Operators' perceptions of abattoir waste management: evidence from a semi-urban Nigerian city

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Abstract
This study appraises abattoir operators' perceptions of waste management at Ijebu Igbo Abattoir in Ogun State, Nigeria. A cross-sectional survey approach was adopted in this study. A structured questionnaire was used to elicit data from 127 abattoir operators using a random sampling technique. One hypothesis was formulated and tested. Data were analysed using both descriptive and inferential statistics. Major findings revealed that abattoir operation is male-dominated (57%) with considerable youth involvement. Findings also revealed that current waste management practices at the abattoir were unsatisfactory. It was found out that recycling of abattoir waste is yet to be fully harnessed despite the existing potentials. Chi-square (χ^2) tested result established a statistically significant relationship between abattoir operators' socio-demographic characteristics and their perceptions of waste collection effectiveness. Finally, the study presents recommendations comprising the urgent preparation of abattoir waste management (AWM) guideline that must involve relevant stakeholders; the need to harness abattoir waste recycling opportunities to maximize benefits such as hygienic abattoir, enhanced employment opportunity and wealth creation; the implementation of innovative waste management approaches; and the upgrade of abattoirs basic facilities to promote and improve sanitation within the abattoir facility, with a view of achieving sustainable abattoir waste management at the Ijebu Igbo Abattoir and facilities with similar attributes.

Introduction

Abattoir (or slaughterhouse) is a specialised facility that requires accreditation by governing authority for slaughtering, processing, preservation and storage of meat for human consumption (Obidiegwu et al., 2019). Bello and Oyedemi (2009) state that abattoir, among other neighbourhood facilities, sometimes has locational disadvantages surpassing its advantages. This is because poor waste management within abattoir facility poses risk on human health and the environment. Despite the crucial role of an abattoir, it remains a major waste generator. Abattoir wastes are considered potential polluter of the surface and underground waters as well as the air quality, which pose health challenges to the residents living in the abattoir's vicinity (Bello

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and Oyedemi, 2009; Fadare and Afon, 2010; Bandaw and Herago, 2017). The environmental hazard and health risks imposed by abattoir facility made its siting a concern to researchers. Further, the increasing concern informed various studies on abattoir globally including Nigeria. Studies regarding abattoir have explored various dimensions ranging from the impact of abattoir on residents' health and the environment giving considerations to the proximity of residents' house to abattoir (Bello and Oyedemi, 2009; Abdullahi *et al.*, 2015; Ekpo, 2019; Dada *et al.*, 2020; Daramola and Olowoporoku, 2015); waste types generated along with waste handling practices deployed at abattoirs (Fadare and Afon, 2010; Omole and Ogbiye, 2013; Oruonye, 2015; Adeolu *et al.*, 2019; Ademola, 2019); wastewater treatment systems of slaughterhouses (Masse and Masse, 2000); sanitation at abattoir Adeolu et al., 2019; Obidiegwu et al., 2019]; to abattoir operations (Fearon *et al.*, 2014; Officia, *et al.*, 2018; Adebowale, 2019). Adeolu et al. (2019) decry the poor sanitary operation at abattoir that deserves attention towards averting severe environmental and health effects on residents and workers. Omole and Ogbiye (2013) posit that dung, paunch contents and blood emanating from slaughterhouses operation pose a great threat to the environment. Based on the negative impacts of the abattoir on residents living within its vicinity, Bello and Oyedemi (2009) recommend that abattoir should not be sited within residential neighbourhoods due to lack of special disposal system. Dada et al. (2020) note that legislation guiding Nigeria's slaughterhouse operations focused on animal inspection by veterinary medicine experts and transportation of slaughtered animals but lacks legislation addressing abattoir waste management (AWM). This continuous neglect was echoed by Oruonye (2015) who states that abattoir has not received the government attention over time due to perceived low-income generation. Ekpo (2019) concludes that inadequacy of sanitary operational environment exposed the health of staff, customers, residents and host communities to risk of water borne diseases. This situation is aggravated by physical environmental implications in form of unsightly scenes coupled with odour attracting flies, mosquitoes, rodents and other diseases vectors. Similarly, Officia *et al.* (2018) report that the impacts of abattoir on environment manifested in form of air, water and soil pollutions; filthy environment; drainage system blockage; and flies' infestation and health effects. Daramola and Olowoporoku (2015) affirm that residents belonging to

