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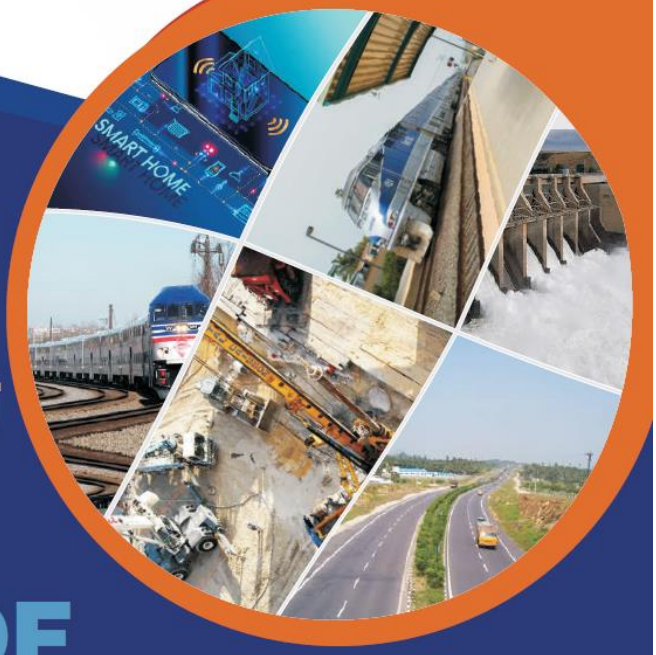
THEME

REPOSITIONING CIVIL ENGINEERING PRACTICE FROM THE PERSPECTIVE OF ICT

3RD DECEMBER, 2020



BOOK OF PROCEEDINGS

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Federal University of Technology, Minna, Nigeria

Wastewater Management Practice in Nigeria: Inadequacies and Strategies on the Way Forward

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ABSTRACT

This paper assesses the current handling of wastewater including public reaction to the existing practices and the introducing various alternative approaches that are applicable. The survey culminates in developing a national policy to guide management of Wastewater and general sanitation across the country. This paper is prepared based on the observations and feedbacks gotten from the survey carried out on the assessment of the Wastewater Management practices in Nigeria. It assesses Wastewater management practices in Lagos and Kano States of Nigeria. The study is categorised mainly into two sections: data collection and facilities assessment. The latter is based on site visitation and collection of Wastewater effluent parameters using a survey template while the former collected data and information from residents, WASH experts through the administration of (general and professional) questionnaires as well as oral interviews. Overall results indicate that the conventional Wastewater management practice in Nigeria is inefficient. The processes and facilities are poorly monitored and maintained. A need for improved fragmented institutional responsibilities is now than later. Therefore, a strong and effective governance is required with regulation backed up by financing, monitoring, control, and enforcement. Feedback gotten from residents, professionals and stakeholders showed that there are fundamental sanitation issues vis-a-vis the role of masses and in particular, that of the government towards the actualization of a healthy ecosystem. The result of the assessment and proposed strategies could serve as a guide to the effective development and management of Wastewater in Nigeria.

Keywords: *assessment, management, sustainability, WASH, wastewater.*

1 INTRODUCTION

Wastewater is sewage, storm-water and water that has been used for various purposes around the community. Without proper treatment and disposal, wastewater can harm public health and the environment. Most communities generate wastewater from both residential and non-residential sources. Wastewater is mostly water by weight. Other materials make up only a small portion of wastewater, but can be present in large enough quantities to endanger public health and the environment. Practically, anything that can be flushed down a toilet, drain, or sewer can be found in wastewater, even household sewage contains many potential pollutants (see Figure 1). The wastewater components that should be of most concern to homeowners and communities are those that have the potential to cause disease or detrimental environmental effects. Most of our wastewater, treated or untreated, eventually ends up in our rivers, streams, lakes, and oceans-sometimes via groundwater, the underground water source we tap for well water. We often assume that groundwater is pure-and it usually is-but unfortunately, well water contaminated by sewage is a common cause of outbreaks of wastewater-related diseases (Taylor et al., 1997) .

