

Solid waste management practices in an indigenous Nigerian city: a case of Alesinloye in Ibadan

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Abstract

Solid waste management (SWM) is an essential urban service in every human settlement. Despite its importance, cities globally struggle to guarantee its provision even in developed countries. This study examines SWM practices in Alesinloye, Ibadan, Nigeria. A structured questionnaire prepared with KoboCollect was used to interview 182 households using a convenience sampling technique. Findings revealed that households are predominantly married youth with formal education and largely from the Yoruba ethnic group. It further established that food constitutes the leading solid waste component in households. The food waste, along with other waste materials generated, was disposed of mixed because there is no waste sorting system. The households mainly adopt unhygienic and unsustainable approaches such as disposable polythene bags and open space to store solid waste generated temporarily. The private waste firm was primarily responsible for solid waste collection using door-to-door (kerbside) methods in providing its service. The solid waste collection is mostly executed weekly, and the majority of the households consider it suitable. The households paid users' charges of between ₦500 (\$1.09) and ₦ 2000 (\$4.35) monthly, and the variations were attributed to mainly waste quantity. While 75.2% of the households expressed satisfaction with users' charges on solid waste services, 78.6% were unwilling to pay more for improved services, thus indicating the value placed on environmental quality. Finally, the study recommends the establishment of a SWM system towards zero waste community; the establishment of a waste management committee to serve as environmental stewards; the intensification of public campaigns and awareness of the importance of sustainable SWM, and the resuscitation of the Alesinloye recycling plant.

Keywords: Ibadan, solid waste collection, storage receptacle, users' charges, willingness to pay

Introduction

Solid waste management (SWM) concerns cities worldwide (Aryampa et al., 2019; Naftal et al., 2019). The SWM challenges in developing countries have been attributed to population growth, culminating in unprecedented waste quantity (Naftal et al., 2019). Because cities cannot effectively and efficiently manage the waste, most households resort to self-help and unethical approaches such as burning, and dumping in drainage channels, roadsides, and other unauthorized places (Adepoju, 2022; Lawal, 2023; Mudiare et al., 2016; Ogunseye & Kadiri, 2017). These alternative disposal methods have also been linked to the low efficiency of municipal solid waste agencies (Olukanni et al., 2020), and have resulted in grave consequences for cities in the form of flooding, pollution, mortality, disease infestation, and destruction of aquatic habitats amongst others (Adepoju, 2022; Mangoro & Kubanza, 2023).

This study is organised as follows. The next section presents a brief literature review on SWM in Nigerian cities. The third section focuses on the description of the

study area and the procedures for data collection and analysis. Section four is about the discussion of results, while the fifth section is where the study concludes with recommendations.

Brief Literature Review

Much research has been conducted addressing SWM in Nigerian cities. These studies examine solid waste issues comprising waste collection (Aliu et al., 2014; Wahab & Ola, 2018), storage (Afon, 2008; Chukwu, 2023), recycling (Ogunseye, 2015; Ogunseye et al., 2020), and disposal (Mudiare et al., 2016; Ogunseye & Kadiri, 2017). Specifically, some studies addressed satisfaction with service coverage, user charges, willingness to pay, and public-private partnership. Despite the research efforts, the solid waste problems have defied solutions, thus a need to understand the underlying issues of the SWM practices in Nigerian cities to achieve sustainable SWM.

The issue of willingness to pay for SWM services in Osogbo metropolis (Nigeria) was examined by Adepoju et al. (2017). The study revealed that the majority (87%) of the respondents were willing to pay for improved waste service. Still, the majority were only willing to pay less than

5% of their monthly income on waste management services. Oloruntade et al. (2013) study in Akure city revealed that different approaches to waste collection exist, which include house-to-house, collection from roadside storage areas, street cleaning and collection of municipal solid waste from the streets, and households in handcarts. In addition, households deposit their waste in communal bins for agencies saddled with waste management to pick up. However, the waste collection activities in Akure city are the responsibility of both the state and local governments. Each owns a fleet of waste collection vehicles, considered inadequate but still takes care of 90% of the collection problems if all the vehicles are operational. Aliu et al. (2014) studied the performance of public private partnership (PPP) in Lagos (Nigeria), and findings showed that waste generated weekly is higher in high residential-density areas than in medium residential-density areas. Additionally, service providers visit on a selected day in the week to collect household wastes already bagged and positioned in front of residences. Moreover, the performance of the PPP in waste collection was connected to the level of accessibility aided by the improved road network in Lagos. Furthermore, PPP performance through operational quality was influenced by the type and quality of equipment as well as the personnel in charge of them, which proved decisive among other indicators. Finally, the residents have a strong perception of PPP as a waste collection policy framework, thus indicating the synergy between the government and the private sector has enhanced the modes of operation of waste collection and treatment.

