transfers in faecal sludge management.

Table 11: Proposed stakeholders in financial transfers in faecal sludge management

Stakeholder	Function
Household-level toilet users; water and sanitation committee	Removing faecal sludge from property that they own or rent. These stakeholders have an on-site sanitation technology that requires periodic faecal sludge removal. Technologies that require periodic emptying include septic tanks, pit toilets, anaerobic baffled reactors (ABRs) (for clusters of houses) or other similar water-based storage technologies.
Private enterprises	Operate on a profit basis by providing goods or services in exchange for payment. Private enterprises are bound by the laws of the state, and may accept contracts to work for the state. They are, however, not wholly or in part associated with the government at any level and do not receive guaranteed government funding (though they may apply for subsidies, loans, etc.).
Non-profits	These organizations operate on a not-for-profit basis and are not funded or supported directly by government, although they are often subcontracted by government for specific tasks. NGOs operate in the social-service niches left where governments and private enterprise are unwilling or unable to operate effectively.
Government authorities	Responsible for the rules and regulations to which private enterprises must adhere. Government authorities may outsource work to private enterprises, but may also plan and manage their own faecal sludge programmes internally. Government authorities are responsible for collecting taxes in order to cover, or partly cover, their budgets. Authorities may also be recipients of foreign aid, which may be allocated to the construction, operation or maintenance of the infrastructure.
End-use industries	Make use of the inherent nutrients and energy potential of treated faecal sludge. End-use industries are a relatively new, but growing sector in the faecal sludge process chain. The end use(s) of the sludge should be considered when designing the entire sanitation service chain to ensure the appropriate design of treatment technologies, i.e. so that the best quality faecal sludge can be generated for its specific final use.

Source: Faecal Sludge Management: Systems Approach for Implementation and Operation. *2014. Ed. Strand Linde, et al. IWA Publishing. p. 427.*

Financial transfer types

Within a FSM system, money is exchanged for different activities (e.g. emptying, transport, processing) at different orders of magnitude (e.g. small service payments, massive construction costs), and with different frequency (e.g. daily transfer frees, annual taxes). To achieve a financially sustainable business model, a prudent selection of the transfer types may be implemented (see Table 12: *Proposed types of financial transfer*).

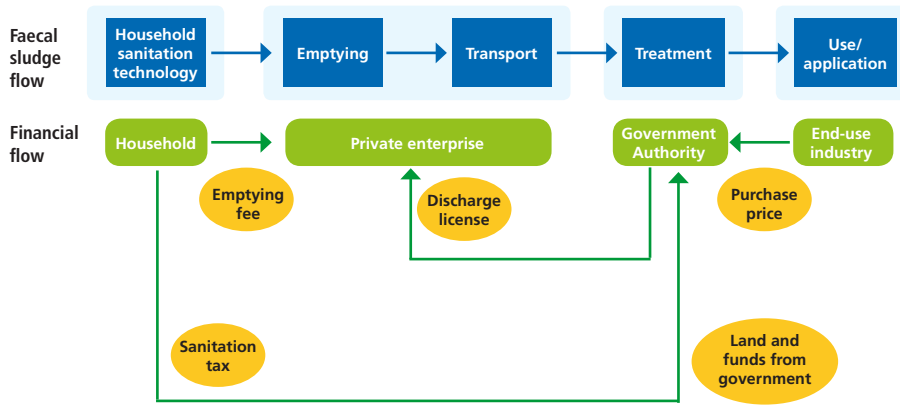
Table 12: Proposed types of financial transfer

Type	Definition	Who pays, imposes and approves
Capital investment	Costs are paid once, at the beginning of the project, to cover material, labour and associated expenses needed to build the facilities and associated infrastructure. Examples of capital investments include purchase of land for constructing faecal-sludge drying beds, designing and building a treatment plant, purchase of a vacuum truck for collecting and transporting faecal sludge and/or wastewater, and installation of septic tank at the household level.	Paid by communities, private enterprise, NGOs, end-use industries or government bodies
Discharge fee	This is charged for permission to discharge faecal sludge at a facility. The fee is paid with the intention of transferring responsibility to a stakeholder who has the legal and technical ability to safely process and/or transfer sludge to another responsible stakeholder (under enforced law). It may be charged according to the volume of sludge discharged (which may be difficult to measure, and does not take into account the density of the sludge), or per discharge event regardless of the volume	Paid by private enterprise
Discharge license	This is a financial instrument used to control the number and quality of collection and transport enterprises that are allowed to discharge faecal sludge at the treatment plant	Approved by government authority
Emptying fee	The fee that is charged at the household level for removing faecal sludge from the on-site sanitation technology where it is collected and stored. Typically, the same stakeholder that is responsible for emptying is also responsible for transporting the sludge away	Paid by household owners or water and sanitation committee
Operation and maintenance (O&M)	Expenses that are paid regularly and continually for as long as the service life of the infrastructure/equipment has been reached. This may also include the replacement of machineries (or even plants), vehicles etc. and the end of service life	Paid by private enterprise/non-profits
Sanitation tax	A fee collected either once or at regular intervals, and paid in exchange for environmental services such as a water connection or removal of sludge, or any combination of these services.	Paid by household owner or water and sanitation committee

Compiled by CSE.

For effective working of the faecal sludge treatment facility the relationship between various stakeholders should be established in the following way (see Fig.13: *Dual licensing and sanitation tax model*). Household owners will empty the sludge on time and pay a sanitation tax to the government. Private de-sludgers are controlled through strict licensing. Tax paid can be used for operation and maintenance of treatment facilities.

Figure 13: Dual licensing and sanitation tax model



Salient points:

- Suitable for small towns, rural areas and areas dominated by itinerants;
- The sector can be well controlled by legislation and licensing;
- No constraint on discharge stops illegal dumping;

Source: Faecal Sludge Management: Systems Approach for Implementation and Operation. *2014. Ed. Strand Linde, et al. IWA Publishing. p. 427.*

Investment options

The sanitation projects are implemented through government, funding from donors or international NGOs, or through user fees. Government and international NGOs generally have programmes or schemes for construction of toilets, faecal sludge treatment plants, vacuum tankers etc. There are also funds available for the local government authorities to prepare feasibility reports and detailed project reports (DPRs) as well as for awareness and communication strategies.

Apart from this, public–private partnerships may be an option for funding through which the state can bridge the gap due to lack of technical knowledge and financial deficit (see Box 7: *PPP model for faecal sludge treatment plant at Leh and Box 8: How communities manage wastewater through partnerships with government and NGOs*) for both faecal sludge and wastewater treatment.

BOX 7: PPP MODEL FOR FAECAL SLUDGE TREATMENT PLANT AT LEH

Situated in the Himalayas at an altitude of over 3,500 metres above sea level, with a harsh climate (the temperature ranges from –40°C to 35°C, with seven months of severe winter), Leh is a popular tourist destination, with 250,000 annual visitors. Inadequate sanitation infrastructure and services has led to groundwater contamination.

The local government identified an urgent need for improved faecal sludge management, but lacked the funds and technical expertise to operate the faecal sludge management services in the town. Bremen Overseas Research and Development Association (BORDA), an international non-profit facilitated a partnered with Blue Water Company (BWC), a private provider of turnkey wastewater management solutions, to implement and manage every aspect of faecal sludge management in Leh, India. BWC financed, built and profitably operates the faecal sludge treatment plant on town-owned land. The town collects fees from customers, which are in turn paid to BWC for complete service of faecal sludge management provision.

From signing the contract to operational faecal sludge management for all residents and hotels took less than four months. This is a performance-linked payment and the investment is 100 per cent private. The treatment plant was commissioned in 2017.

Source: https://www.borda.org › 2019-02-FSM-inclusive-citywide-sanitation-services

BOX 8: HOW COMMUNITIES MANAGE WASTEWATER THROUGH PARTNERSHIPS WITH GOVERNMENT AND NGOs—MANKA VILLAGE

Manka village in Rajasthan, India, is 10.72 sq. km in area and has 550 households. It was the first village in the block (a unit lower than local government area of Nigeria) to become 100 per cent open-defecation free. The excreta was managed by pour-flush pit toilets, but the wastewater in the village was flowing uncontrolled and would flood the village during heavy rains.