the low income group bear the brunt of the prevalence of disease vectors while the proximity of abattoir determines the extent of impacts on environment and humans. Despite previous studies on abattoir focusing on operations, waste management and its associated impacts on the environment and public health in Nigeria, Ezeoha and Ugwuishiwu (2011) posit that further studies are required to address the AWM problems. Specifically, studies regarding abattoir in Ogun State, Nigeria (where this study is conducted) barely focused on AWM but emphases have been on foetal losses and wastage recorded at the abattoir (Oyekunle *et al.*, 1992; Oduguwa *et al.*, 2013) as well as impacts of effluents on the environment and public health (Akindele et al., 2015). It was also observed that abattoir operators were scarcely engaged in studies of AWM despite being important stakeholders involved with abattoir operations daily. In this study, abattoir operators' perspectives on AWM were duly considered to address this gap. This study attempts to answer the following questions: who are the abattoir operators at the Ijebu Igbo Abattoir, Ijebu North LGA, Ogun State, Nigeria? what constitutes waste management system? what are the types of waste generated at the abattoir? does recycling potential exist at the abattoir? are there sanitation impacts due to existing abattoir waste handling practices? and who manages the abattoir operations? Given this background, this study aims at analysing abattoir operators' perceptions of waste management at the Ijebu Igbo Abattoir with a view of addressing problems towards effective waste management. Findings from this study would provide information for planners, environmentalists and policymakers not only at Ijebu Igbo Abattoir but abattoir with comparable characteristics.

Material and Methods

Study area

The case study, Ijebu-Igbo Abattoir, is situated in Ijebu North LGA of Ogun State, southwestern Nigeria. Nigeria is the most populous black nation in the world with a population of about 200 million. The country is made up of 36 states and a federal capital territory, which are further divided into 774 local government areas. It lies between latitude 4° and 14° and longitudes 2° and 15°. Nigeria covers a total area of 923,768km², which thus makes it the 32nd largest country (Badejo, 2014).
Ogun State is located at the extreme southwest of

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Nigeria. Geographically, the State is contained within longitudes 2°45′E and 4°45′E; and latitudes 6°15′N and 7°60′N and has a total land area of 16,762km². It is bounded on the west by the Republic of Benin, to the south by Lagos State and a 20km stretch of the Atlantic Ocean, to the east by Ondo and Osun States, and to the north by Oyo State Ogun State Government, 2008. Ijebu North LGA covers 969.02km² with a population of 213,612 as at 2003. This population has been projected to 423,594 by 2025 (Ogun State Government, 2008). The primary occupation of the residents of the LGA is farming although petty trading, milling, plank selling and cow selling are still predominant among them (Akinsulu et al., 2019). Ijebu Igbo Abattoir is located between latitude 6° and 7° North and longitude 3° and 5° east of the Greenwich Meridian (Figure 1). Ijebu-Igbo Abattoir is on land covering about 12 hectares and is sectioned into the areas, which are butchering section, rinsing section and dung pit. An approximate of 120-170 cows are slaughtered daily (Neboh et al., 2013), thus confirming its importance to the LGA and neighbouring towns and cities it currently serves. Additionally, the number of cows slaughtered daily indicates the quantity of waste generated at the facility, thus requiring effective management. More importantly, Ijebu Igbo Abattoir is one of the two largest abattoirs in Ogun State, the other being Lafenwa Abattoir (Oyekunle *et al.*, 1992) and is the only recognised abattoir in Ijebu North local government area (LGA) providing for the meat consumption of residents as well as customers from outside the LGA and Ogun State.
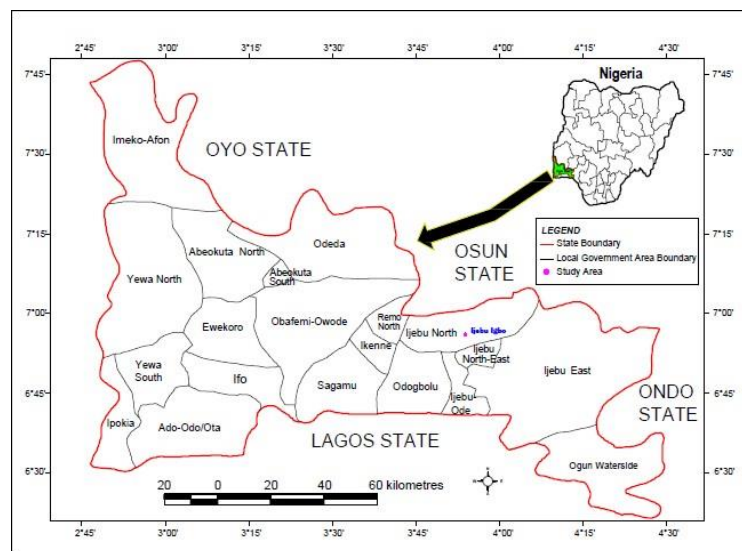

Figure 1. Map of study area.