Research efforts have also not been in doubt regarding SWM in Ibadan, Nigeria. Oludare and Awodumi (2020) assessed the profitability of investing in SWM at local government by private investors in Ibadan and results indicated that 35% of dwellers who do not have waste bins but are ready to acquire one were willing to pay ₦1500 whereas 64% are willing to pay between ₦1200 and ₦1,500. From the number of buildings identified in the study area, it was concluded that ₦1.5 million can be raised monthly from the residents to cater for SWM. This, in turn, will engender unemployment reduction and contribute significantly to environmental cleanliness. Salami (2019) evaluated the effectiveness of solid waste recycling projects in the Alesinloye market in Ibadan. Findings revealed that the project brought about cleanliness in the market environs and generated income for the market. Additionally, before the commissioning of the recycling project, 95.2% of the traders disposed of their waste by themselves with 51.1% of the traders disposing of waste in the public dumpsite. Also, due to the proximity and accessibility of the waste bin provided by the Alesinloye recycling plant, the majority (78.8%) do not pay for waste disposal. Wahab and Ola (2018) investigated the effects of seasonal changes on the types and volume of waste handled by the informal waste collectors, patronage level and income earned in five local

government areas of Ibadan. Findings showed that the patronage level of the informal waste collectors dropped by 25% during the rainy season due to a decrease in waste volume generated and increased burning among residents. In addition, income realized by informal waste collectors declined as the number of daily collection trips made during this period dropped correspondingly.

Since the solid waste problem is region-specific (Rossit & Nesmachnow, 2022), the situation at a location must be captured for the proper deployment of appropriate solutions to address the specific problem associated with the study area, such as in the developing countries (Byamba & Ishikawa, 2017). The aim of this study is to explore the SWM practices in Alesinloye in Ibadan, southwestern Nigeria. The specific objectives of the study are to: i) examine issues of solid waste storage and collection in the study area, and ii) evaluate households' satisfaction with solid waste users' charges and their willingness to pay more for improved solid waste services in the study area. The significance of this study is that it will improve SWM in Alesinloye, Ibadan as well as inspire the implementation of SWM policy in other neighbourhoods in the local government area, and by extension in towns and cities sharing similar attributes across the States in the federation and particularly in developing countries.

Methodology

Description of Study Area

Nigeria (Figure 1) is the most populous country in Africa with a population of over 200 million. It is situated between latitudes 4° E and 14° E and longitudes 2° N and 15° N. It covers an area of 923,768 km² which makes it the 32nd largest country in the world. It is bordered to the west by the Benin Republic, to the east by the Cameroon Republic, to the north by Niger Republic, and the south by the Atlantic Ocean (Badejo, 2014).

Oyo State is located in the southwestern region of Nigeria. It is bordered to the north by Kwara State, to the east by Osun State, and the south by Ogun State, and shares its western boundaries with the Republic of Benin. Its topography varies in elevation from about 520 metres in locations such as Igbeti, Irawo, Ogboro and Aba Iseyin in the north to about 65 metres near the southern border with Ogun State around Igbo Ora in Ibarapa area (Lawal et al., 2022).

Ibadan is the administrative capital city of Oyo State and is situated within the coordinates of 7° 25'E and 7° 45'N latitude, and 3° 40' E and 3° 70' N longitudes. Ibadan is the third largest city in Nigeria behind Lagos and Kano with a reputation as a significant commercial, industrial and administrative centre in Nigeria (Adekunle, Sangodoyin & Wahab, 2020). Besides, Ibadan is one of the fastest-growing cities in Nigeria. According to the Census Population Report, its population was 1,829,300 in 1999

and 2,560,853 in 2006 with a growth rate of 2.22% per annum. By the growth rate adopted by the Ministry of Budget and Planning, Micro-Statistics Department of Oyo State, Ibadan was projected to reach 4,372,902 by the year 2023 (Tomori, n.d.). As a metropolis, Ibadan is made up of 11 local government areas (LGAs) and they include Ibadan Southwest, Ibadan Southeast, Ibadan North, Ibadan Northeast, Ibadan Northwest, Lagelu, Ido, Oluyole, Akinyele, Egbeda and Ona Ora.