The district authority (equivalent to local government authority in Nigeria) approached New Delhi based non-profit Centre for Science and Environment (CSE) in 2017 to build capacity of their officials to implement systems to manage the wastewater in the village and treat them economically.

CSE worked with government officials and the village community. With the help of the village community, the wastewater flow was tracked and found to flow towards existing ponds in the village. Technical guidance was provided by CSE so that government officials could plan the wastewater treatment systems. Underground pipes were laid in the village to carry the wastewater into two decentralized wastewater treatment plants constructed near the two ponds. Provision was made so that the treated wastewater overflowed from polishing ponds to existing ponds. The community gave land for the wastewater treatment facilities and different government schemes (under the Ministry of Finance and Ministry of Rural Development, India) contributed to cost for the laying of the pipes, treatment systems and deepening of ponds. The system was commissioned in 2018.

The community is now working towards the sustainability of the systems. It plans to charge US $0.4 per household per month for the operation and maintenance of the systems. The salaries of personnel for this activity will be also paid from this. The community is also leasing out the ponds for fish farming and will use the money earned for operation and maintenance of the system. The treated wastewater will be used in horticulture.

CSE

CSE researchers discuss the design of a decentralized wastewater treatment system in Manka village

C. TOILET AND FSM DESIGN AND WATER AVAILABILITY

This chapter is divided into three parts. The first part details containment options for on-site sanitation in rural areas (rural as defined in WASH-NORM Survey report, 2018) (see *Table 13: Local conditions required for the different containment technologies* and *Table 14: Capital cost for different containment technologies*). The second part includes the technologies that can be used for faecal sludge management along with wastewater. The third part illustrates the importance of water availability for the sustainable use of toilets.

Table 13: Local conditions required for the different containment technologies

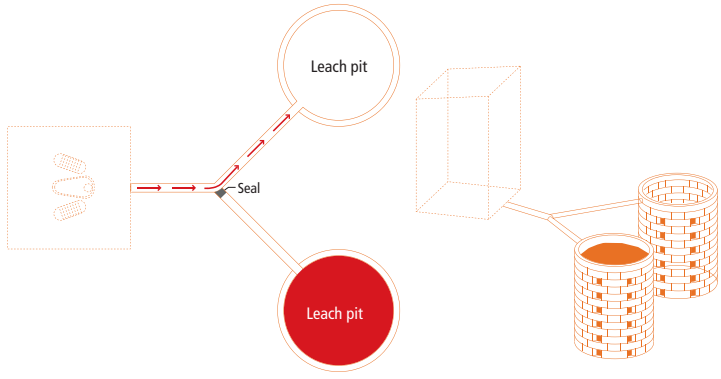
	Dual-pit toilet	EcoSan toilet	Biogas plant linked toilet	Septic tank	Advanced septic tank
Land requirement	Medium	High	High	Low	Low
Water requirement	5–8 litres per user	1–2 litres per user (only for self-cleaning)	5–8 litres per user	10–12 litres	10–12 litres
Piped-water connection	Not required	Not required	Not required	Required	Required
Degree of skilled labour	Medium	High	High	High	High
Groundwater table and terrain	Suitable for generally all the areas except areas with high water-table (including coastal areas) or rocky soil or water logged areas	Suitable for any soil	Suitable for any soil	Suitable for normal/high water table/ rocky areas, but not for water logged areas	Suitable for normal/high water table/ rocky areas, but not for water logged areas
Soil strength	Can be constructed in loose soil areas if the pits are made up of perforated concrete rings	High soil strength required	High soil strength required	High soil strength required	High soil strength required
Operation and maintenance	Low	Low	Low	High	High
Construction cost (see Table 16)	Medium	High	High	High	High
Disposal of waste	Safe reuse of human waste in agriculture	Reuse of human waste and urine as manure	Waste converted to biogas, which is further used as cooking fuel in households	Needs further treatment before reuse	Needs further treatment before reuse
Sociocultural acceptability	Acceptable	Acceptable especially in area where water is scarce	Acceptable when properly demonstrated	Acceptable	Acceptable
Self-building potential	High	Low	Low	Low	Low
Suitability	Areas with water scarcity, especially in northern Nigeria	Areas with water scarcity or prone to water-logging	Any part	Small towns, with no centralized sewer systems and limited land available	Small towns, with no centralized sewer systems and limited land available

Source: Compiled by CSE

ON-SITE TOILET TECHNOLOGIES

1. Dual pit toilet system

Figure 14: Design of dual pit toilet system

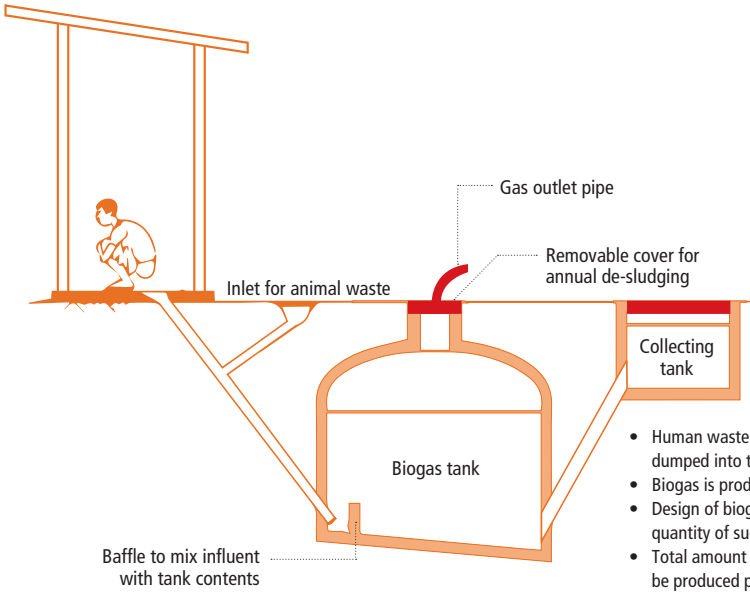


- Dual pits can are used alternately.
- Both pits are connected with a junction chamber.
- Pit walls have a honeycomb structure.
- The bottom of the pit is not plastered and is earthen.
- Capacity of each pit is normally kept for three years.
- After filling up of first pit, it is blocked at the junction chamber and second pit is put in operation.
- Dug out by beneficiaries and digested sludge is used for agriculture and horticulture purposes.

Source: Tilley, E. et al. 2014. Compendium of Sanitation Systems and Technologies. 2nd Revised Edition. Swiss Federal Institute of Aquatic Science and Technology (Eawag). Dübendorf, Switzerland

2. Toilet-linked biogas plant

Figure 15: Design of toilet linked biogas plant

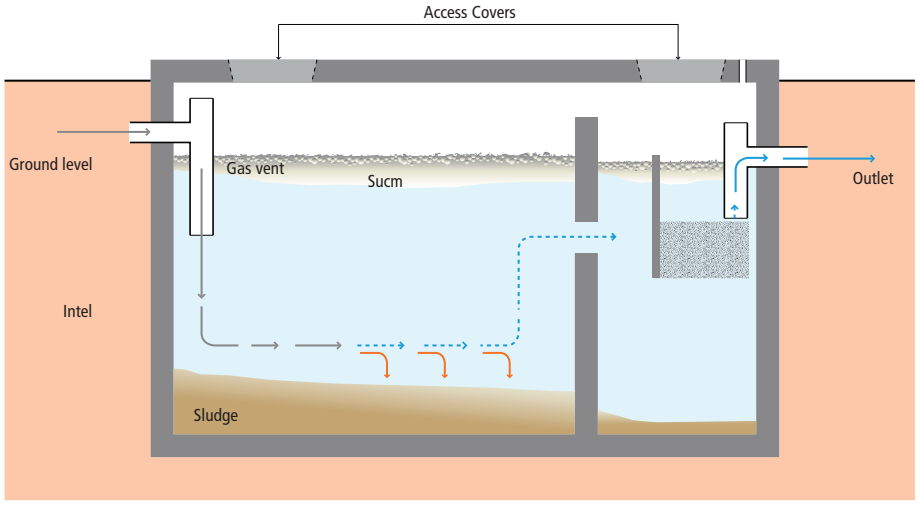


- Human waste along with animal waste is dumped into the biogas tank.
- Biogas is produced through anaerobic digestion.
- Design of biogas tank depends on quality and quantity of such wastes.
- Total amount of biogas of one cubic metre can be produced per day from a family of five with two cattle heads