Research design, population, sampling procedure, instrumentation and data analysis

This study adopted a cross-sectional survey approach to appraise abattoir operators' perception of waste management practices at Ijebu Igbo Abattoir, Ijebu North LGA of Ogun State in Nigeria. The cross-sectional design was used since the study focuses on finding out the prevalence of phenomenon or situation, and more importantly, involves only one contact with the target population (Kumar, 2011). The target population for this study are abattoir operators, that is business owners and workers within the abattoir. Both primary and secondary data were sourced for the study. The secondary sources consist of books, dissertation, government publication and journal articles, and they provide the background for this study. Primary data sources include a structured questionnaire and direct observation. The structured questionnaire was used to elicit information regarding the profile of abattoir operators, AWM and abattoir operations. The questionnaire was designed to include closed-ended and open-ended questions, an approach advocated by Krosnick and Presser (2009). While the close-ended question is used for specificity and make a comparison of results possible (Schuman and Presser 1981, as cited in Krosnick and Presser, 2009), the open-ended questions add richness to issues that appear difficult if not impossible to approach with close-ended questions (Schuman 1992, as cited in Krosnick and Presser (2009). A pilot survey conducted revealed 181 abattoir operators were involved in various

activities at Ijebu Igbo Abattoir but 127 operators were randomly sampled. The samples drawn were considered adequate because Yaro Yamane's formula for calculating sample size resulted in 125 abattoir operators. See Israel (2003) for Yamane's formula presented as equation [1].

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

where: n = Sample, N = Total population, 1 = 1 is constant, e = error limit or margin of error. It is usually accepted at 5% or 0.05.

Conversely, direct observation was employed on the strength to cover an event in real-time (Yin, 2009).
Data collected were analyzed with the use of the Statistical Package for Social Sciences (IBM SPSS Statistics 25) version. Both descriptive and inferential statistics were used for data analysis. The descriptive statistic entails the use of frequency tables and charts for data presentation whereas the inferential statistic (Chi-square [χ^2]) was used to test the hypothesis formulated at 0.05 significance level. The Chi-square (χ^2) equation is as shown in equation [2].

$$X^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i} \qquad [2]$$

where: O = observed frequency, E = expected frequency, n = number of categories

Hypothesis testing
Studies (Adzawla *et al.*, 2019; Yusof, *et al.*, 2002; Lakioti *et al.*, 2017) have shown that socio-economic or socio-demographic factors influence perception about waste management issues. In this study, operators' perceptions of an ideal waste collection in an abattoir may have been influenced by various factors. It is noteworthy that socio-economic or socio-demographic factors influence may be significant or not as previous studies on waste management have demonstrated. Consequently, this study attempts to establish if there is a significant relationship between abattoir operators' socio-demographic factors and their perceptions of waste collection effectiveness.
Based on the aforementioned, a possible statistical relationship between the socio-demographic variables (comprising gender, marital status, age, tribe, level of education, nature of work, income and years of work experience) and abattoir operators' perceptions of waste collection effectiveness were examined using Chi-Square tests. To achieve this objective, a hypothesis was

formulated and stated as follows:
H_o: There is no significant relationship between abattoir operators' socio-demographic characteristics and their perception of waste collection effectiveness
H_1: There is a significant relationship between abattoir operators' sociodemographic characteristics and their perception of waste collection effectiveness

Results and Discussion

Abattoir Operators' Socio-demographic Profile
A total of 127 abattoir operators participated in this study out of which 72 (56.7%) were males and 55 (43.3%) were females. Although a significant proportion of female was found in this operation, notwithstanding, findings indicate that abattoir operation is a male-dominated job in the study area. Above 52% of the respondents were married but 24.4% were single.
47.2% of the respondents are of the age 26 to 40 years, thus signifying greater youth involvement in abattoir operations (Table 1). Similar findings are reported in studies (Adeolu *et al.*, 2019; Obidiegwu *et al.*, 2019).
The majority (79.5%) of the respondents belong to the Yoruba tribe. This is rational since the study area is located in southwest Nigeria. The main ethnic composition of the Southwest zone is Yoruba. The Southwest is one of the Nigerian six geo-political zones and encompasses the lands of the Yoruba, the second-largest tribe in Nigeria after the northern Hausa-Fulani. The majority (68.6%) of the respondents had formal education whereas 31.5% had no formal education. The ratio of the literate to non-literate support the job categories that are obtainable at the Ijebu Igbo Abattoir, some of which do not require specialised skills. For instance, respondents sampled were engaged at the Ijebu Igbo Abattoir as cow owners/sellers (32.3%), labourers (27.6%), butchers (20.5%) and cleaners (19.7%) (Table 1).
The monthly income of the respondents indicated that 40.2% earned between ₦30,001 to ₦50,000 (US$83.30 to 138.90, US$ 1 = ₦360), 8.7% obtained ₦60,000 to ₦90,000 (US$166.7 to 250), and 15.7% took home above ₦90,000 (US$250). The remaining 35.4% of the respondents earned below ₦30,000 (US$83.3), the approved minimum wage in Nigeria by the Federal Government in 2019 and by extension adopted by Ogun State government (Table 1). Almost half (48.8%) of the respondents have been engaged at the Ijebu Igbo Abattoir for more than 20 years,