Aleshinloye is a residential neighbourhood in Ibadan southwest local government area that hosts several landmarks comprising Aleshinloye Market, Aleshinloye Public Health Centre and the National Museum. Additionally, there is a waste recycling facility aimed at converting solid waste into valuable resources but currently, the recycling plant is not operational. The residential neighbourhood contributes a fair share of solid wastes generated in Ibadan city which requires adequate and efficient management to address the health, aesthetic and environmental impacts of solid waste.

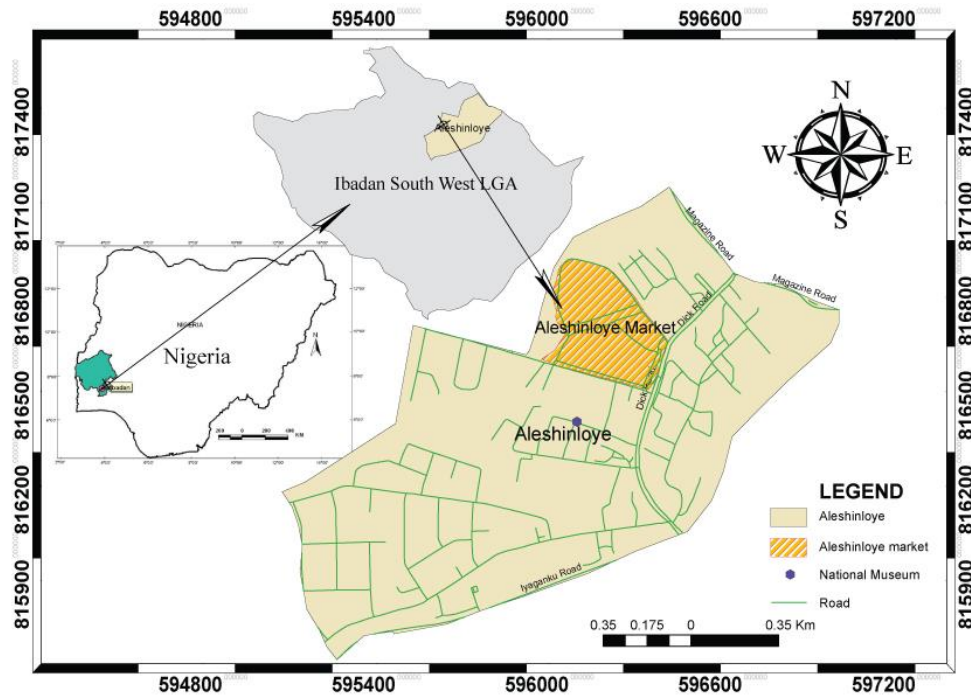


Figure 1: Map of the study area

Study Methodology

This study employed a cross-sectional research design. Data for this study were gathered from a combination of primary and secondary sources. Primary sources constitute the administration of questionnaires and direct observation. Secondary sources such as journal articles, books, dissertations, and consultancy publications were explored and provided the foundational information upon which this study is based. The target population of this study is the residents of the Aleshinloye in Ibadan, Oyo State, Nigeria. The residents comprise the study population since the study focuses on household SWM.

This study relied on the questionnaire as a survey instrument and augmented with direct observation. The questionnaire, primarily made of close-ended questions, was prepared using the KoboCollect. The questionnaire comprised questions about residents' socioeconomic characteristics, perceptions of SWM practices such as waste generation and separation, storage receptacles, responsibility for waste storage, location of waste storage

receptacles, waste collection methods, collection frequency and suitability in the study area. Moreover, there are questions bordering on residents' satisfaction levels with the fees charged by waste collectors and their willingness to pay more for improved services. KoboCollect was employed because of its nature to conduct paperless research and record data in complex formats (Nampa et al., 2020).

Since the population figure of the residents is not available at the time of the study, the buildings within the study area constitute the sample frame. The total number of buildings in Aleshinloye was found to be 1,654. The number of buildings was obtained through satellite imagery made possible by Google Earth software and was ground truth during the reconnaissance survey. Afterwards, the sample size for the study was determined using Taro Yamane's formula (Israel, 2003). The formula is presented below:

$$n = \frac{N}{1 + N(e)^2}$$

where

n = Sample

N = Total population = 1,654

1 = 1 is constant

e = error limit or margin of error (0.07)

Using Taro Yamane's formula, a sample size of 182 questionnaires was appropriate for the study. Additionally, a convenience sampling technique was employed, meaning that the participants were selected based on their accessibility and willingness to participate in the study. The study was conducted between 25th January and 2nd February 2023. Descriptive statistical tools such as frequency tables, bar charts, and pie charts were employed for data presentation.

