

SOCIO-CULTURAL, AND PRODUCTION PRACTICES OF PIG FARMERS IN RELATION TO WASTE GENERATION AND DISPOSAL CHALLENGES IN IMO STATE, NIGERIA.

Edo^{1*} F. A., Ihejirika¹ C. E., Okoli, C. Grace² and Okoli,³I. C.

¹Department of Environmental Management, Federal University of Technology P.M.B 1526, Owerri, Imo State, Nigeria

²Department of Environmental Health, National Open University, Abuja, Nigeria

³Department of Animal Science and Technology, Federal University of Technology P.M.B 1526, Owerri, Imo State, Nigeria

*Corresponding author: Email: edofridaya5@gmail.com

ABSTRACT

The objective of this study was to evaluate the socio-cultural, and production practices of small-scale pig farmers in relation to their waste generation, and disposal challenges in Imo State, Nigeria. The multi-stage sampling technique was used for the study, in which the three agricultural zones of the state were purposively selected, and then two Local Government Areas (LGAs) were selected from each agricultural zone based on the density of pig farms in the LGAs. Finally, 20 pig farmers were also purposively selected from each LGA based on their willingness to participate in the study, and having at least 10 pigs in the farm at the time of the study. Data were generated with the aid of structured questionnaires, interviews, and direct field observations during two visits, first to administer the questionnaires, conduct interviews, and make observations, and second to retrieve the questionnaires, conduct further interviews, and make observations where necessary. The data generated were subjected to descriptive statistics such as frequency counts, means, and percentages. The results showed that there was male dominance (66.67%) in the pig farming population, with majority being within the age bracket of 21 – 50 (78.33%), and were mostly married (48.33%) or widowed (18.33%). The study also revealed that majority of the farmers (80.01%) had minimum of primary education qualification, while 75.00% had at least 1 – 6 members family size. Again, majority of the farmers (46.67%) had farming experience of 1 – 10 years, although mostly on part-time bases (60.00%). Exotic pigs (73.33%) were the popular breeds kept in the farms, with majority (73.67%) of the farmers keeping below 50 pigs, distributed across breeders (33.33%), growers (31.67%), and weaners (35.00%). Most of the farmers (80.00%) utilized cheap local feed ingredients such as palm kernel cake (PKC) (38.33%), spent grain malt (43.33%) and food waste (18.33%) in feeding their pigs, while only 5.00% utilized commercial feeds. The main constraints to pig farming in the state were disease incidence (50.00%), high cost of feed (18.33%), and the stressful nature of the business (18.33%). Most of the farmers (46.00%) generated 4 – 5 (10kg) buckets of waste per day which translates to 14,400 – 18,000 kg of waste per farm, per annum. Majority of the farmers (63.00%) practiced open

dumping system of waste management, while 26.67% donated the waste to crop farmers. Again, most of the farmers (80.00%) have received complaints, and litigations from their neighbors on pollution issues arising from the pig farming activities. There is therefore the need for improved waste management systems in the farms in order to reduce their pollution problems that elicit these complaints and litigations.

Keywords- Pig production, waste generation, dung, farmers

INTRODUCTION

Pig production is playing a major role in increasing animal protein supply at a reduced cost in many African countries (Akintunde *et al.*, 2011). According to Tonukari *et al.* (2016) pigs are capable of converting agro-industrial by-products or “wastes” of all kinds into wholesome animal protein. Such agro-industrial by-products vary depending on the type, namely; food industry wastes, non-food industry wastes, crop residues, and farm animal wastes among others. Virtually all parts of the pig are used as either human food or animal feed. Producers however tend to think of livestock mainly as a source of meat, milk, and eggs, while in practice, they produce more faeces, and dung than anything else (Sillar, 2000). For example, faeces, and effluents from livestock operations have been used in organic farming as fertilizer, feed for fish (Kiritikarnkul 2010), and feedstock for biogas, and biochar or activated charcoal production (Okoli *et al.*, 2019; Ohanaka *et al.*, 2021). In recent years however, commercial pig production systems have come under high scrutiny because of their environmental impacts or concerns (Steinfeld *et al.*, 2006; Iregbu *et al.*, 2014), resulting in the need to identify, and mitigate their environmental burdens. This is specifically because of the increasing amount of waste being generated by the industry, which constitute environmental pollution problem if not properly managed (Liu *et al.*, 2013). Okoli *et al.* (2005a), and Umeh *et al.* (2018a) observed that much of the waste generated in farms currently end up in lagoons, and rivers, and have condemned lots of freshwater sources. Pig dung management is therefore a major factor of consideration in the industry, since any form of mismanagement can lead to environmental problems (Okoli *et al.*, 2006; Bakare, 2007). In order

