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Abstract

Waste management practices in Nigerian have remained poor and appalling despite the increasing global trends in sustainable practices. This paper, therefore, examined poultry waste management and environmental sustainability in Abia state. The objectives were to find out the current methods of waste management adopted by poultry farmers in Abia state; establish the factors affecting the choice of poultry waste management practices by farmers, and ascertain the challenges of poultry waste management practices in the state. The area of study was Ikwuano local government area of Abia state. The study employed survey method, hence, data were collected for this study using a structured questionnaire, while the data collected was subjected to descriptive inferential statistics analysis; using frequency and percentages. Findings indicated that the underlying causes are attributed to conventional forms of disposal adopted by farmers over innovative methods due to the absence of technical competencies among poultry farmers. Consequently, the paper recommended among others, the need for poultry farmers to be trained on how to sustainably utilize poultry waste and equally make additional income through bio-gas production, feed supplements, fertilizer, electricity, bone meal and biodegradable plastic, for environmental safety.

Keywords: Poultry, Waste Management, Environment safety, Sustainability, Disposal

Introduction

Poultry is among the most developed animal industries in Nigeria. The importance of the poultry sub-sector in the provision of food, income, and employment to mankind is widely recognized (International Finance Cooperation, 2014). The increase in poultry patronage and activities, the business is faced with numerous environmental problems. The challenge is aggravated by large-scale accumulation of wastes which poses disposal and pollution problem (Ekenma, 2015). Orhervata and Omoyakhi (2008) gave an estimated daily waste generation of poultry farms to be between 0.09kg and 0.18kg, depending on the farm size. For context, waste can be described as anything that is no longer useful and needs to be disposed of. Waste is identified by the type and place in which it is produced, such as agricultural, household, industrial and mining. The poultry industry produces large amounts of waste that include solid waste and wastewater. The solid waste consists of bedding material, excreta (manure), feed, feathers, hatchery waste (empty shells, infertile eggs, dead embryos and late hatchlings), sludge,

abattoir waste (offals, blood, feathers and condemned carcasses) and mortality.

Poultry waste can be used positively as feather meal, biodiesel, electricity generator, biodegradable plastic, biogas, vermicompost, among others. However, poultry manure is a potential hazard to the environment due to the release of nitrate and phosphate to the streams, ponds, and ground water; as well as ammonia, hydrogen sulphide gas in the air (Dai et al., 2015) due to inappropriate disposal of poultry waste. Poultry litter can also contain several pathogens and other materials that are a potential risk to public health (heavy metals, antimicrobial agents including the genes that confer resistance to these agents and endocrine disruptors) (Runge et al., 2007). Thus, Roeper et al. (2005) cited in Moreki and Chiripasi, (2011) contend that the problem coming along with poultry production is the manure that needs to be taken care of, as a non-appropriate treatment or disposal can become risky for the environment and humans. For instance, manure can support the spread of diseases and may pollute soil and groundwater resources if not properly handled.

Dumping is not a scientific method of disposing of poultry manure, because there is an anaerobic condition inside and due to increasing emission of harmful pollutants like ammonia, phenol, toluene, methanol, etc., into the atmosphere, the resultant effect is obnoxious odor which decreases bird's productivity (Thyagarajan et al., 2014). Therefore crude dumping of poultry waste is not only unattractive but also environmentally harmful. There are several ways poultry waste can be managed and disposed such as burying, rendering, composting, conversion into fertilizer, and using it as feed for livestock. Other methods of disposal for poultry waste include its use for heavy metal-polluted water treatment as well as for power conversion (Draper & Tomlinson, 2012). It has been observed (Adedayo, 2012) that re-using poultry waste can be beneficial and economical, if managed properly by farmers. According to Idowu & Otuniaya (2002), despite the widespread importance and uses, less than 10% of poultry waste is recycled through feed in Nigeria. Thus, the development of waste management plan is a sound investment to avoid environmental issues, however, farmers' choice of disposal techniques depends on the environment, the location, the nature of the poultry housing and the number of birds as well as the socio-economic characteristics of the farmers (Adedayo 2012; Ojewale 2014).