Results and discussion

Socioeconomic Characteristics of the Respondents

This study captures the socio-economic characteristics of the respondents in the study area since it focuses on households. Consequently, various attributes of the respondents, including gender, ethnic affiliation, age, marital status, educational level, occupation, and income were examined. The findings indicated that male respondents were 68.1% whereas female respondents were 31.9% (Table 1). It is noteworthy that the study did not give priority to a particular gender of the respondents instead those willing to participate in the study were sampled. As presented in Table 1, the ethnic composition of the respondents showed that Yoruba accounted for 80.8%, followed by Hausa (13.7%) and Igbo (5.5%). Ibadan is home to Yoruba although other tribes such as Hausa, Igbo, and Ijaw, among others, inhabit the new residential areas in the city (Kayode & Omole, 2011). The heterogeneity in population due to the culture, lifestyles and habits was argued to have influenced waste composition in Ibadan. The age distribution indicated the more significant proportion fell between 25-34 years old (43.4%). Almost 64.0% of the respondents were married which thus implies the potential for increased population growth that influences waste generation (Kayode & Omole, 2011; Naftal et al., 2019). A majority of the respondents had formal education (61.5%), meaning that the respondents will be disposed to innovation in SWM. While a larger percentage (76.2%) were gainfully employed, the majority (64.3%) were self-employed (Table 1). The results corroborate Kayode and Omole's (2011) study, indicating that a more significant proportion of households in Ibadan metropolis trade to earn a living. The data obtained on income showed that the respondents belong to the low- and medium-income groups. The household size results from Table 1 revealed that 53.7% of the households comprised 2-4 persons, 31.0% of households consisted of 5-7 persons, and 31.0% constituted 1-person households.

Solid waste generation

This study also provides insights into the composition of solid waste emanating from the households in the neighbourhood. Results from Table 2 indicated that food was the most generated waste. This is closely followed by polythene (81.9%), cans/tins (60.4%), paper (59.9%), and plastic (41.8%). The least of the generated wastes were glass and wood. The findings corroborate previous studies (Kayode & Omole, 2011; Wahab & Ola, 2018) which established that food and other organic matters constitute the largest part of the waste generated in the Ibadan metropolis. This result further validates the stance that biodegradables form a major part of household waste in developing countries, particularly among the low-income group (Adekunle, Sangodoyin & Wahab, 2020; Alabi, Kasim & Lasisi, 2020). Consequently, an understanding of the types of solid waste generated in the neighbourhood is crucial for developing effective waste management policies towards tackling solid waste problems. Additionally, the findings indicated the need to pay attention to food waste and other organic matters that emit greenhouse gases such as methane and CO₂ into the environment which have implications for climate change (Fawzy et al., 2020).

Solid waste sorting and storage

Waste sorting is not currently practised among the households in the study area because the waste sorting system is not in place. The implication of this is that solid wastes are disposed of mixed together. To temporarily store waste, about 60.0% of the respondents used disposable polythene bags (Figure 2), 54.9% stored waste in open dumps, and 40.0% used baskets (Table 3).



Figure 2: Solid waste stored in polythene bags before collection along Dick Road, Ibadan

The result is in contrast with the study of Hamed et al. (2011) where below average (48%) of the households of Orita-Aperin in Ibadan stored their waste in polythene bags. Open dumping, which is next to polythene bags, was considered the predominant solid waste disposal method in Nigeria (Olukanni et al., 2020).