to mitigate the negative impacts of indiscriminate disposal of pig wastes into the environment, there is a growing need to divert them from the waste stream, and employ them as resources for livestock feeding, biofertilizer production, and bioenergy generation among other added value products (Kivaisi *et al.*, 2010; Ireghu *et al.*, 2014; Ohanaka *et al.*, 2021).

Several studies have highlighted the association between the socio-economic of the farmer, and other important aspects of the farming system, including farm waste management, environmental practices, and adoption of new technologies, especially at the small-scale level (Ume *et al.*, 2018a & b; Moses, 2019). For example, Kadurumba *et al.* (2020) observed that some level of literacy is needed to effectively operate the modern intensive pig production system, while Ume *et al.* (2018a) observed that the business is common among married persons as a means of enhancing family income. Limited studies have however been carried out to elucidate links between the socio-cultural issues associated with small-scale pig production in Imo state, and the management, and the environmental issues arising from the farming operations (Ume *et al.*, 2018a; Kadurumba *et al.*, 2020). Such studies are particularly needed to properly define the issues associated with waste generation, and disposal challenges in such farms, and the appropriate mitigation approaches.

The objective of this study is therefore to evaluate the socio-cultural, and production practices of small-scale pig farmers in relation to waste generation, and disposal challenges in Imo State, Nigeria.

MATERIALS AND METHODS

Study area

The study was carried out in Imo state, southeastern, Nigeria, which is situated in the southern rain forest vegetational zone of Nigeria. It lies between latitude 50, and 60 3'N, and longitude 60 15; and 70 34' E (Figure I). The area is dominated by plains 200 m above sea level except for elevations associated with the Okigwe uplands (Ofomata, 1975). Imo State is bound in the North by Anambra State, in the East by Abia State, and in the south by Rivers state, and covers an area of 5100 sq.km with a population of about 3.9 million people (NPC, 2006).

The state comprises 27 Local Government Areas (LGAs) grouped into the three agricultural zones of Owerri, Orlu, and Okigwe. The climate is marked by two main seasons: a wet (rainy) season, and a dry season. Most of the mean annual rainfall of about 2152 mm (Ibe and Duruike, 2005), occurs during the wet season that extends from April - October, and is associated with the moisture-laden maritime southwest trade winds from the Atlantic Ocean. Average relative humidity is about 80% with up to 90% occurring during the rainy season. The mean daily maximum air temperature ranges from 28 to 35°C, while the mean daily minimum ranges from 19 to 24°C.

Agriculture is the major occupation of people of the state. The climate favors the growing of roots tubers, cereals, vegetables, and nuts, which are normally grown on small-holder plots (Nwaru, 2004). Most households rear animals such as sheep, goat, and poultry, either on full time or part time basis to augment household income.

predominate pig production in the state. The male dominance was particularly highest at Orlu zone (75.00%) and lowest at Okigwe (60.00%). Kadurumba *et al.* (2020) also reported similar male

dominance in pig farming in Imo State, while Okoli *et al.* (2009a), and Ume *et al.* (2018a) attributed this to the fact that the enterprise is labour, and capital intensive.

Table 1: Socio-cultural characteristics of pig farmers at three zones of Imo State