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43.3% had been involved between 5 to 10 years, and a marginal proportion (7.9%) have worked at the abattoir for less than 5 years. The results imply that a greater proportion is familiar with the abattoir operations and stand good stead to provide information regarding waste management practices within the abattoir facility (Table 1).

Table 1. *Sociodemographic profile of abattoir operators.*

Variable	Frequency	Percent	Variable	Frequency	Percent
Gender			**Tribe**		
Male	72	56.7	Yoruba	101	79.5
Female	55	43.3	Hausa	11	8.7
Total	*127*	*100.0*	*Igbo*	*15*	*11.8*
Marital status			*Total*	*127*	*100.0*
Single	31	24.4	**Age**		
Married	66	52.0	26-40 years	60	47.2
Divorced	15	11.8	41-55 years	47	37.0
Widowed	15	11.8	56-65 years	15	11.8
Total	*127*	*100.0*	Above 65 years	5	3.9
Level of education			*Total*	*127*	*100.0*
Primary	51	40.2	**Nature of work/involvement**		
Secondary	26	20.5	Cow seller/owner	41	32.3
Tertiary	10	7.9	Labourer	35	27.6
No education	40	31.5	Butcher	26	20.5
Total	*127*	*100.0*	Cleaner	25	19.7
Monthly income			*Total*	*127*	*100.0*
Less than ₦18,000	20	15.7	**Years of experience**		
₦18,001-₦30,000	25	19.7	Less than 5 years	10	7.9
₦30,001-₦60,000	51	40.2	5-10 years	55	43.3
₦60,001-₦90,000	11	8.7	11-20 years	41	32.3
Above ₦90,000	20	15.7	Above 20 years	21	16.5
Total	*127*	*100.0*	*Total*	*127*	*100.0*

Abattoir waste management

In this subsection, focus was shifted to abattoir waste management where issues pertaining to waste types, storage, collection, treatment and disposal were analysed and discussed. Table 2 demonstrates that various waste types are generated at the Ijebu Igbo Abattoir and these include animal dung (36.2%), blood (19.7%) and hair (44.1%). However, during the field survey, it can be observed that other waste types such as bones, paunch, undigested foods are being generated

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but the hair, animal dung and blood were predominant among other waste types generated at the abattoir, and very possibly abattoir waste with greater public health and environmental impacts. The prevalence of animal dung and blood as abattoir waste is consistent with the findings of studies (Bello and Oyedemi, 2009; Omole and Ogbiye, 2013; Adeolu *et al.*, 2019) despite being the minute parts by weight of the slaughtered animals (Omole and Ogbiye, 2013).

Again, the result indicated that no storage receptacle was provided (Table 2) as the wastes transit from the generation point to the dung pit (Figure 2). The result is contrary to findings of Fadare and Afon (2010) whose study established that diverse waste storage receptacles such as drum without cover, sacks and nylon bags were used for waste storage at sampled abattoirs although these receptacles were considered inadequate.

Table 2. *Abattoir waste management*

Variable	Frequency	Percent	Variable	Frequency	Percent
Waste type			**Waste storage receptacles**		
Animal dung	46	36.2	Open Space	127	100.0
Blood	25	19.7	*Total*	*127*	*100.0*
Hair	56	44.1	**Waste collection responsibility**		
Total	*127*	*100.0*	Government Sector	66	52.0
Waste collection Fee			Private waste collector firm	10	7.9
Yes	102	80.3	Cow seller/owner	51	40.2
No	25	19.7	*Total*	*127*	*100.0*
Total	*127*	*100.0*	**Effectiveness of waste collection**		
Amount of fee charged			Very effective	76	59.8
₦100-₦200	10	7.9	Fairly effective	46	36.2
₦201-₦300	36	28.3	Not effective	5	3.9
₦301-₦400	41	32.3	*Total*	*127*	*100.0*
₦401-₦500	5	3.9	**Waste collection Frequency**		
No specific amount	10	7.9	Once in a week	20	15.7
No response	25	19.7	Twice in a week	107	84.3
Total	*127*	*100*	*Total*	*127*	*100.0*
Recycling within abattoir			**Problem prior to waste collection**		
Yes	30	23.6	None	112	88.2
No	97	76.4	Air pollution	15	11.8
Total	*127*	*100.0*	*Total*	*127*	*100.0*
Purchase of abattoir waste			**Buyers of abattoir waste**		
Yes	107	84.3	Farmers	85	66.9
No	20	15.7	Industries	42	33.1
Total	*127*	*100.0*	*Total*	*127*	*100.0*
Products from abattoir waste			**Waste disposal method**		
Manure	35	27.6	Disposal outside abattoir	5	3.9
Animal feed	65	51.2	Dump in an open space	117	92.1
Ceramics	27	21.3	Burning	5	3.9
Total	*127*	*100.0*	*Total*	*127*	*100.0*