Source: Franceys, R., Pickford, J. and Reed, R., A. 1992. Guide to the Development of On-site Sanitation, WHO, Geneva

3. Septic tank (two-chambered with filter)

Figure 16: Design of septic tank

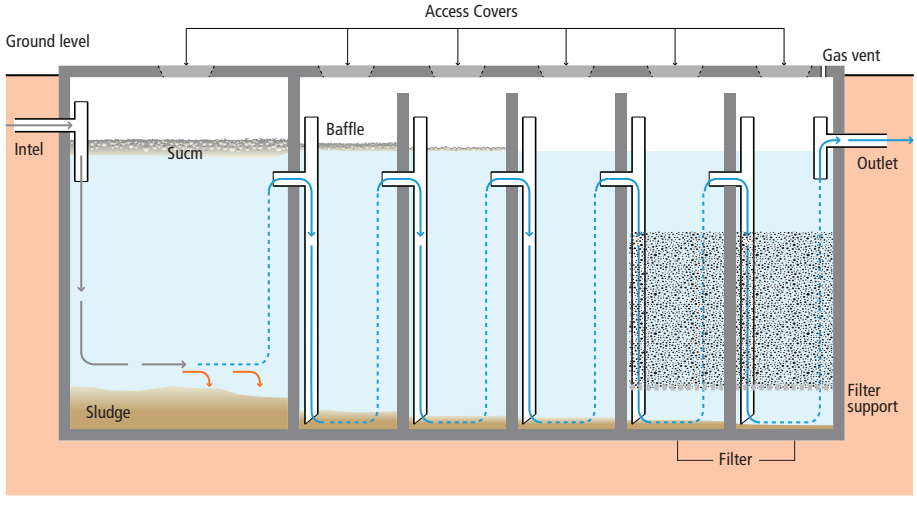


- Septic tank is a watertight chamber made of concrete, fibre glass, PVC or plastic.
- Settling and anaerobic processes reduce solids and organics. Include two chambers with a single filtration chamber resulting in improved treatment.
- As wastewater flows through the filter, particles are trapped and organic matter is degraded by the active biomass that is attached to the surface of the filter material

Source: Rohilla, S. et al. 2019, Integrated Wastewater and Faecal Sludge Management for Ghana: Draft Guidelines, *Centre for Science and Environment, New Delhi.*

4. Advanced septic tank with filter

Figure 17: Design of advanced septic tank

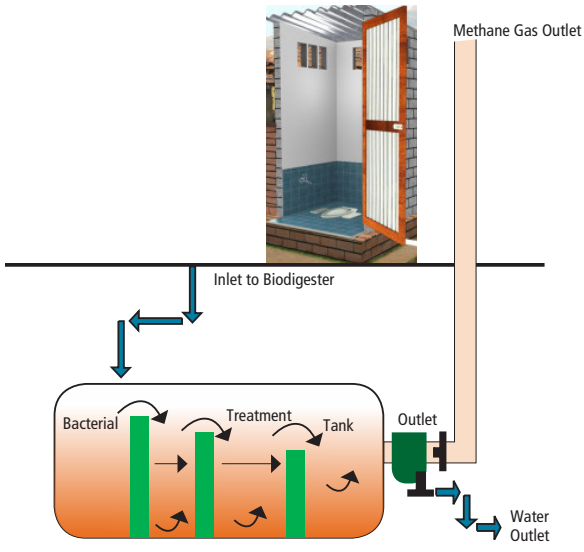


- Septic tank is a watertight chamber made of concrete, fibre glass, PVC or plastic.
- Settling and anaerobic processes reduce solids and organics. Include two chambers with a single filtration chamber resulting in improved treatment.
- As wastewater flows through the filter, particles are trapped and organic matter is degraded by the active biomass that is attached to the surface of the filter material

Source: Rohilla, S. et al. 2019, Integrated Wastewater and Faecal Sludge Management for Ghana: Draft Guidelines, *Centre for Science and Environment, New Delhi.*

5. DRDO—Biodigester toilet

Figure 18: Design of DRDO biodigester toilet

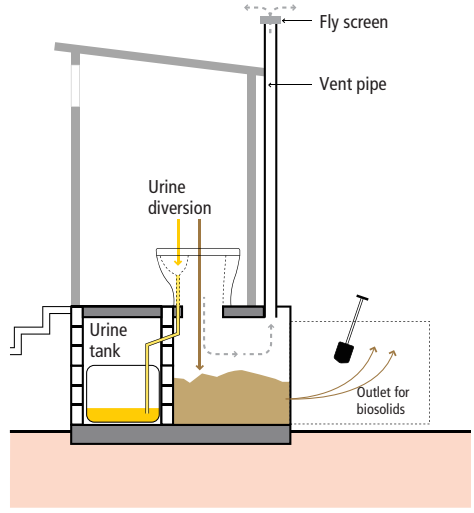


- Biodigester toilet (bio toilet) is developed by Defence Research and Development Organization (DRDO), a premier Research and Development Organization of India, for the treatment of toilet wastewater.
- Normally for a household, these bio toilets are filled up to 1/3rd of its volume by inoculums to activate digestion process.
- Usually, the effluent is connected to a soakage pit

Source: Banka bioloo

6. EcoSan toilets

Figure 19: Design of EcoSan toilet



- EcoSan is a dry toilet, with limited or no use of water.
- Excreta and urine are collected in two different structures.
- Excreta are biologically decomposed by microorganisms (mainly bacteria and fungi).
- The ready compost is a stable, inoffensive product that can be safely handled and used as a soil conditioner

Source: Tilley, E. et al. 2014. Compendium of Sanitation Systems and Technologies. *Second revised edition. Swiss Federal Institute of Aquatic Science and Technology (Eawag). Dübendorf, Switzerland.*

Table 14: Capital cost for different containment technologies

Toilet model	Capital cost (in US$)	Number of pits	Type of toilet
Dual pit pour flush toilet with cemented superstructure (for household of five)	170	Honeycomb brickwork twin leach-pit	Pour flush
Biogas-linked toilet (household of five)	300	No pit	Pour flush
Dual-pit pour-flush toilet with superstructure from locally available material (household of five)	160	Perforated cement ringed twin leach-pit toilet	Pour flush
EcoSan (household of five)	160	No pit	Not applicable (very low water required)
Septic tank/advanced septic tank	320–340	Soakaway pit at the end of the advanced septic tank	Flush toilet

Note: Cost is indicative only. It will vary with the type of soil, availability and cost of materials and labour
Source: Compiled by CSE

If on-site treatment technologies work very effectively, further treatment of black water or faecal sludge is not required or is very minimal. But this is seldom found to happen. This part of the section deals with the treatment options for black and grey water along with faecal sludge for rural Nigeria. It explains treatment at the household and neighbourhood levels (see *Table 15: Treatment options for wastewater at the household and neighbourhood levels in Nigeria*) as well as at a larger level, at faecal sludge treatment plants (see Table 16: *Steps at faecal sludge treatment plants suggested for Nigeria*). Faecal sludge from different rural areas or small towns may be brought and treated together at these plants.