| Parameters | Owerri (n=20) Frequency (%) | Orlu (n=20) Frequency (%) | Okigwe (n=20) Frequency (%) | Overall (n=60) Mean (%) |
|-------------------------------|--------------------------------|------------------------------|--------------------------------|----------------------------|
| (a) Sex distribution | | | | |
| Male | 13(65.00) | 15(75.00) | 12(60.00) | 40(66.67) |
| female | 7(35.00) | 5(25.00) | 8(40.00) | 20(33.33) |
| (b) Age distribution | | | | |
| :21 - 30 | 5(25.00) | 5(25.00) | 5(25.00) | 15(25.00) |
| 31 - 40 | 7(25.00) | 4(20.00) | 8(40.00) | 19(28.33) |
| 41 - 50 | 3(15.00) | 8(40.00) | 4(20.00) | 15(25.00) |
| 51 - 60 | 4(20.00) | 2(10.00) | 1(5.00) | 7(11.67) |
| 60 and above | 1(5.00) | 1(5.00) | 2(10.00) | 4(6.00) |
| (c) Marital status | | | | |
| Married | 11(55.00) | 10(50.00) | 8(40.00) | 9(48.33) |
| single | 6(30.00) | 6(30.00) | 8(40.00) | 20(33.33) |
| widowed | 3(15.00) | 4(20.00) | 4(20.00) | 11(18.33) |
| divorced | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| (d) Educational qualification | | | | |
| Primary | 3(15.00) | 4(20.00) | 6(30.00) | 13(21.67) |
| Secondary | 8(40.00) | 9(45.00) | 8(40.00) | 25(41.67) |
| Tertiary | 2(10.00) | 3(15.00) | 5(25.00) | 10(16.67) |
| None | 7(35.00) | 4(20.00) | 1(5.00) | 11(20.00) |
| (e) Family size | | | | |
| 1 - 3 | 8(40.00) | 5(25.00) | 6(30.00) | 19(31.67) |
| 4 - 6 | 8(40.00) | 9(45.00) | 9(45.00) | 26(43.33) |
| 7 - 9 | 4(20.00) | 6(30.00) | 5(25.00) | 15(20.00) |
| 10 and above | 0(0/00) | 0(0.00) | 0(0.00) | 0(0.00) |
| (f) Farming experience | | | | |
| 1 - 10 years | 11(55.00) | 5(25.00) | 12(60.00) | 28(46.67) |
| 11 - 20 years | 3 (15.00) | 7(35.00) | 3(15.000) | 13(21.67) |
| 21 - 30 years | 2(10.00) | 1(5.00) | 2(10.00) | 5(8.33) |
| 31 - 40 years | 2(10.00) | 2(10.00) | 1(5.00) | 5(18.33) |
| 41 - 50 years | 1(5.00) | 2(10.00) | 1(5.00) | 4(16.67) |
| 51 - 60 years | 1(5.00) | 1(5.00) | 1(5.00) | 3(5.00) |
| (g) Professional engagements | | | | |
| Full time | 8(40.00) | 7(35.00) | 9(45.00) | 24(40.00) |
| Part time | 12(60.00) | 13(65.00) | 11(55.00) | 36(60.00) |

The mean age distribution values for the farmers were 25.00% each, for the 21 – 30, and 41 - 50 years age brackets, while the 31 - 41 years group recorded 31.67%, indicating that 78.33% of the farmers were under 50 years of age, while 11.67% were in their middle age (51-60 years). Okoli *et al.* (2009a) reported a preponderance of the 40 - 56 years for these farmers, in agreement with the 58.30 % reported by Ume *et al.* (2018a). Kadurumba *et al.* (2020) also observed that most pig farmers in the state are aged below 50 years, while Nwaru (2004) observed that this is probably because the creativity, risk taking and the daily

demands of farming, which requires a lot of energy decreases with age.

Most of the farmers (48.33%) were married or widowed (18.33%), while only 33.33% were single, indicating that pig farming in the area is commonly practiced by married couples. Chah *et al.* (2014) also reported that 68.3% of married couples engage in livestock farming at different locations in southern Nigeria. Okoli *et al.* (2009a), and Ume *et al.* (2018a) also observed that pig farmers in Imo State are mostly married couples.

The majority of the pig farmers in the state were also found to have attended secondary school (41.67%), while 21.67% attended primary school, and only 16.67% had tertiary education. These results agree with the findings of Okoli *et al.* (2009a), Ewuziem *et al.* (2009), and Ume *et al.* (2018a) in the same study area. Kadurumba *et al.* (2020) observed that modern pig production requires some level of education for the farmers to be able to understand the technicalities involved in its management, such as drug administration, dosage, and fumigation specifications, as well as other innovative technological practices. Farmer education also enhances the farmer's managerial abilities, especially record keeping, rational, and financial decision taking, and maximization of opportunities that arise from the farming processes.