Table 1: Socioeconomics characteristics of the respondents

	Frequency	Percent		Frequency	Percent
Gender			Age		
Male	124	68.1	18-24	28	15.4
Female	58	31.9	25-34	79	43.4
Total	182	100.0	35-44	54	29.7
Marital status			45-54	21	11.5
Single	41	22.5	Total	182	100.0
Married	117	64.3	Household size		
Separated	24	13.2	1 person	22	12.0
Total	182	100.0	2-4 persons	98	53.7
Monthly income			5-7 persons	56	31.0
Less than N30,000	29	15.9	8-10 persons	6	3.3
N30,001-N60,000	67	36.8	Total	182	100.0
N60,001-N90,000	67	36.8	Ethnic affiliation		
N90,001-N120000	14	7.7	Yoruba	147	80.8
Above N120,000	5	2.8	Hausa	25	13.7
Total	182	100.0	Igbo	10	5.5
Occupation			Total	182	100.0
Civil servant	11	6.0	Educational level		
Private sector	29	15.9	No formal education	70	38.5
Self-employed	117	64.3	Primary	31	17.0
Retiree	3	1.7	Secondary	47	25.8
Student	21	11.5	Tertiary	34	18.7
No response	1	0.6	Total	182	100.0
Total	182182	100.0			

Source: Authors' Field Survey (2023)

Table 2: Solid waste generation by household

Solid waste type	Frequency*	Percent*
Food	167	91.8
Paper	109	59.9
Textile	31	17.0
Plastic	76	41.8
Cans/Tins	110	60.4
Glass	8	4.4
Wood	8	4.4
Rubber	27	14.8
Ceramics	30	1.7
Garden waste	56	30.8
E-waste	56	30.8
Polythene (nylon)	149	81.9
Leather	27	14.8

Note: *Based on multiple responses from households.

Source: Authors' Field Survey (2023)

These findings highlight the need to promote appropriate solid waste containers or bins among households. Responsibility for waste storage was found to be shared among various family members. Approximately 39.0% of the respondents stated that any family member took on this responsibility, while children, mothers, fathers, guards, and maids also had roles in waste storage,

albeit to varying degrees (Table 3). Regarding the location of solid waste storage receptacles, the majority (68.1%) were placed within the compounds of households, with 18.7% located within buildings and 13% outside the compounds (Table 3). Overall, the study emphasizes the importance of raising awareness, providing education, and promoting the adoption of sustainable SWM practices such as waste sorting and appropriate storage receptacles.

Solid waste collection

Table 4 presents an analysis of waste collection responsibility. Results indicated that 65% of the respondents claimed that private waste firms collect the generated waste in the study area and 16% attributed waste collection to the Oyo State Solid Waste Management Authority (OYOWMA). Marginal proportions of 9%, 6%, and 4% stated that individual households, cart pushers (informal waste collectors), and local government were responsible for waste collection, respectively. However, a greater proportion saying private waste firms could be linked to the privatisation of SWM in Oyo State. The involvement of the private sector in solid waste collection in Ibadan had earlier been reported in studies (Ike et al., 2018; Wahab & Ola, 2018).

Table 3: Solid waste sorting and storage

	Frequency	Percent		Frequency	Percent
Solid waste sorting			Storage responsibility		
Yes	0	0	Father	13	7.1
No	182	100	Mother	22	12.1
Total	182	100	Children	51	28.0
Storage receptacle			Any family member	71	39.0
Refuse bag (polythene)	109*	59.9	Maid	1	0.6
Metal bin with cover	11*	6.0	Guard	13	7.1
Metal bin without cover	15*	8.3	No response	11	6.1
Plastic bin with cover	14*	7.7	Total	182	100.0
Plastic bin without cover	19*	10.4	Receptacle location		
Bucket	17*	9.3	Within the building	34	18.7
Basket	73*	40.1	Within compound	124	68.1
Open space/dump	100*	54.9k	Outside compound	24	13.2
			Total	182	100.0

Note: *Based on multiple responses from households; Source: Authors' Field Survey (2023)

Table 4: Solid waste collection

Collection methods	Frequency	Percent	Collection responsibility	Frequency	Percent
Door-to-door	150	82.4	Government agency	29	15.9
Communal bin	31	17.0	Private waste firm	119	65.4
Others	1	0.6	Individual household	16	8.8
Total	182	100.0	Cart pushers	11	6.0
Collection frequency			Local government	7	3.9
Daily	20	11.0	Total	182	100.0
Weekly	117	64.3	Suitability of time		
Twice weekly	17	9.3	Very suitable	94	51.6
Once in two weeks	7	3.9	Suitable	62	34.0
Monthly	20	11.0	Unsuitable	15	8.2
Never	1	0.6	Very unsuitable	11	6.0
Total	182	100.0	Total	182	100.0

Source: Authors' Field Survey (2023)

However, in contrast, Jazat et al. (2023) reported a greater government involvement in solid waste collection in Ibadan North, Ibadan Northwest and Ibadan Northeast LGAs. The private sector arrangement in Ibadan was geared towards offsetting “governmental bureaucracy, cost saving and sustained hygiene and health benefits” (Sridhar & Hammed, 2014, p. 199). Concerning the waste collection methods, results showed that the door-to-door approach (82.4%) was the most predominant while communal bins accounted for 17.0%. From Table 4, most of the respondents (64.3%) stated that waste collection occurred every week. However, approximately 86% of the respondents admitted to the suitability of the once-a-week, thus suggesting households are satisfied with the timing of waste collection. The frequency needs to be improved considering that the neighbourhood is of high residential density.