Kalu et al. (2016) are of the view that the existing disposal methods for poultry waste in Nigerian cities are neither cost-effective nor environmentally friendly. Moreover, Vide (2012) states that, there has been no conscious effort made to clearly understand the management practices of poultry waste; including the problems associated with its acquisition, and handling. This concern has brought the need to focus attention on the choice and practices used for managing poultry waste by farmers. Therefore, understanding the drivers of poultry waste management and utilization techniques especially as its affect the environment, could pave way for improving poultry waste activities for environmental sustainability in Abia state. Studies have shown that poultry waste management follows the same practice across most African countries (Ayodeji et al., 2011; Moreki & Keaikitse, 2013; Adeoye et al., 2014). For instance, reports have it that

dumping on nearby wasteland or flushing into pit or nearby streams are the most common waste management practices, while a few farmers practice composting in Nigeria (Ayodeji et al., 2011; Moreki & eaikitse, 2013). This is done to save cost and thus result into soil, water and air pollutions. Similarly, factors such as ignorance, lack of technical knowledge, high cost of management, unavailability of appropriate technology, and lack of policy initiatives affect proper management of poultry waste (Adeoye et al., 2014; McAllister, 2015). Key environmental policies vital to the establishment of poultry farms in Nigeria as contained in the sustainable development goals which include regulations for the location of farms in urban communities, safer recovery of wastes and promotion of sustainable waste management pattern that are environmentally sound (Adedayo, 2012), have also received low compliance among poultry farmers; against this backdrop, this paper will examine poultry waste management for environmental sustainability in Abia state.

Purpose of the Study

The general aim of this study is to examine poultry waste management for environmental sustainability in Abia state. Based on this, the specific objectives are as follows:

- i. To examine the current methods of waste management adopted by poultry farmers in Abia state;
- ii. To determine the factors affecting the choice of poultry waste management practices by farmers in Abia state; and
- iii. To ascertain the challenges of poultry waste management practices in Abia state.

Research Questions

- i. What are the current methods of waste management adopted by poultry farmers in Abia state?
- ii. What are the factors affecting the choice of poultry waste management practices by farmers in Abia state?
- iii. What are the challenges of poultry waste management practices in Abia state?

Methodology

The area of study is Ikwuano local government area of Abia state. The study employed multi-stage sampling method. Accordingly, from the four agricultural zones in Abia state, Ikwuano zone was purposively selected because of the high concentration of poultry farmers in the zone. In the second stage, from the selected zone, three blocks were randomly selected. In the third stage, two cells were selected from each block using simple random technique to make up six cells. From each cell, two communities were randomly selected to make up 12 communities. Subsequently, 10 poultry farmers were randomly selected to make up a total of 120 poultry farmers as the sample size. Data were collected for this study using a

structured questionnaire. Information that bothers on poultry wastes management techniques and its impact on the environment were collected from the respondents. Data collected also includes demographic information such as age, gender, marital status, educational background, and household size. Information were also obtained on the production data such as poultry farm scale, type of poultry farm housing system, type of poultry bird raised, stocking density, types and sizes of poultry waste generated, and waste disposal method employed by farmers. Data collected were subjected to descriptive statistics; hence, frequency and percentages were used to analyse data collected.

Results

Table 1: Socio-demographic Information of Respondents

Age	N	%
Below 30	20	16.2
31 –40	38	31.2
41 –50	33	27.5
51 – 60	16	13.3
Above 60	13	10.8
Sex		
Male	72	60
Female	48	40
Marital status		
Single	29	24.2
Married	91	75.8
Household size		
Small (<= 5)	37	30.8
Medium (6 –9)	69	57.5
Large (10+)	14	11.7
Educational qualification		
No formal education	7	5.8
Primary	14	11.7
Secondary	32	26.7
Tertiary	67	55.8

Table 1 indicates that out of the 120 poultry farmers assessed, 60% were male while 40% were female. Similarly, the table shows that majority of the farmers (31.2%) fell within the age range of 31-40 years, 27.5% were between the ages of 41-50, while 16.2% were below 30 years. More so, table 1 demonstrates that 75.8% of the respondents were married; meanwhile, a greater number of the respondents (57.5%)

had medium household sizes; on the other hand, majority had between secondary (26.7%) and tertiary (55.8%) educational qualifications.

Table 2: Production Data of Respondents' Poultry Farms

Mode of Operation	N	%
Subsistence	11	9.2
Commercial	109	90.8
Farming Experience (years)		
Less than 5yrs	36	30
6 – 10 yrs	49	40.8
11 – 15	27	22.5
Above 16 yrs	8	6.7
Membership of Poultry Association		
Yes	83	69.2
No	37	30.8
Access to Extension Service		
Yes	57	47.5
No	63	52.5
Housing Type		
Battery cage	24	20
Deep litter	69	57.5
Both	19	15.8
Free range	8	6.7
Poultry Breed		
Broiler	57	47.5
Layers	23	19.7
Broilers and layers	21	17.5
Broiler, layer, and Cockerel	19	15.8
Stock Size (birds)		
Less than 1000	9	7.5
1000 – 2000	45	37.5
2000 – 3000	31	25.8
3000 – 4000	24	20
4000 & above	11	9.2