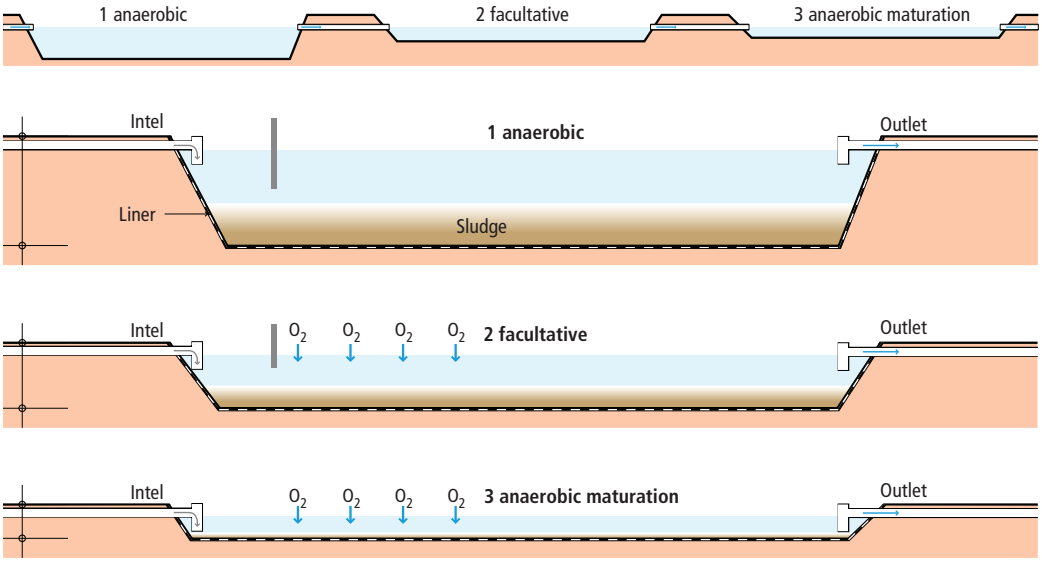
Table 15: Proposed treatment options for wastewater at the household and neighbourhood levels in Nigeria

Type of treatment	Scale	Description	Advantages	Suitability
Leach pits	Individual household	• Planned only for wastewater from kitchen and bathroom • Brick-lined single circular pit using honeycomb masonry • Diameter of pit approximately 1 metre • Wastewater percolates into the ground • Pit to have insect-proof cover with inlet pipe using a water-seal trap to avoid mosquito breeding	• Can handle larger volumes of water than a traditional soak pit • Prevents water stagnation • Prevents vector breeding • Can be managed easily by household owner	• Suitable in areas where groundwater is deep
Kitchen garden	Individual household	• Planned only for wastewater from kitchen and bathroom • Wastewater is passed through a silt and grease trap to remove debris and into a simple surface irrigation system or into a piped root zone water system • The root system has the added feature of a filter bed around the PVC pipes which further filters the water before it reaches the plants.	• Simple and cost-effective technology • Prevents water stagnation • Prevents vector breeding • Supports growth of plants • Can be managed easily by the household owner	• Suitable in any type of soil

Anaerobic baffle reactor	Community	• Wastewater passed through series of reinforced cement concrete (RCC), stone-masonry tanks (three or more) brought through locally laid drainage lines • Drainage system may carry both black and grey water or either of them to the system • Treatment takes place by microbial activity	• Treated water can be stored and used when needed	• Suitable in small towns, where cost is not a constraint
Waste stabilization ponds (WSP)	Community	• Wastewater from local laid out drainage system passed through large shallow basins or ponds placed in a series • Drainage system may carry both black and grey water or either of them to the system	• Capital cost is very low • Natural process operation and maintenance cost is low • Can be managed by the community	• Suitable in areas where groundwater is deep
Constructed wetland	Community	• Wastewater from local laid out drainage system passed into the wetlands • Drainage system may carry both black and grey water or either of them to the system • The wastewater into the wetland has to be channelized within the wetland and water may be sprayed vertically or horizontally (see Fig. 25: Horizontal subsurface flow constructed wetland and Fig. 26: Vertical flow constructed wetland) • Masonry or natural structures planted with wetland plants and supported by gravel and boulders at the bottom • The process uses natural biological process of plants and soil to clean water	• Is technically simple • Is ecologically sustainable • Can handle large variety of pollutants	• Suitable in rural areas. In southern Nigeria, which is prone to water-logging, the base of the wetlands should be structurally modified
Soil biotech-nology	Community	• Wastewater from local laid out drainage system passed into the system • Drainage system may carry both black and grey water or either one of them to the system • RCC, stone-masonry or soil bunds and consists of an impervious containment • An under-drain layer lies at the bottom above which lies a layer of media housing microbial culture and plants • Physical (like sedimentation, infiltration) and biochemical processes are carried out to treat wastewater	• No sludge production • No odour • Duration of treatment is small • Treated water can be stored and used when needed • Considered as one of the most efficient treatment technologies	• Suitable in small towns, where cost is not a constraint

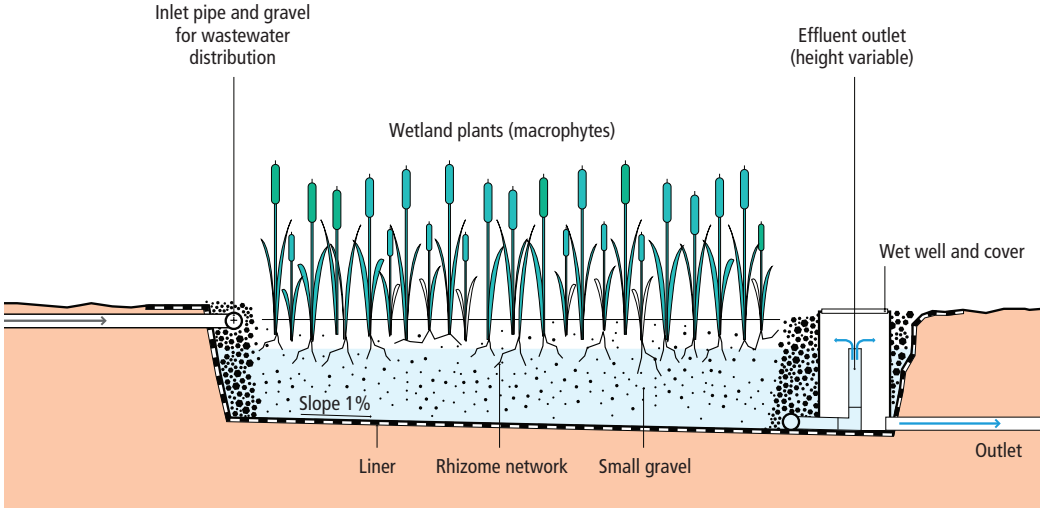
Source: Compiled by CSE.

Figure 20: Waste stabilization pond



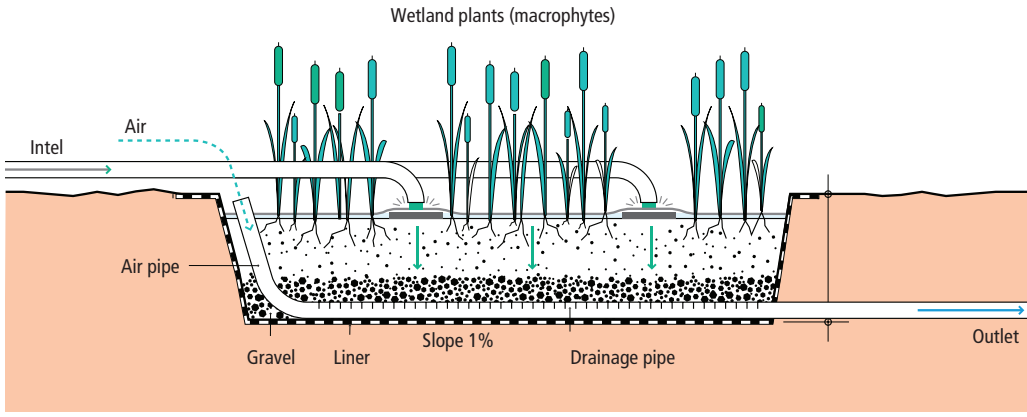
Source: Tilley, E. et al. 2014. Compendium of Sanitation Systems and Technologies**.** *Second revised Edition. Swiss Federal Institute of Aquatic Science and Technology (Eawag). Dübendorf, Switzerland.*

Figure 21: Horizontal subsurface flow constructed wetland



Source: Tilley, E. et al. 2014. Compendium of Sanitation Systems and Technologies. *Second revised edition. Swiss Federal Institute of Aquatic Science and Technology (Eawag). Dübendorf, Switzerland.*