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Figure 2. *Waste (cow dung and paunch contents) collection from the butchering section.*

An attempt was made to determine whose responsibility is the waste collection at the abattoir. 52.0% of the respondents stated the government, 40.2% claimed the cow sellers and 7.9% opined private waste collection firm. Besides, the majority (84.3%) stated that wastes were collected twice a week while 15.7% said once a week. Furthermore, fees were charged for waste collected (80.3%) but 19.7% stated fees were not charged. The lack of awareness about the fee charged indicated non-involvement of some operators in waste management matters at the abattoir. The fees charged for the waste collection range from ₦100 to ₦500 (US$0.28 to US$1.39) but considerable proportion paid between ₦201 and ₦400 (US$0.56 and US$1.11). (Table 2). The variations suggest the amount charged was determined by waste quantity generated.

Further analysis as shown in Table 2 on the effectiveness of waste collection within the abattoir revealed that it was effective (59.8%), fairly effective (36.2%) and not effective (3.9%). Results also showed that marginal proportion (11.8%) considered waste as a problem before the routine waste collection within the abattoir. It was, therefore, surprising that abattoir operators do not perceive a delay in the waste collection as a problem despite its contribution to poor sanitary condition observed within the abattoir facility.

Regarding waste treatment within Ijebu Igbo Abattoir facility, the majority (76.4%) opined that there was no provision by the management to get abattoir waste treated (Table 2). This finding agrees with Akanni *et al.*'s (2019) conclusion that almost all the abattoir facility in Nigeria dispose of their waste on land or stream with or without pretreatment with grave implication for the aquatic environment. This inaction to abattoir waste treatment was also reported by Bello and Oyedemi (2009).

From the analysis presented in Table 2 on final waste disposal, 92.1% of the respondents affirmed the disposal of the waste generated through dumping in an open space while equal proportion (3.9%) stated burning and disposal outside the abattoir respectively. This result supports the findings of studies (Adeolu *et al.*, 2019; Fadare and Afon, 2010; Adebowale, 2019) that open dumping is the major waste disposal method at the abattoirs in Nigeria. In a study by Akanni *et al.*, (2019), this unrestricted dumping of abattoir waste resulted in the pollution of the nearby well and stream water, found to contain e-Coli and other harmful organisms from animal waste. However, deliberate action towards curtailing open dumping approach to abattoir waste disposal and channelling wastewater to the surrounding (Figure 3) would help address environmental hazard and risks associated with the unethical disposal methods. Franke-Whittle and Insam (2013) describe diverse possibilities for abattoir waste pretreatment, which include composting, alkaline hydrolysis and anaerobic digestion. Of these approaches and to a great extent, this study revealed composting seems to be in practice at the Ijebu Igbo Abattoir as cow dung are collected by farmers to be used as manure on their farms. However, alkaline hydrolysis and anaerobic digestion can be feasible options that could be harnessed as studies outside Nigeria have demonstrated their potentials to adequately cater for problems imposed by abattoir waste on the environment and public health.

Figure 3. *Untreated wastewater drained from the butchering. section.*

Perceived Values of Abattoir Waste

Further investigations were conducted to ascertain operators' perceived values of the various waste types generated at the abattoir. All the operators (100%) affirmed that abattoir waste consisting of animal dung, paunch, horn as well as hides and skin are useful and can be recycled. Also, a significant proportion (96.1%) of

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the respondents considered hooves as valuable abattoir waste materials while 11.8% perceived hair as useful
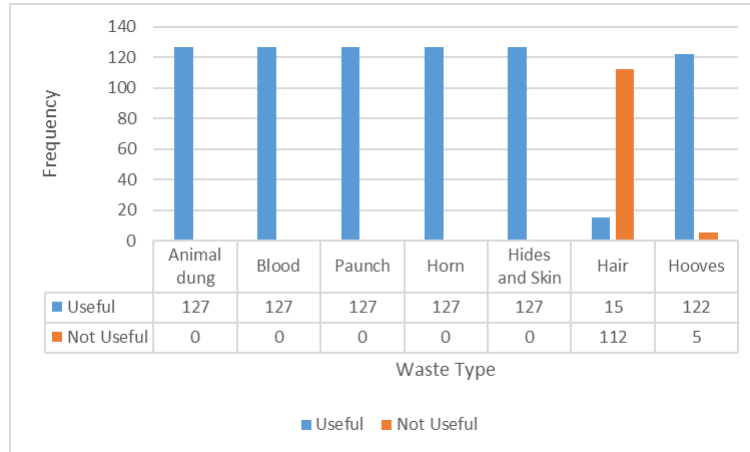
waste materials (Figure 4).