In Nigeria, Wastewater management is inefficient and barely practiced in most places leading to a lot of negative impacts on both public health and environmental sustainability. Wastewater contains harmful substances and should not be discharged into the environment without proper treatment (Joshua, 2015). This survey will help review the present Wastewater management practices in the selected cities and all information gotten from this study will facilitate a well-planned and coordinated Wastewater management practice through formulation of sanitation policy that will guide effective Wastewater management in order to minimize public health hazard. Industries in Nigeria are not the highest consumers of water, however, they have high contribution to pollution in Nigeria, as they introduce different polluting substances in their wastewater into the natural streams. For instance, the agricultural sector, the domestic household activities and the industrial sectors consume, approximately, 69%, 21%, and 10% of the water in Nigeria (Kayode et al., 2018).

Figure 1: Basic colour code for Wastewater
Adapted from United Nations Economic and Social Commission for Asia and the Pacific (ESCAP), United Nations Human Settlements Programme (UN-Habitat) and Asian Institute of Technology (AIT), 2015.

1.1 Environmental Sustainability

Holistically, Sustainable Development Goal (SDG) focuses explicitly on "Ensuring availability and sustainable management of water and sanitation for all". Hence, the availability and productive use of good quality water is essential to achieve many other proposed SDGs. Having known, in the context of worsening global climate change, the achievement of water-related SDGs will be even more challenging than the work done on the Millennium Development Goal targets. Sustainable development in any society is an access to initiate a good standard of living for the populace. Figure 2, illustrate the criteria for Sustainable Sanitation Services (SSS) with the aim of SDGs at providing solutions to the economic, environmental, and societal challenges without posing a threat to human and environmental future development (Hein et al., 2019). Also, these include social progress and equality, environmental protection, conservation of natural resources, and stable economic growth. The shift towards sustainability has become a necessity for the entire globe. As the rate of urbanization and capacities of cities keep increasing, the volume of production and consumption of water has led to a big surge in wastewater generation. Therefore, the study of how natural systems function, remain diverse and produce everything it needs for the ecology to remain in equilibrium becomes a necessity (Busari, 2019).

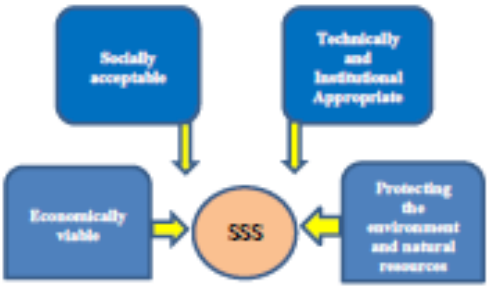

Figure 2: Criteria for Sustainable Sanitation Services

Sustainable wastewater management creates a system that is environmentally effective, economically affordable and socially acceptable for a particular region and its individual circumstances. The practice minimizes the negative environmental impacts and associated health risks that come along with improper waste management. One of the major problems associated with improper wastewater management is that it contributes to global warming, sustainability aims at reducing it. Global warming occurs when carbon dioxide (CO_2) and other air pollutants and greenhouse gases collect in the atmosphere and absorb sunlight and solar radiation that have bounced off the earth's surface. Normally, this radiation would escape into space, but these pollutants, which can last for years to centuries in the atmosphere, trap the heat and cause the planet to get hotter. That is what is known as the greenhouse effect (MacMillan Amanda, 2016). From the viewpoint of sustainable development, applicable wastewater management is crucial for conserving the environment. Improvement of developing countries is directly related to preventing environmental pollution and expanding public health services. Suitable wastewater management contributes to not only reducing emissions of greenhouse gases (GHGs), but also the reduction in water, atmospheric pollutants and odours (Ishizaki et al., 2011).

Negative effects of improper wastewater management not only bring about disgusting views but also affects the overall economy of a country. State has to spend a lot of money to counter the effects of improper wastewater management and water-borne diseases. Moreover, flora and fauna depended on the environment also face a great threat due to eutrophication. (MTS, 2017).

1.2 Current Wastewater Management Practices in Nigeria

The wastewater of a community is the total of used and spent water generated from domestic sources in residential homes from the use of water for toilet flushing,

bathing, drinking, cooking, cleaning, washing, hygiene, and sanitation (UNICEF, 2012). It also covers wastewater from commercial, industrial, medical and agricultural enterprises. The rule in Nigeria as noticed during the study is for residential estates, commercial, large-scale medical and agricultural facilities to provide conventional wastewater treatment plants/ off-site sanitation and for industries to put in place Sewage Treatment Plants, while individual homes are required to provide on-site sanitation such as septic tank/soakaway pit for their domestic wastewater with regular evacuation and maintenance schedules.