Figure 22: Vertical flow constructed wetland



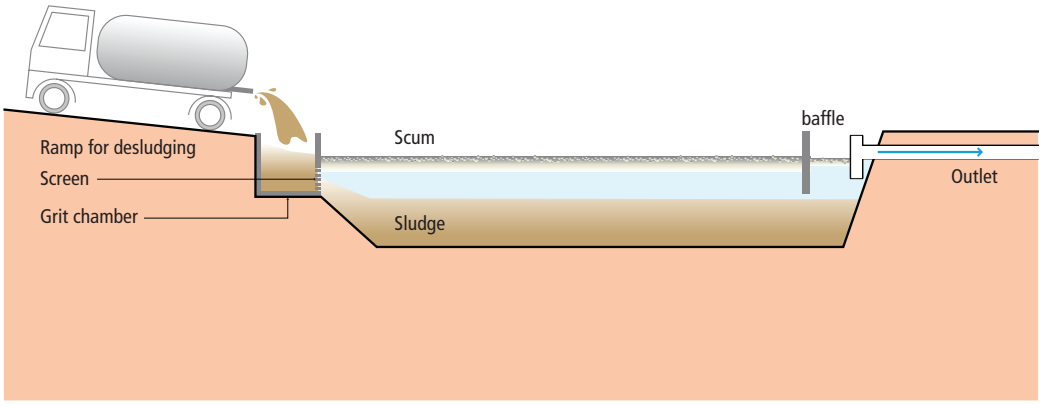
Source: Tilley, E. et al. 2014. Compendium of Sanitation Systems and Technologies. *Second revised edition. Swiss Federal Institute of Aquatic Science and Technology (Eawag). Dübendorf, Switzerland.*

Table 16: Steps at faecal sludge treatment plants proposed for Nigeria

Primary treatment of faecal sludge		
Types	**Features**	**Advantages**
Sedimentation tanks	• One/more series of ponds • The first pond is anaerobic pond and the second is a facultative pond, followed by maturation ponds • Residential time is more	• Cost effective with low energy needs • Simple to operate • Reuse of effluent in agriculture • Can handle shock load
Reed bed filters/ constructed wetland	• De-watering technique • Planted sealed shallow concrete structure filled with filter materials • Provides solid liquid separation • Sludge dried naturally by percolation and evaporation	• Low capital and energy cost • Low odour • High quality of treated liquid • O&M cost low
Post treatment of faecal sludge		
Types	**Features**	**Advantages**
Co-composting	• Stabilization of organic material through aerobic decomposition process • Solid is mixed with bulking agent (solid waste) and aerated mechanically • High temperature kills pathogens • Results in humus-like material	• End product is safe and marketable • Supports nutrient cycle for agriculture • Low cost and simple technology
Stabilization ponds	• One or more series of ponds • Function same as sedimentation pond • Residential time is less • Optimum pathogen reduction	• Simple and reliable process to achieve desired water quality

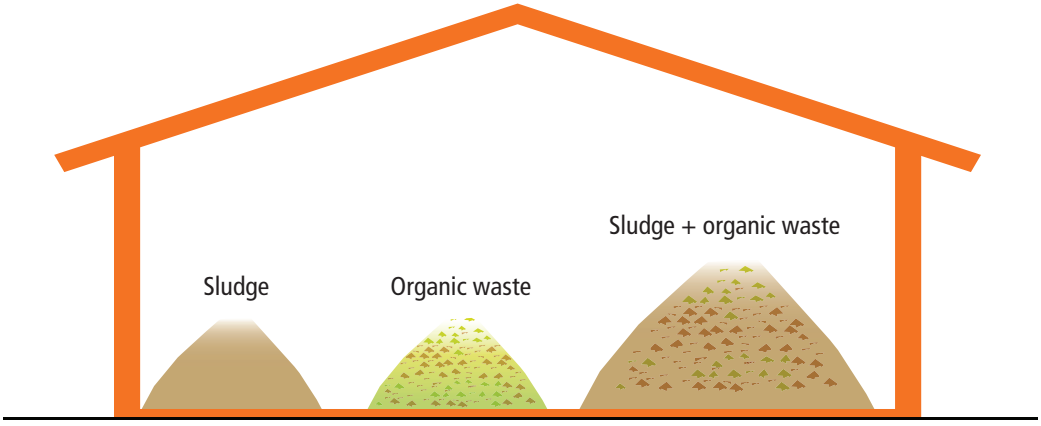
Source: Compiled by CSE

Figure 23: Sedimentation tank



Source: Tilley, E. et al. 2014. **Compendium of Sanitation Systems and Technologies.** *Second revised edition. Swiss Federal Institute of Aquatic Science and Technology (Eawag). Dübendorf, Switzerland.*

Figure 24: Co-composting



Source: Tilley, E. et al. 2014. Compendium of Sanitation Systems and Technologies. 2nd Revised Edition. Swiss Federal Institute of Aquatic Science and Technology (Eawag). Dübendorf, Switzerland.

Undigested sludge can be co-treated with sewage. For this, existing sewage treatment plants or effluent treatment plants can be used or new facilities can be created. Wherever a sewage treatment plant is located near a settlement, provisions should be made to carry undigested sludge to the treatment facility so that it can be co-treated with sewage (see *Table 17: Using existing treatment plants versus new faecal sludge treatment plant*).

Table 17: Using existing treatment plants versus new faecal sludge treatment plant

Parameters	Treatment using existing infrastructure	Treatment using new infrastructure
Treatment option	• Co-treatment with sewage at sewage treatment plant (STP), effluent treatment plants (ETPs) etc.	• Separated facility is created considering the quality and quantity of faecal sludge • Termed as faecal sludge treatment plant (FSTP) • Stabilization ponds, co-composting, anaerobic digestion etc. are parts of treatment systems
Features	• Faecal sludge can be added at different treatment stages • The treatment capacity depends on the capacity for sewage/effluent treatment and type of processes involved	• The basic idea is to separate solid and liquid fractions of faecal sludge by de-watering, digestion etc. • Leads to efficient recovery of resources—biosolids and water
Advantages	• Advanced technology-based STP such as moving bed biofilm reactor (MBBR) highly efficient in treating faecal sludge • Does not need additional setting cost • Forms an integrated solution	• Provides tailor-made solution to sludge management • Most of the technologies employed are nature-based solutions, and hence require low O&M • Allows resource recovery
Disadvantages	• System needs proper control and skilled labour for handling • Needs additional management of residual/biosolids handling and disposal • Suitable if the treatment plant exist in vicinity • High O&M	• Needs additional planning • Separate compliance and regulatory requirements • Requires separate handling and skilled labour

Source: Compiled by CSE.

BOX 9: HOW A FAECAL SLUDGE TREATMENT PLANT IN THE NILGIRIS USED THE END-PRODUCT OF DECOMPOSED FAECAL SLUDGE TO EMBRACE ORGANIC FARMING

When the hill districts of the Nilgiris in Tamil Nadu finally became open-defecation free in 2018, after years of continuous effort, residents of what used to be a laggard district celebrated with double the zeal. The happiness was the result of a byproduct that is helping the primary occupation of the inhabitants of Nilgiris—which, as across the country barring cities, is agriculture.

The Nilgiris District is known for its tea and coffee plantations. Farmers in the area had at one point been worried that traditional agricultural practices had dwindled with the introduction of tea and other mono-crops (carrots, beetroot and potato) and the use of chemicals had increased exponentially. The district is affected by eight months of water crisis every year, and over and above this the high cost of chemicals affected the rural population.

A sustainable replacement for chemical fertilizers was thus needed. Faecal sludge was an abundant resource for organic fertilizer. The transformation of the Nilgiris began much before Swachh Bharat Mission's (India's sanitation programme launched in 2014) push towards total sanitation. Initially the district dumped faecal sludge from septic tanks and single-pit toilets in the forestland by honeysuckers—big trucks with a tank and pump designed to pneumatically suck septage into the tank.

To resolve this issue, the Nilgiris-based non-profit Rural Development Organisation (RDO) Trust started the project Securing Water for Food. RDO helped the villagers build toilets and use them regularly. It created facilities for the treatment of faecal sludge at Ketti and Adigratti town panchayats. Technical support was provided by German non-profit Bremen Overseas Research and Development Association (BORDA) and the Dutch non-profit WASTE. The faecal sludge treatment plants (FSTPs), which were commissioned in 2008, produce dry sludge, which is mixed with organic waste for the production of co-compost. Ketti Resource Management Centre collects the solid waste from 22 villages and three trucks of faecal sludge weekly. The FSTP capacity at Ketti is 1,700 kilo litre per day (KLD).