The results of the study also showed that 43.33% of the farmers had between 4, and 6 family members, while 31.67% had between 1, and 3 members, and 20.00% had 7 to 9 members. This probably highlights the fact that pig farming is an important livelihood activity for the improvement of family income in the state (Okoli *et al.*, 2009a). Kadurumba *et al.* (2020) also observed that 68.10% of pig farmers in the state have maximum of six family members, while only 31.90% have 12 members. Most of the farmers (46.67%) have been in the business for 1 - 10 years, followed by the 21.67% that have farmed for 11 - 20 years. This rate of experience among the farmers indicates that there is high rate of sustenance in the business over the years. Several constraints, such as disease outbreaks, low capital input, high cost of feed, and environmental concerns by neighbours have been shown to influence livestock farm sustenance in the state (Okoli *et al.*, 2009a; Anukam, 2013). Ume *et al.* (2018a) in Imo state, and Ajieh and Okwoha (2015) in Delta State reported that up to 77.00% of pig farmers have been in the business for more than 10 years.

The study showed that 60.00% of the farmers were engaged in pig farming on part time basis, while 40.00% were in full time business. Several studies have shown that livestock production could enhance

family income, and livelihood while also serving as business investment, and source of animal protein to households, and for festivals (Okoli *et al.*, 2005b) Kadurumba *et al.* (2019) specifically reported very high rate of return from pig production business in southern Nigeria, and attributed this to its popularity as a livelihood improvement venture in the region.

Table 2 shows the characteristics of pig production in the state with emphasis on pig breeds, stock number, and stock characteristics. About 73.00% of the pigs reared in the state were exotic breeds, while only 26.67% were local breeds. These exotic breeds have become popular in southern Nigeria in recent time because they are amenable to tropical intensive production systems, are highly prolific, and profitable in terms of marketability (Izunobi, 2006). Okoli *et al.* (2009a), and Udin and Osasogie (2016) also reported that in the intensive pig production approach, exotic breeds such as large white, and landrace are preferred in southern Nigeria.

Majority of the farmers (73.00%) kept below 50 pigs in their farms, while another 28.33% kept between 50 and 100 pigs. About 30% of the farmers however kept more than 100 pig in their farms. Okoli *et al.* (2009a) reported that small-scale pig farmers in Imo state rear 60 – 80 pigs, while the medium-scale rear, 110 - 120 pigs, and the large-scale farms rear 230 - 260 pigs. Pig production in Imo state is therefore predominantly small-scale, and growing gradually to medium-scale. The gradual increase is in agreement with the report of Okeudo (2004), and Okoli (2006) for Nigeria, with farm units of 500 to 1000 being rare.

Again, the general distribution of the pig populations was observed to be weaners (35.00%), breeders (33.33%), and growers (31.00%), indicating that most farmers grow their pigs mainly from the weaner to the grower or finisher stages. Ideally, the weaner, and grower populations in the farm should be more than the breeder population (Okoli, 2006). Piglets, and weaner pig production has however become the popular ventures in the study area because of lucrative nearby market demand (Moses, 2019), thus explaining the relatively high number of breeders in the farms.

Table 2: Characteristics of pig production in Imo State

| Parameters | Owerri (n=20) | Orlu (n=20) | Okigwe (n=20) | Overall (n=60) |
|--------------------------------|---------------|---------------|---------------|----------------|
| | Frequency (%) | Frequency (%) | Frequency (%) | Mean (%) |
| (a) Type/breeds of pigs farmed | | | | |
| Exotic | 16(80.00) | 11(55.00) | 17(85.00) | 44(73.33) |
| Local | (20.00) | 9(45.00) | 3(15.00) | 16(26.67) |
| (b) Number of pigs in the farm | | | | |
| Below 50 | 10(80.00) | 9(45.00) | 6(30.00) | 44(73.67) |
| 50 - 100 | 5(25.00) | 4(20.00) | 8(40.00) | 17(28.33) |
| 101 - 150 | 2(10.00) | 4(20.00) | 2(10.00) | 8(13.33) |
| 151 - 200 | 1(5.00) | 2(10.00) | 1(5.00) | 4(6.67) |
| Above 200 | 2(10.00) | 1(5.00) | 3(15.00) | 6(10.00) |
| (c) Population characteristics | | | | |
| Breeders | 5(25.00) | 7(35.00) | 8(40.00) | 20(33.33) |
| Ggrows | 8(40.00) | 5(25.00) | 6(30.00) | 19(31.67) |
| Weaners | 7(35.00) | 8(40.00) | 6(30.00) | 21(35.00) |