In Nigeria, managing wastewater disposal has become a major nuisance due to lack of supervision of the management chain. For residential apartments, on-site sanitation does not have construction implementation and sanitation guideline. No law to monitor the management chain: from construction of the facility – evacuation-transportation - treatment – disposal. Agencies responsible for this mandate are not living up to expectation. Ideally, evacuation of wet sludge from septic tank, transportation to treatment site and finally, the disposal needs to be monitored. Any act of violation of lay down rule deserve to be punished or penalized as the case may be.

Most estates own by government have Sewage treatment plants. Generally, the overall inspection shows that the facilities are poorly managed and some are not operational due to lack of maintenance with few exceptions such as the private owned facilities and central sewage treatment plant located at WUPA, Federal Capital Territory, Abuja.

This study will provide extensive information on the management of Wastewater in Nigeria. Emphasis will be on domestic wastewater in the selected States based on administered questionnaires, prefeasibility and feasibility studies, oral interview, and expert opinion. The inadequacies will be highlighted and discussed. More so, strategies on the way forward shall be the main contribution of the authors.

1.3 CHALLENGES IN WASTEWATER MANAGEMENT IN NIGERIA

Safe water supply and hygienic sanitation facilities are the two basic essential amenities that communities need as top priority for healthy living. In Nigeria, provision of safe drinking water takes precedence in the order of provision of basic amenities to community than the importance of hygienic sanitation facilities through low cost on-site sanitation. Again, conventional sewage treatment is seriously lagging in most cities across the country. About 80% of water used by the community comes out of houses in the form of Wastewater which unless properly collected, conveyed, treated and safely disposed-off may eventually pollute our scarce water resources and cause environmental degradation. The provision of safe drinking water alone is not sufficient to break the chain of diseases affecting our societies. Safe disposal of the Wastewater/Fecal sludge is even more important, which can be at an individual/private property level or at group housing level like apartments, complexes/shopping mall, or at housing estate/community level.

In most cities and towns of Nigeria, only the households within some housing estate are connected to a conventional sewage system. Worse still, only a small fraction of the sewage from these households is treated effectively at primary or secondary sewage treatment level. The rest of the urban/peri-urban and rural population have either:

(i) Some form of on-site sanitation like septic tank/soak away pit for disposal of human excreta or,

(ii) Kitchen & bathroom waste disposing into road drains or directly on roads, thereby creating unhygienic conditions or,

(iii) Inadequate sanitation facilities in public places - market area/ public transport (motor) parks hence the practice of open defecation in such places.

About two third of Nigeria urban population is dependant on on-site sanitation, or has no access to sanitation services while the entire rural population dependants on on-site sanitation and open defecation.

2 METHODOLOGY

2.1 DATA COLLECTION AND INSTRUMENTS

For this study, the primary source of data collection was adopted. Data were collected through the administration of questionnaires, and survey templates. In addition, more information was received through site visitation as well as a direct conversation with management staff of the available Wastewater facilities. Figure 3 shows the method adopted for this study.

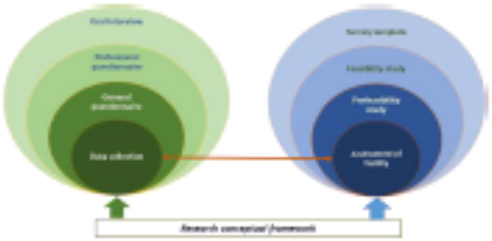

Figure 3: Adopted research method

For data collection, two sets of questionnaires were developed. Two key groups were targeted, thus the need for the two sets of questionnaires. One set of the questionnaire was addressed to the residents of the Cities while the other set targets the professionals in various agencies that are directly or indirectly involved in the Wastewater management in the selected Cities. Professional questionnaires aimed at Wastewater and WASH managers in the States. The distribution of the questionnaires covered all agencies in the WASH sector. In a situation where more information is required to support the data, expert opinions are resulted to through oral interview.