Adigratti Resource Management Centre collects solid waste from 46 villages and five trucks of faecal sludge weekly and the total treatment capacity of the FSTP is 5,000 KLD. In both the FSTPs, the raw faecal sludge is put into a series of gravel beds where the solid component dries up at the top and the liquid (wastewater) filters down and collects into the soak pit. The dried solid is further processed with organic waste material to form co-compost. The co-compost has an organic waste to dried-solid ratio of 80:20.

The process takes a month. To ensure the quality of the treatment process and the ready co-compost, continuous analytical tests are conducted at the government laboratory at Chennai, but to get the best results, RDO Trust is in touch with renowned institutions of the country. The cost of ready co-compost is Rs 5 per kg and now each centre is producing one tonne of co-compost per day. Even this is not enough to meet the increasing demand due to the positive effect of co-compost on vegetable growth and soil productivity.

As co-compost contains human excreta, farmers were initially reluctant to use it. The RDO Trust built confidence among farmers and educated them about the importance and efficiency of co-compost. When compared to the cost of chemical fertilizers (US $0.56 per kg), co-compost is a more economic alternative. The total expenditure of co-compost for 0.40 ha (1 acre) of land comes around US $421.30, including transportation cost. This is almost half the cost of chemical fertilizers. The farmers are happy with the quality of the yield. The decrease in pesticide cost is an additional benefit for farmers using co-compost.

RDO is trying to evolve a business around co-compost. The idea is to involve women in the process and make them compost entrepreneurs. The Nilgiris has witnessed a successful example of closing the nutrient loop in a sustainable way.

Vikas Choudhary / CSE

Composting of faecal sludge and organic waste in Nilgiri District

Vikas Choudhary / CSE

Fertilizer from co-composting in Nilgiri District

Source: Verma, R. Niligiris' journey to being ODF led to it embracing organic farming. Down to Earth. 16–30 September 2019.

Water availability for toilets: While toilet construction is critical to ending the scourge of open defecation, research studies (see T*able 1: Sanitation facilities in urban and rural areas of Nigeria*) and the WASH-NORM Survey show that flush or pour-flush toilets are quite common in urban areas. But these toilets are also common in rural areas, especially in small towns (also classified as rural in WASH-NORM Survey).

To make these toilets functional, however, continuous water supply is needed. Only 6 per cent of the households in rural areas receive 12 litres per person per day. These households are located within 500 metres of the water supply but this does not mean that they are connected through piped-water supply. Around 78 per cent of the households either do not receive water supply or receive less than 5 litres per capita per day. On an average, the rural

BOX 10: POTENTIAL FOR WATER HARVESTING TO MEET NIGERIA'S RURAL HOUSEHOLD WATER NEEDS

Population* = 166.2 million

Land area* = 92.3 million hectares

Average household requirement in rural households = 55 litres/day/person (based on India's rural household requirement, which is much higher than what is currently supplied to Nigerian rural households)

Average annual rainfall at national level = 1,197 mm

Annual water requirement in a year for a population of 166.2 million at the rate of 55 litres per capita per day (as per India's rural water supply) = 3,336.47 billion litres

Land requirement = 0.56 million hectares = 0.6 per cent of the land availability (assuming that the collection efficiency is just 50 per cent)

Source: Agarwal, A., Narain, S. 1997. Dying Wisdom: Rise, Fall and Potential of India's Traditional Water Harvesting Systems (State of India's Environment, Volume 4). *Centre for Science and Environment, p. 29.*
**http://worldpopulationreview.com/countries/nigeria-population/*

households receive 3 litres per capita per day. The households use the available water for cooking, drinking and washing and using it for sanitation is the last priority.

At the national level, only 8 per cent of the population has piped-water supply—of this, only 3 per cent have water on household premises. Around 4.3 per cent of population use public taps. Households using piped-water supply in their premises lie mainly in the south-south geopolitical zone. The population belonging to the richest quintile uses piped-water supply and in its absence use groundwater pumped through borewells or tube wells. The population belonging to poorest quintile depend, in the absence of piped-water supply, more on surface-water supply, using almost eight times more than the population belonging to the richest quintile.

There is a gap in understanding that water and toilets are correlated. Unless there is equal expenditure on resources for development of both sanitation as well as water availability, people will abstain from using toilets on a regular basis. Hence initiatives should be taken to construct toilets which are less water-intensive, especially for the population in the poorest quintile. Since a large percentage of the population depends on borewells or tube wells, a scheme for harvesting rainwater should be prioritized in the country.

Proposed steps for the country:

1. Introduce a policy of small-scale water-harvesting systems: National policies should be worked out to encourage the growth of small water-harvesting systems. The systems should be planned and managed by the community.
2. Revive the traditional water-harvesting systems: Nigeria has a system of collecting rainfall in tanks on roofs and other catchments and reusing it. These systems should be revived. A healthy mix of traditional and modern systems should be used but priorities should be given to traditional systems as they conserve rainwater.
3. Focus on sponges: Waterbodies should be protected and created, and communities should revive degraded waterbodies, with minimal involvement of the states. The emphasis should be not on community participation but on community governance. This implies not merely the social management of a water-harvesting structure handed

over by the state but the involvement of the community in both its planning and implementation.

4. Involve women and girls in all the stages of the project: Women should also be equally included in the planning, design and implementation of such projects as women and adolescent girls are worst affected by water scarcity and play an important role in carrying water from far-flung places.
5. Capacity building of the communities: Major investments have to be made to increase the capacity of communities so that they efficiently operate and maintain the rainwater harvesting structures (including lakes and waterbodies) in different ecological regions.
6. Communities to be motivated for ownership: Finances for the initial construction and rehabilitation of the water-harvesting structure should come from the community as much as possible. At least 25–30 per cent can be obtained from the community, provided the investment planning for rehabilitation is undertaken by the community itself, with state agencies and other external agencies playing only a supportive role. The exact modalities of financing and cost recovery should be best left to the community. The community must contribute effectively at all stages of the project. While state subsidies may be necessary, their level should be decided according to the community needs and regional specificities. Further, greater emphasis has to be on subsidies to the community rather than on private subsidies to individuals.
7. Incentivize the communities for decentralized water supply projects: The state rural water supply and sanitation agencies should incentivize the communities going for source sustainability projects for water supply through harvesting rain in the form of awards and discounts in water tariffs.
8. Sustainable water supply to functional toilets: Once rural areas are declared open defecation free, they should have a steady source of water to their toilets for regular use (if flush or pour flush toilets) as well as for self and hand-washing purposes. Water and environmental sanitation departments should help communities plan and implement decentralized water-supply projects for this purpose.

D. BEST PRACTICES OF BEHAVIOUR CHANGE

This section details best case practices on behaviour changes from South Asia[57] and Africa[58] whereby communities not only built toilets but also started using them. It clearly identifies the ways in which such changes can be brought about at the country, state and local levels.

(a) COUNTRY LEVEL

Case study: Bangladesh

Bangladesh's drive to improve sanitation started in 2003, after its first nationwide baseline survey. According to the Department of Public Health and Engineering (DPHE), the survey during this time revealed that only 33 per cent of Bangladesh's population had improved (pit latrines with slab) sanitation while 42 per cent had no toilets. Shortly thereafter, political commitment and a multi-stakeholder approach helped improve sanitation coverage in the country. According to a 2019 JMP Report, the country has become open-defecation free, with 48.2 per cent of the population using basic latrines. Around 29.1 per cent of the population uses unimproved latrines and 22.7 per cent share latrines. The report states that open defecation reduced from 32 per cent in 1990 to 1.3 per cent in 2015 and to nil in 2017.

What worked in Bangladesh?

I. The strategy of containment of faeces helped people understand how to use toilets and improved environmental sanitation, paving the way for moving up the sanitation

ladder: The movement to get people to defecate at one location, using any sort of toilet, started in the 1970s. The Department of Public Health and Engineering, with the help of UNICEF and WHO, initiated the introduction of sanitary latrines on a limited scale in the 1970s. DPHE engineers designed high-quality, high-cost toilets and promoted several technologies, worked with NGOs and the private sector, and coordinated and monitored activities at the field level. Toilets were installed free of charge as demonstration models. The premise was that this would attract people's attention and they would install more on their own. The idea was to get people used to the idea of toilets and then, as resources permitted, move them up the sanitation ladder.