In table 3, data indicates that 15.8% of the farmers generated less than 2.00 metric tons of waste per week, 20.8% generated between 2.10 –4.00metric tons/week, while the highest (25.8%) generated between 4.10 –6.00 metric tons/week; farms that generated around10.10 metric tons and above per week were 5.8%. As regards the method of disposal, the farmers indicated methods such as burying (33.3%), burning (30.8%), composting (25%), as well as flushing of waste (10.8%). The frequency for which waste was collected from the farm house indicates that most farmers (38.3%) preferred to do so weekly, 14.2% did so daily, while some (23.3%) collected wastes once in two weeks, with 24.2% doing so on monthly basis. Findings further reveal that the farmers chose their methods of disposal for reason of convenience (21.7%), distance (17.5%), transportation difficulty (14.2%), disease prevention (18.3%), as well as manuring (28.3%). Lastly, data on poultry waste utilization indicates that 15% percent used poultry waste as supplement for fish feed, 47.5% used it for agricultural purposes; 11.2% used waste for erosion control; 16.2% of farmers sold out the waste to interested buyers, while 9.2% mentioned biogas and power generation.

Table 4: Environmental Hazards of Poultry Waste

	Effect	N	%
1.	Presence of leaches/flyes	14	11.7
2.	Bad odour	69	57.5
3.	Emission of Ammonia from litter	37	30.8

In table 4, among the environmental hazards reported by poultry farmers include contending with the presence of leaches and flies (11.7%), bad odour (57.5%) as well as emission of ammonia (30.8%) from poultry litter.

Discussion of Findings

Table 1 indicates that out of the 120 poultry farmers assessed, 60% were male while 40% were female. The implication is that the poultry farms in the study area were managed by a significant number of males than females, probably as a result of the tediousness involved in handling birds. This corroborates the position of Olumayowa and Otunaiya (2011) who maintained that poultry production is requires masculine strength to undertake most of its activities; hence the presence of more men in the sector. Similarly, the table shows that majority of the farmers (31.2%) fell within the age range of 31 -40 years, 27.5% were between the ages of 41-50, while 16.2% were below 30 years. This entails that they are more of young and active individuals in the poultry business; hence, they ought to be able to undertake the labour related to poultry waste management. More so, table 1 demonstrates that 75.8% of the respondents were married; hence poultry can be a good source of economic livelihood for farmers. Meanwhile, a greater number of the respondents (57.5%) had medium household sizes, signifying that the household size could provide labour supply in the management of poultry wastes; on the other hand,

majority had between secondary (26.7%) and tertiary (55.8%) educational qualifications. This entails that the environmental impact of improper waste management is not lost on them; hence, they should be able to follow good poultry waste management practices.

In table 2, the distribution of respondents according to the mode of operation showed that 90.8% operated their farms on commercial basis, while 9.2% operated on subsistence level, meaning that poultry farming in the study area were mainly business and profit oriented. Equally, the findings indicate that 40.8% of the poultry farms have been in operation between 6 – 10 years; an indication that more knowledge on poultry waste management needed to be gained through the years. Likewise, the result showed that poultry farmers were not operating their farms in isolation as a good number (69.2%) belonged to poultry associations. Being part of such associations helps to boost farmers' knowledge in managing poultry farms as it could help in the acquisition of relevant information in form of trainings and seminars which can enhance proper management of poultry waste (Baruwa & Omodara, 2018). In the same vein, data indicates that lesser percentage of poultry farmers (47.5%) have access to extension services while the larger population (52.5%) do not. This could be partly responsible for the poor waste management practice as access to extension services provide farmers with guidelines on proper poultry waste disposal. Additionally, the data gathered reveals that deep litter housing system seems to be the most preferred, as 57.5% of poultry farmers adopts this form of housing, while the use of battery cage system recorded 20%, while some farmers (6.7%) adopted free range system. Furthermore, data shows that respondents produced different breeds of birds ranging from broilers only (47.5%), layers only (19.7%), broilers and layers mixed (17.5%), as well as a mix of broilers, layers and cockerels (15.8%). This finding is in line with that of Moreki and Keaikitse (2013) who posit that most poultry farmers prefer layers production to other birds. Regarding the range of stock raised by farmers, majority (37.5%) of the poultry farmers owned between 1000 – 2000 birds; and indication that most farms in the zone were operated on a small-scale.