Assessment of the facilities followed three stages: professibility, feasibility studies and distribution of survey templates. The survey templates were distributed to managers and technical staff of the available Wastewater treatment plants to obtain relevant information on the plant capacity, treatment methods, effluent standard, BOD levels and disposal methods.

2.2 Questionnaires' Target Groups

2.2.1 RESIDENTS

Residents play important role in the management of Wastewater. They generate Wastewater daily, hence, proper management of Wastewater starts from the household (Oladoja, 2017) Also, community awareness and participation are needed for any future plan for improving Wastewater practices in the city. The enumerators administered questionnaires in the two major parts of Lagos State namely; the Mainland and the Island and in Kano City.

Questionnaires were administered in Lagos Mainland areas: Ipodo, Awolowo way, Anifowoshe, John Akinde, Afariogun, Apena, Oba Akran Avenue, Seriki, Araromi, Balogun, Tonade, OjulowoImoshe and Obasa while areas covered in Lagos Island include Sapara Williams, Kofo Abayomi, Idowu Martins, Ojora Colony, Kosoko, Akin Olugbade, Musa Yaradua, Ojo Military Cantonment and Olowu. Similarly, in Kano State, questionnaires were administered to residents of areas such as Brigade, Sabon-Gari, Zoo road, Court road, Kofar Mata,Yakasai, Wambai, Mandawari, Rimi, SabonTiti, Jakara, Sharada, Kabuga, Hausawa, Shagari Quarters, Jaji Quarters, Hajj Camp Quarters, Airport Road, Zaria Road, Hotoro, Naibawa Quarters, Tarauni, Nasarawa, Yan Awaki, Tudun Murtala, Tudun Maliki, Fagge, Kuntawa and Goron Dutse axis.

2.2.2 PROFESSIONALS

This set of people are very crucial in this survey. Apart from the fact that they have access to facts and information that cannot be gotten from the residents, they also, have adequate knowledge of Wastewater practices in the Cities. They are the people in the WASH sector of the State.

The questionnaires for the professionals in Lagos state were distributed and administered during the stakeholders' meeting held at the Lagos State Wastewater Management Office in Ikeja, Lagos. The captured agencies include: Lagos State Environmental Protection Agency, Ministry of Local Government and Community Affairs. (WASH department), Ministry of Environment, Water Regulatory Commission, Lagos State Planning Erosion Management Authority, Lagos State Wastewater Management Office, Lagos State Water Corporation, Lagos State Building Control Agency, Ministry of Physical Planning and Urban Development, Private Organizations and Water/Wastewater Consultants.

Similarly, in Kano state, Questionnaires for the professionals were administered during the stakeholders' meeting held at the Ministry of Water Resources in Kano. The questionnaires were distributed among various agencies as follows: Kano State Ministry of Water Resources, Ministry of Environment, Ministry of Lands, Ministry of Works, Refuse Management and Sanitation Board, Rural Water Supply and Sanitation Agency, Ministry of Housing Corporation.

2.3 Survey Templates

The basic objectives of distributing survey template were to obtain first-hand information on the effluent quality parameters, sludge re-use possibilities, and wastewater treatment processes (Malin et al., 2006). The response depicted a pervasive lack of data record relating to virtually all aspects of WWM in the selected States. The concept of collecting, storing, analysing and sharing data is key to the understanding wastewater challenges and roadmap to proffering solution (Englande et al., 2015). Without adequate data, serious environmental issues are unlikely to be identified and managed adequately to protect human and ecosystem health.

It appears that WWM in the selected States concentrates on regulating septic standard for residential building and

ensuring small-scale WWTP in commercial buildings. In Lagos state, survey templates were handed out to request for information on the WWTP during a visit to the various treatment plants. However, in Kano state, since there were no operational treatment plants managed by any of the agencies, the survey templates were handed over to the same agencies that were given the professional questionnaires. Survey templates aimed at Management and Technical staff members of Wastewater treatment plants.