The results in table 3 showed that local sourcing, and gathering of feed raw materials by the farmers accounted for 36.67% each, as the major sources of feed in the farms, while only 5% of the farmers purchased commercially prepared feeds. These practices reflect the need to keep the cost of feeding low in order to maximize profit. Several local studies have been carried out to identify cheaper alternative feed raw materials needed to reduce the cost of feeding, pigs in south Nigeria, with most of the results being adopted by local pig farmers in Nigeria (Ohanaka *et al.*, 2017; Moses, 2019). Specifically, palm kernel cake (PKC) was found to be the major feed raw material (38.33%), utilized by the farmers, and was followed by spent grain malt (25.00%), brewer's spent grain (18.33%), and food wastes (18.33%). Ume *et al.* (2018a) reported that the availability of cheap, and locally accessed feedstuffs such as PKC, and brewer's spent grain has led to the

rise in pig production in Imo State in recent years. Kadurumba *et al.* (2020) also observed that the acceptability of pig production, especially by small-holder farmers could be attributed to its survival rate, and ability to utilize locally available agro-industrial by-products, and crop residues with little or no processing, and at a minimal cost.

The major disease symptoms mentioned by the farmer across the three agricultural zones of the state were changes in skin colour, and weakness, indicating, the need for actual disease diagnosis, and extension services to improve disease recognition prevention, and control in the pig farms. Ume *et al.* (2018b) observed that lack of extension services, and siting of most veterinary posts in urban centres are major animal healthcare constraints to rural pig production in Imo state.

Table 3: Feeding management, and major disease challenges in the pig farms

| Parameters | Owerri (n=20) | Orlu (n=20) | Okigwe (n=20) | Overall (n=60) |
|------------------------------|---------------|---------------|---------------|----------------|
| | Frequency (%) | Frequency (%) | Frequency (%) | Mean (%) |
| (a) Source of feed materials | | | | |
| Local sourcing | 7(35.00) | 8(40.00) | 7(35.00) | 22(36.67) |
| Gathering | 8(40.00) | 5(25.00) | 9(45.00) | 22(36.67) |
| Commercial feeds | 1(5.00) | 1(5.00) | 1(5.00) | 3(5.00) |
| Eatery waste | 4(20.00) | 6(30.00) | 3(15.00) | 13(21.67) |
| (b) Types of feed material | | | | |
| Palm kernel cake | 7(35.00) | 9(45.00) | 7(35.00) | 23(38.33) |

| | | | | |
|------------------------------|--------------------|----------|------------------------------------|-----------|
| Brewers spent grain | 3(15.00) | 4(20.00) | 4(20.00) | 11(18.33) |
| Food waste | 5(25.00) | 3(15.00) | 3(15.00) | 11(18.33) |
| Spent grain malt | 5(25.00) | 4(20.00) | 6(30.00) | 15(25.00) |
| (c) Major disease challenges | skin colour change | weakness | weakness, skin colour change to re | |

The results in Table 4 showed most of the farmers (50.00%) viewed pig diseases as the major constraints to their production effort, with the problem being relatively higher (75.00%) at Okigwe than at the other zones. Other constraints highlighted were the stressful nature of the business, and the high cost of feeds (18.33% each), complaints from neighbours (11.67%), and poor market for finished products which was mentioned only at Owerri zone. The

results again highlight the need for improvements in animal healthcare services delivery to the farms (Kadurumba *et al.*, 2020). Although the farmers did not mention waste disposal as a constraint, the complaint from neighbours could be linked to poor waste management practices which have been reported by Oseghale (2010); Iregbu *et al.*, (2014), and Ume *et al.* (2018a).

Table 4: Constraints to pig production in Imo State

| Parameters | Owerri (n=20) | Orlu (n=20) | Okigwe (n=20) | Overall (n=60) |
|---------------------|---------------|---------------|---------------|----------------|
| | Frequency (%) | Frequency (%) | Frequency (%) | Mean (%) |
| Stressful | 6(30.00) | 3(15.00) | 2(10.00) | 11(18.33) |
| High feed cost | 4(20.00) | 5(25.00) | 2(10.00) | 12(18.33) |
| Neighbours protests | 2(10.00) | 4(20.00) | 1(5.00) | 7(11.67) |
| Disease | 7(35.00) | 8(40.00) | 15(75.00) | 30(50.00) |
| Low quality pig | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| Waste disposal | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| Poor market | 1(5.00) | 0(0.00) | 0(0.00) | 1(1.67) |

Table 5 highlighted the volume of pig waste produced in the farms, and their disposal methods.