Table 3 illustrates the quantity of wastes generated in the poultry farms. Accordingly, data indicates that considerable quantity of waste were generated from poultry farms in the study area as follows: 15.8% of the farmers generated less than 2.00 metric tons of waste per week, 20.8% generated between 2.10 – 4.00 metric tons/week, while the highest (25.8%) generated between 4.10 – 6.00 metric tons/week; farms that generated around 10.10 metric tons and above per week were 5.8%. On the whole, Modak et al (2019) supports this finding when they observed that the quantity of litter generated is directly linked to the number of birds, age, and variation of diet, health of the birds as well as farm management practices. North and Bell (1990) cited in Modak et al (2019) suggest that variation in droppings production could be attributed to variation of feed consumption, water consumption, composition and form of feed, humidity and temperature. As regards the method of disposal, the farmers indicated methods such as burying (33.3%), burning (30.8%),

composting (25%), as well as flushing of waste (10.8%). None of the farmers indicated incineration as a method of waste disposal probably because it is not common within the zone. Thus, burying of waste received more support, and aligns with the result of Gbigbi (2020) who observed that poultry farmers take on this method to keep off the offensive smell that attracts flies and rodents; and further avoid environmental pollution. Similar finding was recorded by Moreki and Keaikitse (2013). The frequency for which waste was collected from the farm house indicates that most farmers (38.3%) preferred to do so weekly, 14.2% did so daily, while some (23.3%) collected wastes once in two weeks, with 24.2% doing so on monthly basis. This finding shows that very few farmers carried out daily removal of poultry waste, while the majority compounded the safety of the environment by not practicing such daily hygienic principle. Modak et al., (2019) observe that, frequency of collection of droppings depends on the number and type of birds. According to them, normally, droppings of layer birds are cleaned daily or at alternate day while droppings of broiler are cleaned in once a week or once a cycle. Nevertheless, Anosike (2007) is of the opinion that, daily removal of waste is essential to hygienic and healthy environment in poultry production. It is therefore imperative to ensure that poultry farmers abide by this important principle of managing waste. Findings further reveal the purposes for which the farmers chose their methods of disposal among which were convenience (21.7%), distance (17.5%), transportation difficulty (14.2%), disease prevention (18.3%), as well as manuring (28.3%). This finding corroborates that of Onu et al., (2015) who found that majority of poultry farms recycle wastes as farm yard manure for crop production. Lastly, the table shows other forms of poultry waste utilization adopted by the farmers. Thus, among the respondents, 15% percent used poultry waste as supplement for fish feed, 47.5% used it for agricultural purposes. Hossain and Ali (2009) report that droppings from birds can serve as soil fertilizer for crop production due to the fact that it contains significant amounts of nutrients essential for plant growth. In addition, 11.2% used waste for erosion control because most part of the state is prone to erosion disturbances; 16.2% of farmers sold out the waste to interested buyers, while 9.2% mentioned biogas and power generation. Biogas is generated through anaerobic decomposition of organic wastes, and is well developed around the world.

In table 4, among the environmental hazards reported by poultry farmers include contending with the presence of leaches and flies (11.7%), bad odour (57.5%) as well as emission of ammonia (30.8%) from poultry litter. In support of this, Moreki and Chiripasi (2011) state that poultry wastes pose serious environmental pollution problems through offensive odours and promotion of fly and rodent breeding.

Conclusion

The poultry industry generates large amount of waste daily which needs particular attention for health and environmental safety. The essence is that

improper disposal of poultry waste in agricultural farms and ponds are an environmental and public health hazard. Members of the society are affected especially those who live within the vicinities of any poultry farm as they suffer from problems like bad odor, flies and other form of pollution. Unfortunately, waste management practices in Nigerian have remained basically poor and appalling despite the increasing global trends in sustainable practices. This study found that the underlying causes are attributed to conventional forms of disposal adopted by farmers over innovative methods due to the absence of technical competencies among the poultry farmers. It is therefore imperative for poultry farmers to be adequately sensitized on the need for waste management practices that are environmentally friendly, which can reduce environmental pollution and incidences of disease outbreak.

Recommendations

Based on this, this study recommends the following:

- i. Government and other key stakeholders within Abia state should provide incentives to poultry farmers for construction of waste shed.
- ii. Environmental regulatory agencies should effectively monitor poultry farm operators and ensure that wastes are properly disposed in designated sites.
- iii. Poultry farmers should be trained on how to sustainably utilize poultry waste and equally make additional income through bio-gas production, feed supplements, fertilizer, electricity, bone meal and biodegradable plastic, for environmental safety.

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