2.4 Site Visitation

To obtain first-hand information regarding these details, a site visitation was embarked on with prior notice to the agencies responsible for the management of these facilities. Lagos state has over 300 wastewater treatment facilities (WorldBank, 1995). One which belong to the Federal government is moribund. Another four treatment facilities, owned and managed by the State government were assessed during the visitation. The remaining treatment facilities are owned by private organization. The State-owned treatment plants visited treat mainly Estate residential wastewater and in various capacities. A site visitation was also made to the Tukuntawa Sewage Treatment Plant, Zoo road in Kano.

3 RESULTS AND DISCUSSION

Resident Questionnaires aimed at the general public in Lagos and Kano States. The distribution of the Questionnaires covered households, parks, and shopping malls. The designed questionnaire considers the socio-economic and sanitation attributes of the population in the study area. The socio-economic attributes captured the gender, age, education, economic activities, number of years in the house, number of occupants in the house, cost affordability, tax payment, numbers of leaching pit in the septic tank, flooding experiences. The sanitation attributes, on the other hand, encapsulates sanitation facilities, methods of collection, laws/guidelines and who should be responsible for the funding of Wastewater in the country.

The information obtained from residents through the administered questionnaire is analysed and summarised into two categories namely: socio-economic attribute and sanitation attributes as shown in Table 1 and Table 2 respectively.

3.1 Analysis of Questionnaires

3.1.1 SANITARY FACILITIES

Adequate water supply is one of the fundamental responsibilities of every government. However, the growing population, countless increase in human activity, poor maintenance and supervision of our water sectors contributes massively to the current stage of water scarcity.

3.1.2 LAGOS STATE SANITARY FACILITIES

All residents in this area have at least a toilet, this signifies improved sanitary condition. Figure 4 shows the proportion of sanitary facilities in the State.

Regarding sanitation facilities, about 85% of residents use soakaway/septic tank with leaching pits for the collection of Wastewater from the household and over 80% of the residents have one or two leaching pits while almost 15% have at least three leaching pit which serves as liquid effluent absorption system for septic tanks/soakaway, this often helps to reduce the liquid load in septic tank/soakaway. Similarly, Mainland residents have toilets in which 94% uses water system as a medium of conveyance, 5% of residents use pit toilet while 1% do not have a toilet, thus, using dump sites and shared toilet as a way of disposing of faeces.

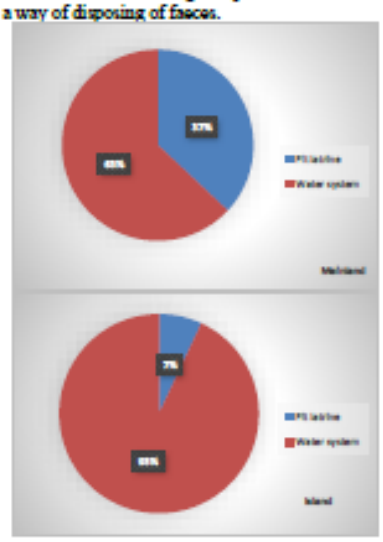

Figure 4: Available Type of Toilet (Lagos)

3.1.3 KANO STATE SANITARY FACILITIES

From the survey, 48% of the residents use private well/borehole and public well/borehole, 3%, 2% of residents use reticulated water system and surface water supply respectively. All residents have at least a toilet in their household. Water closet system of toilet dominates while the others rely mostly on the pit latrine system of the toilet as shown in Figure 5.

not have knowledge of Wastewater treatment. In the same manner, Mainland Residents have a lesser view on treatment process as 85% have no idea on the treatment process and how often it is treated neither the location of a treatment facility in the community. Almost 37% of

were of the opinion that there are no laws while others agreed to be cognizant of the existing laws. However, over 72% of Mainland residents claim to be unaware of any law and legislation guiding collection, treatment and

disposal practices in the community while 20% are aware of Wastewater management legislation. The residents do not deny the effect of poor Wastewater management on the environment.

Observation shows that where laws exist, there is a need for its transformation into policy. On the consideration of policy formulation on Wastewater management in the state, the result of the analysis shows that it is a welcome idea by residents.

Source of Water

A greater percentage of Island residents have access to private well/borehole which serves as a primary source of water supply, this shows the inadequacy of reticulated water system in the area. An average percentage (56%) of Mainland residents use private well/ borehole as a source of water supply, 40% residents source water via public well/ borehole while others use the reticulated system of water supply. Meanwhile, there are water truck pushers popularly known as Mairuwa who fetch water for residents as a means of livelihood. Both residents were of the opinion that the highest percentage of Wastewater comes from domestic activities.