Figure 4. Perceived value of abattoir waste.

Furthermore, this study established the invaluable resource in abattoir waste with the visit of farmers and industries who purchase abattoir waste for the production of animal feeds, ceramics plates and buttons. This waste-to-wealth approach to waste management was also reported by Omole and Ogbiye (2013) in their study of slaughterhouses in southwestern Nigeria. However, Masse and Masse (2000) documented with regards to Canadian slaughterhouses, that most discarded animal parts are sent for recycling with the screen solids, skin, hair, and unusable interior (for example bad liver, lungs and spleen) are used in cosmetic production; pancreas for penicillin production; and blood is dried and transformed into an animal protein feed. The Canadian experience supports abattoir waste recycling potential. The management and other stakeholders must therefore

be willing to seek superior knowledge and be receptive to innovations about how best to maximize benefits from abattoir waste.

Abattoir Management

An investigation into the management of the Ijebu Igbo Abattoir revealed that the abattoir is managed by the Trade Unions (92.1%) and equal proportion (3.9%) stated government and private firm respectively (Figure 5). This result corroborates Oruonye's (2015) findings in which the Taraba State government in Nigeria handed over the Jalingo main abattoir to butchers association. The management of abattoir in most instances is coordinated by the government Ministries, Departments and Agencies though it may be privatized for efficiency.
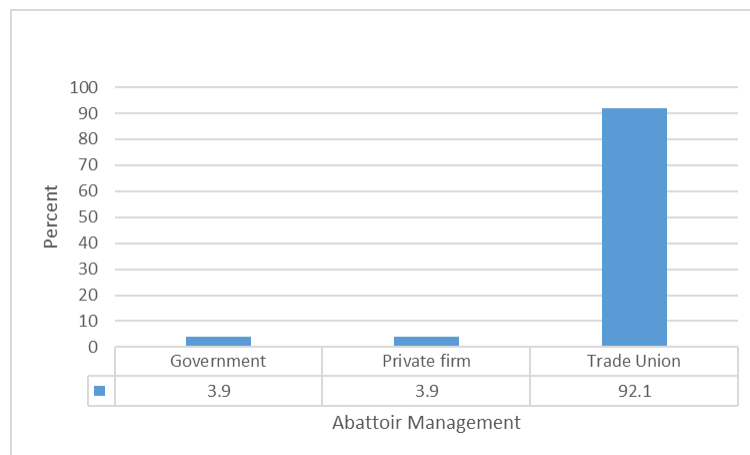

Figure 5. *Abattoir management.*

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Abattoir Facilities

For a smooth operation at a modern abattoir, and more importantly, to ensure sanitation is not compromised, basic facilities such as water supply, electricity and cold room (refrigeration system) are indispensable. In Table 3, the analysis indicated that borehole was the major water supply source (92.1%) at the Ijebu Igbo Abattoir facility. The results corroborate the finding of Bello and Oyedemi (2009) regarding abattoir activities in Ogbomosho, a traditional city in Nigeria. However, findings of Adeolu et al.'s (2019) study on Karu Abattoir showed the majority relied on tap water to meet water

requirements. Further, the result indicated that Ijebu Igbo Abattoir sourced electricity from the public main as supplied by the electricity service provider (ESP) (15.7%) and power-generating set (59.8%). The use of power-generating set as an alternative to electricity has implications for climate change due to carbon emission that would not only result in air pollution but contribute to global warming. The abattoir lacks cold room facility, and thus, operators resort to various preservation methods of meats and edible parts. The methods used include self/home preservation (55.9%), ice block (40.2%) and refrigeration (3.9%) (Table 3).