The residents paid varying user charges for waste collection in the study area. Data analysis revealed 35% of

the respondents paid ₦1,500 (\$3.26), followed by 32% who paid ₦2,000 (\$4.34) and 10% stated they paid ₦1,000 (\$2.17) (Figure 3) and with direct payments to private waste collectors as the most common method (Figure 4). The proportion of households who did not pay for waste collection services may be associated with illegal dumping (Figure 5) activities observed in the study area during the field survey. The users' charges for waste collection services were mainly determined by the waste quantity (63.7%). In contrast, some households opined that family size, number of rooms and housing type are the determinants of the users' charges (Figure 6).

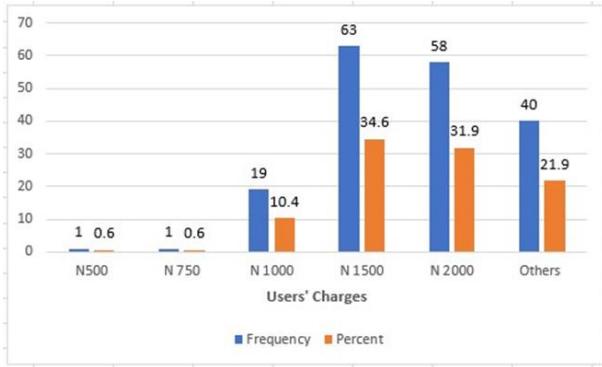


Figure 3: Users' charges for solid waste collection services

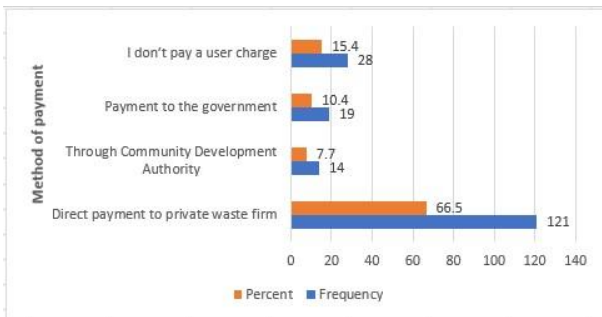


Figure 4: Method of payment for solid waste collection



Figure 5: Illegal solid waste dumping along Dick Road, Ibadan

Satisfaction Level with Users' Charges and Willingness to Pay More for Improved Services

This study further probed if households are satisfied with the users' charges for waste collection services. Despite greater satisfaction recorded among households regarding users' charges (Figure 7), the majority of respondents (78.6%) were not willing to pay more for improved services (Figure 8). The result implies the value households place on environmental quality. The result aligns with the study of Oludare and Awoduni (2020) where residents (35%) expressed willingness to pay ₦1500 and 25% were willing to pay less between ₦1200 and

₦1500. This suggests that residents knew of the users' charges applicable in other parts of the Ibadan metropolis. These findings can inform decision-making related to SWM financing and the improvement of waste collection services in the study area. It is, therefore essential for an SWM agency or organisation to be cautious in the manner of increments in users' charges. This is because high-cost users' charges may compel households to dispose of their waste by less costly methods (Olukanni et al., 2020).