3.1.6 FUNDING

Over 70% of Mainland and Island residents support Government funding. The result also indicates, less than 15% of residents support joint participation. More so, 8%, 3%, and 2% of residents agreed on individuals, community and NGOs funding approaches respectively. Less than 50% of residents support a tax for Wastewater management in the city while others consider payment on a monthly basis as the appropriate option. However, 52% of residents agree that the government should impose a tax on an individual for the management Wastewater facilities while others raised an objection.

3.1.7 AGENCIES RESPONSIBLE FOR WASTEWATER MANAGEMENT

A greater percentage of the residents are not aware of agencies responsible for Wastewater management in their States. Most of the residents (95%) neither know of any public-private partnership regarding Wastewater management nor aware of any ongoing program involving stakeholders and government. They solely associate the responsibility to the Ministry of Environment and Lagos State Wastewater Management Offices (LAWSMO). This shows there is a need for advocacy in the State. On the other hand, those that identify responsible agency rated their performance above average and commend their effort.

TABLE 1: SOCIO-ECONOMIC ATTRIBUTES OF SURVEYED CITY'S POPULATION

Socio-Economic Survey	Personal attribute	Distribution (%)		
		Lagos Island	Lagos Mainland	Kano
Gender				
	Male	62.67	53.11	64.77
	Female	37.33	46.88	35.23
Age	Below 26	5.80	5.45	18.32
	26-35	35.51	26.43	33.33
	36-45	42.75	31.06	24.18
	46-55	15.94	21.53	16.85
	Above 55	0.00	15.53	7.33
Education	Primary School	6.16	17.80	3.51
	Secondary School	28.08	37.96	35.44
	Diploma	19.86	13.87	26.32
	University Graduate	40.41	14.14	23.86
	Vocational Training	4.80	12.04	5.26
	Others	0.69	4.19	5.62
Economic Activities	Farming	0.00	0.80	4.30
	Fishing	0.66	0.00	1.07
	Trading	38.41	83.96	53.05
	Mining	0.66	0.27	0.72
	Other Activities	60.26	14.97	40.86
Duration of stay in the house	Below 5 years	61.64	29.12	13.64
	5-10 years	24.66	37.37	25.52
	10-20 years	9.59	20.10	30.77
	Above 20 years	4.11	13.40	30.07
Number of occupants in the house	1 to 3	29.25	20.10	33.57
	4 to 5	21.09	23.76	30.42
	6 to 8	17.00	29.50	18.53
	9 and above	32.65	26.63	17.48
Cost Affordability	Yes	20.16	31.69	45.61
	No	32.26	40.98	32.45
	No idea	47.58	27.31	21.93
Time Duration for payment on wastewater management	Monthly	55.23	52.22	39.17
	Quarterly	9.52	15.19	13.36
	Annually	34.29	30.74	36.87
	Bi annually	0.95	1.85	10.60
				63.08
Number of leaching pits	1	43.33	62.63	32.97
	2	42.22	34.88	3.94
	3 or more	14.44	2.49	