Table 3. *Abattoir facilities*

Variable	Frequency	Percent	Variable	Frequency	Percent
Water supply source			**Cold room facility**		
Borehole	117	92.1	Available	0	0
Well	10	7.9	Not available	127	100.0
Total	*127*	*100.0*	*Total*	*127*	*100.0*
Electricity source			**Alternative to cold room facility**		
Electricity service provider	20	15.7	Self/home preservation	71	55.9
Power generating set	76	59.8	Ice block	51	40.2
None	31	24.4	Refrigeration	5	3.9
Total	*127*	*100.0*	*Total*	*127*	*100.0*

Desirable improvements by the abattoir operators

Operators commented on areas they are desirous of witnessing improvement at the Ijebu Igbo Abattoir. These include the renovation of abattoir block (activity areas for butchering and rinsing), roads rehabilitation, electricity provision, refrigeration and waste management. But surprisingly, the renovation of the abattoir block (48%) was preferred above waste management (12.6%) (Figure 6). The majority clamouring for the renovation of abattoir block may be justified by some failed portions that are cracked, buckled or sunken in some instances causing uneven concrete floor.

Sanitation impacts

This study probed into sanitary condition, as perceived by the residents living within abattoir's vicinity and visitors to the abattoir, all the respondents sampled stated that there has not been any form of complaints. The non-complaints by the residents could be linked to the location of the residential neighbourhoods at a distance of more than one kilometre away from the Ijebu Igbo Abattoir. The closest developments are the farmers' house, station and meat markets. The absence of complaints, however, should not be a justification for the continual poor waste management practices observed but pre-emptive actions through an informed policy should be executed before residential developments spread to the site of the Ijebu Igbo

Abattoir facility. However, it is noteworthy that the Ijebu Igbo Abattoir facility has never been shut down as a result of poor sanitation as confirmed by 96.1% of the respondents (Table 4).
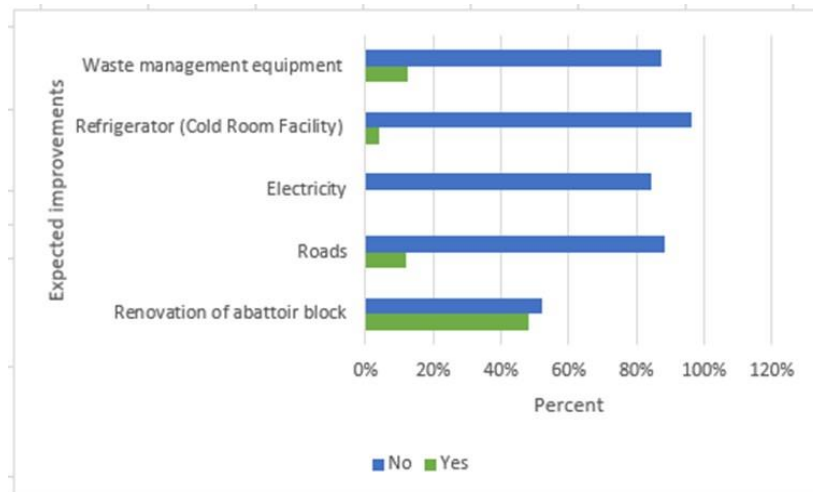

Figure 6. *Desirable improvements by the abattoir operators.*

Table 4. *Sanitation impacts*

Variable	Frequency	Percent
Complaints about sanitation		
Yes	0	0
No	127	100.0
Total	*127*	*100.0*
Shut down due to poor sanitation		
Yes	5	3.9
No	122	96.1
Total	*127*	*100.0*

Relationship between socio-demographic characteristics and abattoir operators' perception of waste collection effectiveness

Further investigations were conducted to test the hypothesis. Table 5 presents the observed statistical relationship between the distribution of a categorical variable (socio-demographic variables) with the distribution in another independent group of variables (abattoir operators' perception of waste collection effectiveness) through the use of Chi-Square (χ^2) test. The results of the Chi-square (χ^2) Test (Table 5) show that seven (7) out of the eight (8) independent group of variables were statistically associated with the abattoir operators' perception of waste collection effectiveness at the $p < 0.05$. They are gender (p= 0.030), age (p=0.000), tribe (p=0.000), level of education (p=0.037), nature of work (p=0.001), income (p=0.000), and years of work experience (p=0.000). Only marital status (p=0.4093) has calculated significant values greater than the table value of 0.05.

Based on this result that all the cases except one were statistically significant as the calculated p-value of the Chi-square (χ^2) Test was less than the table value of 0.05 (Table 5), hence, the rejection of the null hypothesis that there is no significant

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Table 5. *Summary of cross tabulation and Chi-Square Test of sociodemographic Characteristics and abattoir operators' perceptions of waste collection effectiveness*