About 46.00% of the farms generated 4 to 5 standard buckets (10kg) of waste daily, while another 38.33% generated more than 5 buckets. These translate to 40 – 50kg or more of waste per day, and 1,200 to 1,500 kg per month and 14,400 to 18, 000 kg per annum. These wastes were made up of both liquid, and solid components in the form of dung, urine, and the water used in cleaning the pens. This volume of waste is relatively high, and agrees with the reports of Ewuziem (2021) that up to 67,952 kg of dung per annum are generated from 60 pig farms in Imo state. The high volume of waste has been attributed to the feeding of unconventional feedstuffs (Obikaonu *et al.*, 2004; Okoli *et al.*, 2009b; Moses, 2019) characterized by high fiber content, and low digestibility (Iyayi, 2009; Okoli *et al.*, 2009 a and b) in order to reduce the cost of feeding the pigs. Such low nutrient digestibility usually results in high volume of dung in these farm, and may result in waste disposal challenges (Iregbu *et al.*, 2014).

The results on waste disposal methods show that majority of the farmers (65.00%) disposed their pig wastes at designated sites in the farms, while another 26.67% allowed crop farmers to freely collect the solid waste (dung) for use as manure/fertilizer. Only 8.00% of the farmers sold dung to crop farmers, while Kadurumba *et al.* (2019) however reported up to 20.00% sell to farmers in neighbouring Rivers state. Iregbu *et al.* (2014), and Ume *et al.* (2018a) reported rampant cases of indiscriminate dumping of pig dung into the environment by farmers in the state. Ewuziem (2021) also reported that majority of pig farmers (75.00%) in Imo state practiced open dumping, and incineration systems of waste management, while Kadurumba *et al.* (2019) included flushing into water bodies (21.25%), burning (23.33%), and recycling as fertilizers (14.17%) as the major management methods in River state.

Table 5: Pig waste generation, and their disposal methods in Imo State

| Parameters | Owerri (n=20) | Orlu (n=20) | Okigwe (n=20) | Overall (n=60) |
|--|---|----------------|-----------------|------------------------------|
| | Frequency (%) | Frequency (%) | Frequency (%) | Mean (%) |
| (a) Estimation of daily waste generation | | | | |
| One bucket | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| Two buckets | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| Three buckets | 3(15.00) | 1(5.00) | 5(25.00) | 9(15.00) |
| Four buckets | 6(30.00) | 7(35.00) | 4(20.00) | 17(28.00) |
| Five buckets | 4(20.00) | 2(10.00) | 5(25.00) | 11(18.33) |
| Above five buckets | 7(35.00) | 10(50.00) | 6(30.00) | 23(38.33) |
| (b) Waste disposal methods | | | | |
| Farm waste dump | 14(70.00) | 12(60.00) | 13(65.00) | 39(65.00) |
| Dump in river | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| Sale to farmers | 1(5.00) | 3(15.00) | 1(5.00) | 5(8.33) |
| Donate to farmers | 5(25.00) | 5(25.00) | 6(30.00) | 16(26.67) |
| Other method specify | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| (c) Different uses of waste manure | | | | |
| (d) On-farm waste processing | | | | |
| Yes | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| No | 20(100.00) | 20(100.00) | 20(100.00) | 60(100.00) |
| (e) Economic benefit of waste | | | | |
| | Selling to farmers as for fertilization of soil | Sale as manure | Generate income | Sales and use as fertilizers |

The major constraints to appropriate pig waste management in the state are reported by Ume *et al.* (2018a) to include, lack of access to expert advice, and poor road network at most rural locations where the pig farms are located. Across the three agricultural zones, pig dung was commonly applied as manure in farms, indicating that crop farmers in the study area are highly aware of the value of pig dung as soil enrichment medium. This agrees with Sloan *et al.* (2008) and Ogbuewu *et al.* (2012) that application of manure to croplands increases soil organic matter (OM), microbial biomass, and mineralization rate. Okoli *et al.* (2006) also reported that in southeastern Nigeria, the popular waste management systems in pig farms include; disposal into cemented drainage gutters, and water bodies. Other methods practiced in other

countries include composting, and digestion to produce organic fertilizer, and biogas respectively (Henuk, 2001; Tiquia, 2005).