TABLE 2: SANITATION ATTRIBUTES OF SURVEYED CITY'S POPULATION

Sanitation Service Chain	Survey Question	Attributes	Distribution (%)		
			Lagos Island	Lagos Mainland	Kano
	Medium of wastewater collection	Soakaway	60.81	55.97	
		Septic tank	25.67	29.71	72.67
		Sewer drains	11.49	11.41	17.55
		Other source	2.03	2.39	8.42
	Available wastewater system				1.40
		Cesspool	5.55	6.60	
		Septic tank/leaching pool	54.17	35.20	23.67
		Community system			48.76
Sanitary Facilities		Central sewer system	0.69	0.26	
		I don't know	15.27	0.53	18.25
					3.89
	Type of domestic wastewater channeled through sewers	Washing water	24.30	17.41	13.45
		Bath water			
		Faecal water	8.05	3.98	
		All of the above	2.01	8.49	17.89
		Washing/Bath	39.59	54.64	12.98
		Washing/faecal	37.58	30.7	25.96
		Bath/faecal	8.72	0.53	41.05
			4.03	0.00	0.35
			0.00	1.59	1.05
					0.70
	Frequency of emptying septic tank/soakaway	Within 3 years	36.64	65.76	40.08
		4-6 years	4.38	17.93	36.35
Collection		7-10 years	0.73	2.72	12.06
		More than 10 years	0.00	3.53	4.67
		I don't know	18.25	10.05	12.84
	Frequency of sanitation on drainage system	Weekly	65.75	72.85	13.40
		Bi-weekly	2.05	2.69	3.21
		Monthly	20.55	17.74	70.36
		Bi-monthly	3.42	4.84	7.88
		Others	8.22	1.88	4.64
	Knowledge of wastewater treatment	Yes	24.65	7.39	21.20
		No	6.34	6.86	25.44
Treatment	Willingness to learn about wastewater	No idea	69.01	85.75	53.36
		Yes	82.31	88.86	95.44
		No	17.69	11.14	4.56
	Disposal sites of wastewater/faecal sludge	WWTPs	20.00	11.32	6.06
Disposal		Farmlands	0.71	0.53	34.64
		Rivers/streams	8.57	9.21	4.55
		Inside storm Sewers	0.71	0.52	4.55
		No idea	70.00	78.42	50.38
Laws/Guidelines	Existence of policy and law	Yes	42.38	20.05	34.15
		No	3.97	7.65	30.99
		No idea	53.64	72.30	34.86
	Consideration of policy formulation	Yes	59.02	82.58	83.33
		No	40.98	17.42	16.67
Source Of Water	Primary source of water	Private well/borehole	82.12	56.18	47.56
		Public well/borehole	6.62	39.52	47.89
		Reticulated water system	10.59	3.23	2.46
		Surface water supply	0.66	1.08	2.11
Funding	Wastewater management funding	Individuals	8.00	14.32	12.94
		Community	2.67	3.71	9.44
		NGOs	2.00	1.06	1.39
		Government	74.00	70.82	63.98
		Collective input	13.33	10.08	12.24

3.1.8 OPINIONS AND SUGGESTIONS OF RESIDENTS

The stakeholders' participation (especially consumers/end-users/beneficiaries) is very important in the formulation of any policy. The opinions of residents regarding Wastewater system have been sampled and suggestions were documented. Amongst the resident's suggestions are highlighted as follows;

a) Creation of awareness programs.
b) Encouragement of Community participation
c) Enforcement of laid down laws.
d) Provision of adequate drainage
e) Monitoring/inspection programs
f) Involvement of private institutions in Wastewater Management.
g) Quality measures
h) Tax enforcement
i) The government should focus on rural areas in terms of sanitation.
j) Improvement of the present Wastewater Management practices.
k) Competency and diligence of officials in charge of Wastewater

3.1.9 LAW/POLICY

Enforcement of law and policy would enhance effective Wastewater management practice, 34% of the residents are aware of the existing law that guides collection, treatment, and disposal of Wastewater which contradicts the statement of the WASH experts. Thirty-one percent of the residents do not know of any law whereas, other residents have no idea of any such law. Almost, all residents (97%) agree to support government policy formulation.

3.1.10 SOURCE OF WATER

The result reveals that more than half (52%) of the residents agreed that significant amount of Wastewater comes from households while 20%, 6%, 2% conclude that the significant amount of Wastewater is from Industries, Agricultural activities, and other sources respectively (Figure 6).

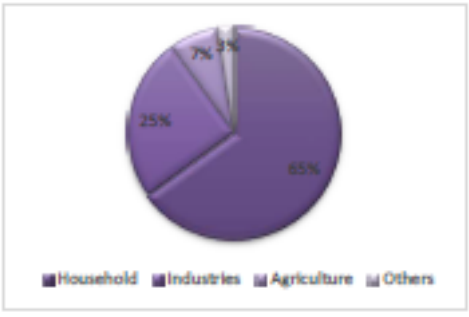

Figure 6: Water Sources (Kano)

3.1.11 PRIVATE SECTOR/GOVERNMENT PARTNERSHIP

Government plays a very vital role in Wastewater management but in order to ensure sustainability, the Government needs to partner with private sectors, NGOs, or international organizations to establish regulatory supervision to ease an effective communication channel on Wastewater management practices.