Sociodemographic profile		Waste collection effectiveness				Pearson Chi-Square	
	Category	Very effective	Fairly effective	Not effective	Total	Value	Sig.
Gender	Male	36.2	20.5	0.0	56.7	7.001	0.030
	Female	23.6	15.7	3.9	43.3		
	Total	59.8	36.2	3.9	100.0		
Marital status	Single	15.7	8.7	0.0	24.4	5.401	0.4093
	Married	28.3	19.7	3.9	52.0		
	Divorced	7.90	3.90	0.0	11.8		
	Widowed	7.90	3.90	0.0	11.8		
	Total	59.8	36.2	3.9	100.0		
Age	26-40 years	19.7	23.6	3.9	47.2	25.030	0.000
	41-55 years	24.4	12.6	0.0	37.0		
	56-65 years	11.8	0.0	0.0	11.8		
	Above 65 years	3.9	0.0	0.0	3.90		
	Total	59.8	36.2	3.9	100.0		
Tribe	Yoruba	52.0	27.6	0.0	79.6	41.109	0.000
	Hausa	3.90	4.70	0.0	8.70		
	Igbo	3.90	3.90	3.9	11.8		
	Total	59.8	36.2	3.9	100.0		
Level of education	Primary	23.6	16.5	0.0	40.2	13.402	0.037
	Secondary	12.6	7.90	0.0	20.5		
	Tertiary	3.90	3.90	0.0	7.90		
	No education	19.7	7.90	3.9	31.5		
	Total	59.8	36.2	3.9	100.0		
Nature of work	Cow seller/owner	20.5	7.90	3.9	32.3	22.729	0.001
	Labourer	15.7	11.8	0.0	27.6		
	Butcher	7.90	12.6	0.0	20.5		
	Cleaner	15.7	3.90	0.0	19.7		
	Total	59.8	36.2	3.9	100.0		
Monthly income	Less than ₦18,000	3.90	7.90	3.9	15.7	45.145	0.000
	₦18,001–₦30,000	7.90	11.8	0.0	19.7		
	₦30,001–₦60,000	31.5	8.70	0.0	40.2		
	₦60,001–₦90,000	4.70	3.90	0.0	8.70		
	Above ₦90,000	11.8	3.90	0.0	15.7		
	Total	59.8	36.2	3.9	100.0		
Years of work experience	Less than 5 years	3.90	0.0	3.9	7.90	82.649	0.000
	5-10 years	19.7	23.6	0.0	43.3		
	11-20 years	19.7	12.6	0.0	32.3		
	Above 20 years	16.5	0.0	0.0	16.5		
	Total	59.8	36.2	3.9	100		

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relationship between abattoir operators' sociodemographic factors and their perception of waste collection effectiveness. It can, therefore, be concluded that abattoir operators' perceptions of waste collection effectiveness are greatly influenced by their sociodemographic attributes.

Conclusions and Recommendations

The purpose of this study was to evaluate waste management at Ijebu Igbo Abattoir in Ijebu North LGA in Ogun State, Nigeria. Abattoir operation is also male-dominated with greater youth involvement as almost half of the abattoir operators were between age 26 and 40 years. The study established that Ijebu Igbo Abattoir shares some attributes with abattoirs across Nigeria that lack a hygienic waste management system. The study also revealed the most prevalent abattoir waste among the various waste types generated are hair, animal dung, and blood. The abattoir waste recycling potential was validated by the visit of farmers and industries who source abattoir waste and process it to obtain manure, animal feed, ceramics plates and buttons. The essential services like water supply, electricity supply and cold room facility necessary for smooth operation at the Ijebu Igbo Abattoir were inadequate. The abattoir is currently under the management of the Trade Union. Despite the unsanitary condition of the abattoir no complaints have been recorded. Chi-square test results established a statistically significant relationship between abattoir operators' sociodemographic characteristics and their perception of waste collection effectiveness. Given the findings, the study put forward the following recommendations towards achieving effective AWM. Firstly, there is urgent need to prepare an AWM guideline and its development process should involve stakeholders from relevant government agencies, abattoir operators and the public. The proposed guideline should be in accordance to the stipulation of the National Environmental Standards and Regulation Enforcement Agency's (NESREA) Statutory Instrument No. 28 titled National Sanitation and Waste Control Regulation 2009 that provides for the specific role of states in Nigeria. Secondly, abattoir waste recycling opportunities, as established by this study, should be harnessed towards creating a hygienic abattoir, enhanced employment opportunity and wealth creation. This can be achieved by adopting best practices from climes with proven achievements in abattoir waste recycling. Thirdly, it is also suggested

that the management of the abattoir should implement innovative waste management approaches such as alkaline hydrolysis and aerobic digestion as pretreatment methods before the wastewater are discharged into the environment. Therefore, engaging professionals with requisite knowledge is desirable to guide against poor implementation. In addition, composting currently practised, though rudimentary, should be improved on as well as sustained. And lastly, the basic facilities such as electricity supply, water supply, refrigeration system, abattoir block (butchering and rinsing sections) and the road should be upgraded to promote and improve sanitation within the abattoir facility.

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