The results also show that all the pig farmers did not process their pig wastes since there was no technological capacity to improve or add value to the dung generated from their farms. The level of application of technology in pig farming is indeed low in the study area, in agreement with the earlier report of Kadurumba (2012) that there is a negative relationship between small-holder pig farming, and adoption of modern technologies. All the farmers however utilized the pig dung as manure or fertilizers, while only few sold it to generate little income, indicating that limited economic benefits are derived from the pig wastes. Kadurumba *et al.* (2020) in their

study specifically reported that about 63.6% of pig farmers in Imo state do not make economic use of the pig wastes generated in their farms.

Table 6 highlights the link between the social environmental issues associated with pig production in Imo State, and focused mostly on the relationships between the farmers, and their neighbours. The farmers reported that 80.00% of their neighbours complained about the siting of the pig farms, indicating that some of the farm activities are not acceptable to these neighbours. Ogunlade *et al.* (2005) in a study of socio-economic effects of livestock operation on their neighbours in Ilorin, North Central LGA, reported that the neighbours to pig farms ranked avoidance of drinking water sources close to their houses because of water pollution as the major socio-economic effect of living near a pig farm.

Again, the farmers reported that majority of the neighbours (80.00%) had issues of litigation with them, indicating that most of these neighbours are not comfortable with the pig farming activities. This also agrees with the report by Oseghale (2010) that

because of the poor conditions of most pig farms, especially poor quality of air, water, and unsightly environments, legal actions may be initiated by neighbours. Such litigations on the grounds of environmental concerns have been reported to result in the closure and/or relocation of pig farms in Nigeria (Bakare, 2007; Iregbu *et al.*, 2014).

Conclusions and Recommendation

Pig farming is a viable livestock enterprise dominated by young, and middle aged relatively educated male farmers in Imo state. These farmers utilize mostly cheap, and locally available unconventional feed raw materials such as PKC, food waste, and brewers spent grain to feed their animals, thereby resulting in the generation of large volumes of wastes, which are not adequately disposed in the environment. Waste management, and processing options are lacking, therefore resulting in complaints, and protest from neighbours. There is therefore the need for the introduction of low cost waste management technologies to improve the waste utilization, and disposal in these farms.

Table 6 Environmental issues associated with pig production in Imo State

| Parameters | Owerri (n=20) | Orlu (n=20) | Okigwe (n=20) | overall (n=60) |
|---------------------------------------|---------------|---------------|---------------|----------------|
| | Frequency (%) | Frequency (%) | Frequency (%) | Mean (%) |
| (a) Complaint from neighbours | | | | |
| Yes | 17(85.00) | 15(75.00) | 16(80.00) | 48(80.00) |
| No | 3(15.00) | 5(25.00) | 4(20.00) | 12(20.00) |
| (b) Litigation from neighbours | | | | |
| Yes | 15(75.00) | 16(80.00) | 17(85.00) | 48(80.00) |
| No | 5 (25.00) | 4(20.00) | 3(15.00) | 12(20.00) |

References

- Adeshinwa, A.O.K., Makinde G.E.O. and Oladele, I.O. (2003). Demographic characters of pig farmers as determinants of pig feeding pattern in Oyo state Nigeria: *Proceedings of 8th Annual Conference of Animal Science Association of Nigeria (ASAN)*, September 16 – 18 Akure, Nigeria, Pp: 127 – 129.
- Ajieh, P. C. and Okwuolu, U. (2015). Constraints and strategies for enhancing pig production in Delta state, Nigeria. *Delta*, 5:5 (Abstract).
- Akintunde, A. O., Omole, C. A., Sokunbi, O. A., Lawal, T. T. and Alaba, O. (2011). Response of growing pigs to diet physical form and allzyme[®] SSF supplementation in a palm kernel meal-based diet. *Animal Production*, 13(2):
- Anukam, K. U. (2013). Development of simple technologies for the control of odors from pig dung. MSc. Thesis, Federal University of Technology, Owerri, Nigeria.
- Bakare, M. (2007). Pig farm with a difference. *The News*, 28 (13): 67-69.
- Chah, J.M., Dimelu, M.U., and Ukwuani, S.U. (2014). Institutional, and production characteristics among smallholder pig producers in Enugu State, Nigeria. *Tropical Animal Health and Production*, 46; 1173-1176.
- Chima, I. U. (2015). Participatory antimicrobial resistance monitoring of intensive poultry production in southeastern Nigeria, using enteric bacteria as a model