Fewer than (9%) of the residents display an awareness of existing partnership between private institution government on Wastewater management but could not make mention of any while 46% of the residents disagreed and 45% of the residents did not know if a partnership exists between the private institutions and government.

3.2 ASSESSMENT OF WASTEWATER MANAGEMENT PRACTICES IN NIGERIA (*INADEQUACIES*)

3.2.1 CONTRIBUTION FROM LAGOS STATE AGENCIES

About 195 (5 pages) questionnaires were distributed for administration by professional in the wastewater sectors during the stakeholders meeting at Lagos State. The responses showed that the wastewater management in the State requires adequate funding, the involvement of private institution, a complete rehabilitation, and management of the treatment plants, training, and retraining of personnel involved. Others suggested restructuring and professionalism in the wastewater and urban sanitation sector. Observation and remarks revealed that improvement in the wastewater management practices can only see the light of the day through public enlightenment, capacity building of stakeholders and operators in the sector, the synergy between relevant agencies and research institute in the State.

Despite the aforementioned inadequacies, increase in budgetary provision for the agency, training as well as understudying working examples is another contribution to upgrade the existing practices. Monitoring of the plants coupled with well-trained personnel would lead to efficient and effective management of wastewater in order to improve the public health and aid environmental sustainability.

3.2.2 CONTRIBUTION FROM KANO STATE AGENCIES

About 70 (5 pages) questionnaires were distributed for administration by professional in the wastewater sectors during the stakeholders meeting held in Kano State. The responses showed that Kano State Government has no operational Wastewater treatment plant. The

ineffectiveness is due to lack of legal framework, inadequate funding, lack of political will, non-inclusion of private partners as well as high-cost implementation with no concept of capital recovery.

Regardless of the existing inadequacies faced in the state, sanitation issues in the State become more challenging during the rainy season. This often leads to an outbreak of water-borne diseases.

3.3 STRATEGIES AND THE WAY FORWARD

Sustainable development requires sustainable wastewater management (SWM) (Kärrman, 2001). The shift towards sustainable practices makes it important to come up with strategies that can be adapted. For the purpose of this research, three strategies are looked at in terms of having a good wastewater management system, they include; laws& policies, institution & stakeholders and technologies. Figure 7 shows the three strategies involved and highlights the parties, resources and processes needed for a successful management system. In order to understand the strategies better, figure 8 shows the links and relationships between the strategies and how they are mostly interconnected.

4 CONCLUSION

The current management approaches in the selected States do not consider all elements of wastewater cycles from production to final disposal/ safe re-use. Virtually all the wastewater treatment plant was designed based on the (estate population statistics) as large parts of the community are not connected to the sewage network.

There are no records of effluents parameters, hence, it is very difficult to analyse any environmental hazards if exit. There is zero re-use of treated wastewater, therefore, the need for optimization of the re-use wastewater should be encouraged. For example, Kano state requires adequate infrastructural development to meet the growing population. If and when provided with effective management, the wastewater can serve as a source of nutrient for agriculture, drought – resistance source of water as well as a soil fertilizer.

The assessment also revealed that institutional responsibilities for wastewater need improvement. Wastewater needs to be commercialized and reformed utilities should see value in investing in wastewater infrastructure. Otherwise, it will be difficult to apportion responsibility for the impacts on health and the environment. There is a need for mechanisms to agree on standards for monitoring and enforcement.

In the presence of wastewater parameters, effective wastewater treatment, re-use could bring opportunities to sustainable development to achieve this goal a strong and effective governance is required with regulations backed up by monitoring, control, and enforcement.

The government should know that water pollution affects public health, the environment, local economic activities and national competitiveness (e.g. environmentnl standards as non-tariff barrier in international trade.

As a result of the above, the cost of inadequate investment is far, far greater in terms of actual money spent and also (both direct and indirect) damages to health and socioeconomic development. In order to create a sustainable system, policies are therefore needed to support more effective wastewater pricing systems that permit sufficient cost recovery, ensure adequate investments and give room to long-term operation and maintenance.

Figure 7: Strategies

Figure 8: Links between strategies

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