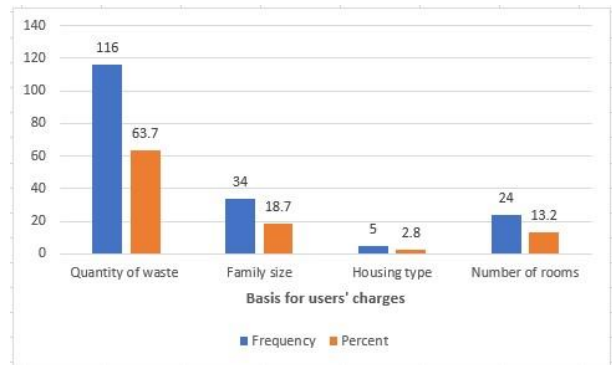


Figure 6: Basis for the users' charges

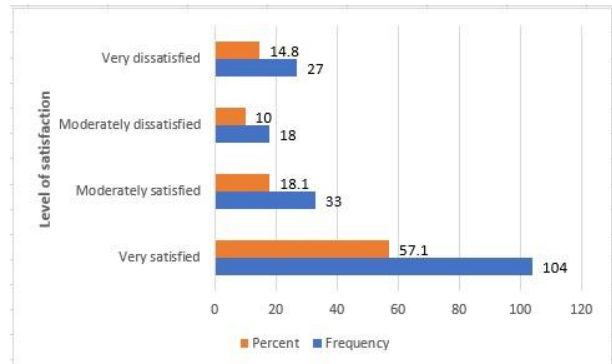


Figure 7: Satisfaction level with users' charges

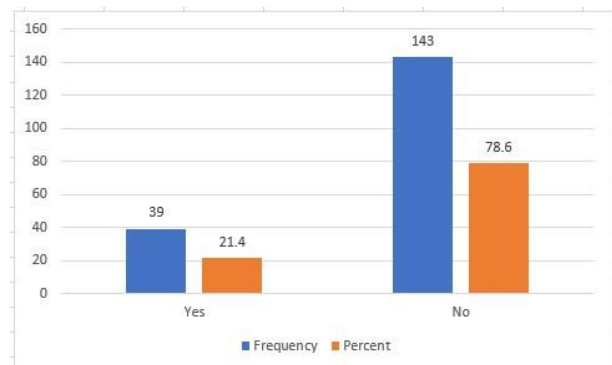


Figure 8: Willingness to pay more for improved services

Conclusions

This study focused on neighbourhood perception of SWM practices in an indigenous Nigerian city and shed light on various aspects of SWM practices in Alesinloye, Ibadan, Nigeria. The study revealed that more males

participated in the study than females. The residents are composed of people of diverse ethnic affiliations though primarily from the Yoruba ethnic group. Almost three-quarters of the residents were youth, approximately two-thirds were married, and about three-fifths had obtained formal education. The primary composition of solid waste generated by households includes food, polythene, cans/tins, paper and plastic. Households primarily use disposable polythene and open spaces to temporarily store waste generated even though the methods are not sustainable. The dominant role of private waste firms as waste collectors was evident perhaps due to the privatization of SWM in Oyo State. The door-to-door collection emerged as the most common method, thus emphasizing the importance of convenience and accessible waste collection services. The waste collection occurred majorly every week, yet a majority of the households were satisfied with the arrangement. It can also be observed that some households still get involved in illegal dumping despite the provision of communal bins in a few locations within the study area.

Based on the findings, the following recommendations are put forward to improve SWM in the study area (Alesinloye).

The Oyo State government should do more than just privatise SWM rather they should institute a SWM system that will position the State towards achieving a zero waste community. This is achievable if an enabling environment is provided for stakeholders, including waste generators, Oyo State Solid Waste Management Authority (OYOWMA), the private sector, non-governmental organisations, community-based organisations and the informal waste sector to collaborate.

There is a need to actively engage the community by establishing a waste management committee. The committee should include volunteers serving as environmental stewards to ensure households comply with best practices in SWM. On the other hand, OYWMA should oversee the activities of the private waste firms in charge of solid waste collection to ensure that quality service delivery to the households is guaranteed.

The Oyo State government and the private consultant on SWM should intensify efforts on public campaigns and awareness about the importance of sustainable SWM. This can be achieved through school programmes, community workshops and public outreach initiatives.

The resuscitation of the Alesinloye recycling plant should be pursued as a matter of urgency by the appropriate authorities. The recycling plant will help process recyclables from the solid waste generated and thus reduce the quantity of non-biodegradable waste that may end up in landfills.

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Author contribution

Conceptualization, Ogunseye N. O. and Lawal A. O.; methodology, Ogunseye N. O. and Lawal A. O.; formal analysis, Ogunseye N. O. and Lawal A. O.; investigation, Lawal A. O.; writing—original draft preparation, Ogunseye N. O. and Lawal A. O.; writing—review and editing, Ogunseye N. O. All authors have read and agreed to the published version of the manuscript.

Conflicts of interest

The authors declare no conflict of interest.

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