II. NGOs, entrepreneurs and microfinance institutions helped supplement and accelerate government programmes along with the development agencies: In 1991, the government formulated a ten-year sanitation strategy. In 1993, it launched a social mobilization (SOC-MOB) approach jointly with UNICEF with the objective of improving safe disposal of excreta, promoting personal hygiene and increasing the use of safe water for domestic purposes. The strategies of SOC-MOB included increased involvement of the community in planning and implementation, strengthening programme communication and training, forging alliances with partners and achieving political and social commitment. In 2003, the government declared a time-bound target to achieve sanitation for all. It started the national sanitation campaign with Community-led Total Sanitation (CLTS). CLTS motivates and empowers rural communities to stop open defecation and build and use latrines without subsidies. Local people analyse their sanitation profile, including open defecation, and assess the faecal–oral contamination routes that affect everybody. This inspires them to stop open defecation and improve sanitation.

   The role of NGOs is to facilitate and improve the capacity of the stakeholders. With the support of development agencies, such as the Bill and Melinda Gates Foundation, DPHE and NGOs provide finance and technology and supply hardware to the community and local government institutions. Entrepreneurs train in business development and toilet technologies, microfinance institutions provide soft loans, implementing NGOs help create linkages with local government institutions, which in turn direct financial support towards the poor.

III. Political commitment at all levels, from the federal government to the ward level, ensured sanitation gets priority and resources: At the national level, the local government department (LGD) and National Sanitation Task Force Committee developed the National Action Programme—monitoring was an important part of the programme. The programme included a baseline survey, community mobilization and preparation of action plans that include implementation and monitoring. The action plans enhanced awareness, changed attitudes towards sanitation and promoted hygienic practices and were followed by a construction phase. The last part was monitoring of installations and behaviour change. The main drivers were elected representatives of LGDs.

   Political commitment to improving sanitation is also high and has been an important factor for success. Elected representatives on sanitation task forces are very proactive and observe October as a sanitation month every year. The government focused strongly on advocacy in all policies to create an enabling environment. Local government departments approved a programme framework where sanitation promotion at the grass roots was given top priority through peer learning.

IV. Strong monitoring and supervision: Coordination among line departments ensured strong monitoring of sanitation. Monitoring was followed by reporting and verification from the field.

   Union parishads and paurashavas (municipalities), as the lowest tier of the local government, collect information from ward water and sanitation (WatSan) committees. Community-based organizations help WatSan committees and parishads in this. These reports federate upwards to the DPHE office at the upazila (district sub-unit) level. At the upazila and district levels, the staff compiles monthly data on sanitation coverage and reports to the DPHE sanitation secretariat. In Dhaka, the LGD and DPHE have introduced standard monitoring formats for different

government organizations into the National Management Information System (NAMIS). The system is managed by the Local Government Division (Policy Support Unit/Department). The system is managed by the Local Government Division (Policy Support Unit/Department of Public Health and Engineering) (LGD [PSU]/DPHE) and reports to the National Forum for WSS, which coordinates with ministries and NGOs.

V. Focus shifted from subsidy-driven toilet construction to bringing about behavioural change in people: Bangladesh has made significant changes in its strategy, shifting the focus from subsidy-driven toilet construction to triggering collective behavioural changes. A participatory approach enabled distinct behavioural changes and thus the focus. Respondents associated with behavioural changes realized the consequences, such as improvement in health and protection of women's dignity.

(b) COUNTRY LEVEL
Case study: Ethiopia

What worked in Ethiopia?

I. Strong political will: Ethiopia is a country with strong development priorities and political stability which has made the country work extensively in removing open defecation

II. Connecting sanitation and health: The secret of Ethiopia's success lies in the fact that it recognizes sanitation as a health problem. Sanitation and drinking water are under a single ministry, Ethiopia has put sanitation under the health ministry. In fact, the Ethiopian government's Health Extension Programme, started in 2003, is responsible for rolling out key sanitation interventions in rural areas, where 85 per cent of the country resides. Its Trachoma Prevention Programme is another example of how integrating sanitation with the health programme helps. Rolled out in 2002, the scheme promoted construction of toilets, because poor sanitation and lack of personal hygiene are important triggers for the spread of infectious disease that can leave people blind.

III. Strong community participation: Ethiopia has ensured that sanitation programmes do not focus merely on the construction of toilets but they also promote the idea of using them. Local communities and political leaders together discuss the types of sanitation services required, reflect on the tariff and monitor performance. This principle of participation is visible in all sanitation programmes. In the Health Extension Programme, for example, the services provided at the kebele level—the smallest administrative unit of Ethiopia—are customized to meet the needs, demands and expectations of the people. The Community-led Total Sanitation and Hygiene Programme (CLTSH), another important sanitation scheme that was started in 2009, is implemented by school health clubs and water committees at the kebele level. Community participation has not only given a boost to the construction of toilets, but also ensured the long-term sustainability of the practice.

IV. Well-planned verification and certification guidelines: The country also has open defecation-free verification and certification guidelines and set up committees at every administrative level, from the kebele to the national level, to verify that the guidelines are being followed. After a kebele is declared open defecation-free, monitoring is done by trained leaders from the community. We also have a system where kebeles are coded according to their open defecation-free status.

(c) STATE LEVEL
Case study: Sikkim, India

Sikkim was the first state in the country to achieve 100 per cent sanitation in rural and urban households, schools, sanitary complexes and anganwadi centres. As per the data on Swachh Bharat Mission, the state had constructed 57,525 household toilets and have attained 100 per cent open-defecation free state. Apart from this, the state also worked on solid and waste management through awareness campaigns.

What worked in Sikkim?
The initiative to achieve full sanitation was launched in 1999 in 7,096 sq. km of both rural and urban areas in all four districts of the state. The government fixed the target year of 2009 to achieve total sanitation. To increase the rate of implementation of the project, the Total Sanitation Campaign (sanitation campaign launched by India in 1999) was taken up in mission mode in 2008.

Key to the success of Sikkim's sanitation programme were the following:

I. Strong political and administrative will: It became mandatory for all gram sabhas to have sanitation as the top priority in their agenda.
II. Stringent law and enforcement: The state government also made amendments in the Panchayati Raj Act so that members of panchayati raj institutions construct toilets in their households. If they failed to, their nominations were cancelled in the panchayat elections.
III. Availability of resources: Every family possessed enough land for the construction of toilets and used the land accordingly. Water scarcity was addressed through increased access to tap water.
IV. Sanitation officials understood the issue and worked on awareness campaigns: Information, Education and Communication (IEC) activities were carried out through booklets, pamphlets, documentaries, multimedia presentations, banners, posters and billboards in English as well as the regional languages of Sikkim.
V. Strong advocacy: People began to value toilets as a mark of dignity.

(d) BLOCK LEVEL
Case study: Taranagar block, Churu district, Rajasthan, India

What worked in Taranagar?

I. Strong political and administrative will: The programme was rolled out in campaign mode under the strong leadership of the district collector.
II. Intelligent communication strategy: The campaign's communication strategy to bring about behaviour change was based on engendering dignity and pride in the community. The district helped spread awareness by creating disgust among villagers about open defecation. The campaign focused on malnutrition and health, which served as a trigger for the campaign.
III. Local choice of toilets: People in Churu constructed toilets according to their own preferences, mostly of a higher value than those covered by the government incentive. Since people are allowed to do this, even poor households started investing additional resources, taking into consideration long-term use. No contractor or NGO was hired to construct the toilets. The district administration ensured that appropriate technologies were used for toilets by showcasing toilet designs and training masons. Water was

made available to toilets throughout the year from the shallow groundwater (saline) and rainwater stored in sumps in almost every household.

IV. Easy availability of loans and incentives: The wealthy in the villages offered loans to construct low-cost toilets. The incentives under Nirmal Bharat Abhiyan (the sanitation programme launched in India in 2012) were transferred directly to beneficiaries' bank accounts. Available funds for solid and liquid waste management under Nirmal Bharat Abhiyan were used as an effective community reward for achieving open defecation-free status.

V. Well-planned design of the campaign: The campaign was designed so that the community took the initiative rather than wait for government support. The government's financial support was delivered effectively as incentives and rewards for community-level outcomes.

VI. Effective institutional arrangement: Systems were instituted to facilitate the campaign at the district, block, gram panchayat and village or habitation levels.

VII. Capacity development with respect to technology options for Community-led Total Sanitation: Capacity development programmes targeting stakeholders were conducted, supported by the World Bank's Water and Sanitation Program (WSP) that engaged expert agencies and resource personnel to facilitate the training.

VIII. Effective monitoring: Traditionally, government sanitation programmes monitor the number of toilets. But a campaign that aims to make more and more villages open-defecation free (ODF) has to monitor nothing but the number of ODF villages. This shift in monitoring outcomes rather than outputs was evident in routine review meetings at the district and block levels.

(e) VILLAGE LEVEL

Case study: Tamana village, Ganjam district, Odisha, India

What worked in Tamana?[59]

I. Strong wills of the village committee to bring a change: Due to the water crises, the villagers abandoned agriculture in the early 1980s. Unavailability of water also made the villagers defecate in open, near the village pond, and contaminate the only source of water. Waterborne diseases were a regular feature in the village when the village committee wanted an improvement in water and sanitation.

II. Involvement of the community: With help of a local NGO, the village formed a village executive community with representation from all households and with 50 per cent participation of women to facilitate the construction and maintenance work. The communities were motivated to use local materials and to bear any additional cost.

III. Easy fund availability: A local NGO helped the villagers mobilize funds from government resources.

IV. Water in toilets ensured: The village pond was revived and water diverted to a centrally placed 80,000-litre overhead tank. Water was supplied to all the households through piped-water schemes.

V. Water supply made sustainable: Although the piped-water supply was laid with the help of government funding, the village executive council (VEC) also created a corpus to be used for operation and maintenance of the piped-water supply. The corpus was created from contributions by the villagers. To make the source of water sustainable, the villagers were motivated to protect the catchment through plantation drives and started harvesting rain through traditional ponds and connecting them to the main pond.

VI. Effective monitoring: The VEC is involved in regular monitoring of the toilets and water supply in the village. For maintenance of the systems, the corpus is used.

The common points between all the success stories are as follows:

A. Political and administrative will: Strong, credible leadership;
B. Awareness and education programmes through a decentralized community-centric approach; and
C. Strong implementation plan.
D. Outcome-based monitoring

In all the success stories, health was brought to forefront of the campaigns and people were made aware that safe sanitation was necessary to remove disease. Ethiopia emerged as a champion by integrating both sanitation and health under the same ministry.

5. Conclusion and recommendations

Nigeria, in spite of its progress on sanitation provisioning, has a huge unmet demand—it has the world's largest population that defecates in the open, putting a health burden on its people. According to the Nigerian government's 2018 WASH-NORM report, basic sanitation is grossly inadequate in rural Nigeria, where most of the country's population resides. Analyses of success stories from around the world show that strong political will, awareness and well-planned strategies can bring changes in behaviour with regard to toilet use.

The combined and connected challenge is that where sanitation is provided, excreta from the toilet must be treated and safely disposed of or reused on the land. The 2019 Joint Monitoring Programme report states that in Nigeria almost 70 per cent of rural and 44 per cent of urban household toilets have never emptied excreta from their on-site facilities. Various research reports as well as data from the government's own study reveal that the faecal sludge emptied from pits and tanks is either buried in covered pits or evacuated to be dumped—household owners do not know where. Such dumping causes pollution of drinking-water sources. The latest data on the state of sanitation and hygiene in Nigeria says that waterborne diseases have led to the deaths of 100,000 children below the age of five years annually of which 90 per cent are directly caused by unsafe water and sanitation.

The challenges of accessible and safe sanitation require amending institutional structures and related bylaws and using safe technological options to handle the faecal sludge and wastewater.

Task 1: Strengthening legal and institutional structures for effective implementation
The existing 2005 Policy Guidelines on Excreta and Sewage Management should be revised to bring clarity in the institutional structure. Our recommendations are:

1. The roles and responsibilities of the different stakeholders, from household owners to government authorities and private agencies, should be well defined.
2. Capacity-building and awareness programmes should be planned for users, artisans, NGOs and government authorities involved in the sanitation sector.
3. The local government authorities should develop and implement faecal sludge bylaws, comprising conversion of insanitary toilets to sanitary toilets and implementing best practices of emptying and collecting faecal sludge and transporting it to treatment facilities. Conditions for issuing licenses to private de-sludgers should be well defined to safeguard the health of the people who empty the pits/tanks as well as the community.
4. The model of dual licensing and sanitation tax should be implemented to operate and maintain faecal sludge treatment plants. While discharge licensing should control private sludge-emptiers, government will need to monitor the schedule for de-sludging.

Task 2: Create manual/menu of toilet technologies, which are linked to treatment systems
Nigeria has diverse ecological conditions, varying from dry areas in the north to flood-prone areas in the south. Toilet technologies are accordingly proposed as follows:

1. Biogas-plant-linked toilets are the best option for every part of the country.
2. Dual-pit toilets are suitable for areas that have limited water supply, especially the arid areas in the north. Honeycomb brick masonry structures, normally used in dual-pit toilets, can be replaced by perforated cement rings where the soil is loose.
3. Ecological sanitation toilet is suitable for areas where water is scarce as well as those that easily get waterlogged.
4. Septic tanks are suitable in small towns (classified as rural by the 2018 WASH-NORM report) without a centralized sewer system, where cost is not a constraint.

Task 3: Work on ensuring safe treatment/reuse of household excreta

The following options are suggested:

1. Constructed wetlands, at the community level, are the best option for rural areas. In the southern part of the country, which is prone to severe waterlogging, the base of the wetlands should be structurally modified as per soil conditions.
2. Soil biotechnology is the best option to treat wastewater at the community level in small towns, where cost is not a constraint.

To treat faecal sludge in rural areas, the following steps are suggested:

1. A combination of sedimentation tanks and reed bed filter to effectively separate solid and liquid parts of the sludge;
2. This should be followed by treating the liquid in stabilization tanks and the solid by co-composting it with organic waste. The end-product can be reused. The treated liquid can be used for irrigation and the solid as manure in fields.

In cases where existing sewage treatment plants are near by, sludge from the settlements can be brought to these plants and co-treated with sewage. This is a more cost-effective option than building new faecal sludge treatment plants.

Task 4: Link water availability with sanitation and reuse

The link between toilet sustainability and water supply in toilets must be understood. Only 8 per cent of the Nigerian population has piped-water, with 3 per cent of this figure having water on their household premises. Hence a majority of the population depends on groundwater for all its uses. Nigeria has adequate rainwater-harvesting potential to cater to its household needs.

The country should implement the following:

1. Introduce small-scale water-harvesting systems;
2. Revive traditional water-harvesting systems;
3. Focus on groundwater-recharge structures;
4. Involve communities (especially women) in small-scale projects. Make them aware and motivate them through incentivized schemes;
5. Water should be mandated for functional toilets. Government should provide support to the communities.

The Centre for Science and Environment (CSE), New Delhi, India, will work closely with the Federal Ministry of Environment, Nigeria, and Water Aid, Nigeria. CSE will help them plan and design safe technologies and develop policy regulations to manage faecal sludge and wastewater in different ecological regions in Nigeria and enable the Federal Ministry of Environment choose the most effective projects that adhere to site specification and local rules and regulations.

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In November 2018, the Nigerian government declared an emergency in the WASH sector. According to reports, about 47 million people defecate in the open and 100,000 children below the age of five years die annually as a result of unsafe water supply and sanitation in Nigeria. The country loses almost Nigerian Naira 455 billion every year due to unimproved sanitation.

The poor are the worst sufferers. Undigested faecal sludge emptied from pits and septic tanks is mostly buried or dumped, and wastewater flows though villages freely, contaminating soil and groundwater.

In spite of Nigeria's progress in sanitation, it needs to work on safe containment, emptying, transportation, treatment, and disposal or reuse of faecal sludge and wastewater. Effective guidelines and bylaws aligned to this should be framed. This document addresses these aspects in the Nigerian context.

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