- organisms. PhD Proposal Seminar, Department of Animal Science and Technology, Federal University of Technology Owerri, Nigeria.
- Ewuziem, E. (2021). Pollution, and resources use efficiency among pig farmers in Imo state, Nigeria (Thesis). Repository.mouau.edu.ng: Retrieved August 11, 2021.
- Ewuziem, J.E., Onyenobi, V.O. and Dionkwe, A. G. (2009). Technical efficiency of farmers in Imo State, Nigeria. A trans log stochastic frontier production approach. *Nigeria Agricultural Journal* 40(1): 137-143.
- Henuk, Y.L. (2001). Nutrient adjustments of the diets fed to cage, and barn laying hens to decrease waste. PhD Thesis, University of Queensland, Australia.
- Iregbu, G. U., Kubkomawa, I. H., Okoli, C. G., Ogudu, E. C., Uchegbu, M. C. and Okoli, I. C. (2014). Environmental concerns of pig waste production, and its potentials as biofuel source. *Journal of Animal and Veterinary Sciences*, 1(3): 17-24.
- Ibe, K.M. and Duruike, P.U. (2005). Hydrochemical characteristics of groundwater, and surface water: A case study of Isiala Mbano, Southeastern Nigeria. *World Journal of Biotechnology*, 2: 278-286.
- Ibeawuchi, I.I. (2006). Annual report on livestock production. Imo State Agriculture Development Project, Ministry of Agriculture, and Extension Service, Owerri, Imo state, Nigeria.
- Iyayi, E. A. (2009). Prospects, and challenges of unconventional poultry feedstuffs. *Proceedings of the 3rd Nigeria International Poultry Summit*, 22 – 26 February 2009. Abeokuta, Ogun state, Nigeria.
- Izunobi, N. D. (2006). *Swine science, and husbandry for degree students*. Tabansi Press Ltd., Onitsha, Nigeria.
- Kadurumba, C. (2012). Resource use efficiency, waste impact, and management in pig production in Ebonyi State, Nigeria. Ph.D Thesis, Abia State University Uturu, Nigeria.
- Kadurumba, C., Kadurumba, O.E. and Enekwachi, M.E. (2019). Piggery waste management and environmental implication on human health in Rivers State, Nigeria. *International Journal of Agricultural and Rural Development*, 22(1):4161-4166.
- Kadurumba, C., Nwankwo, E. S., Ene, O. J. and Kadurumba, O. E. (2020). Analysis of waste management, and profit efficiency in pig production in Owerri Agricultural Zone of Imo State. *Nigeria Journal of Animal Science Technology* 3 (2): 213 -224
- Kivaisi, A. K., Assefa, B., Hashim, S. O. and Mshandete, A. M. (2010). Sustainable utilization of agro-industrial wastes through integration of bio-energy and mushroom production. International Livestock and Research Institute, (ILRI) Nairobi, Kenya.
- Kemkarnkul, S. (2010). A cost-benefit analysis of alternative pig waste disposal methods used in Thailand. *Environmental Economics*, 1(2): 1 – 8.
- Liu, Z., Powers, W. and Liu, H. (2013). Greenhouse gas emissions from swine operations: Evaluation of the inter-governmental panel on climate change approaches through meta-analysis 1. *International Journal of Animal Science*, 91: 4017–4032.
- Moses, P. C. (2019). Approaches, practices and nutrient contents of small-holder pig farms diets at two Local Government Areas in Imo state, Nigeria. B. Agric. Tech. Project report, Federal University of Technology Owerri, Imo state, Nigeria.
- NPC (2006). Nigerian census figure. National Population Commission, Abuja, Nigeria.
- Nwaru, J. C. (2004). Rural credit markets, and arable crop production in Imo state of Nigeria. PhD Thesis, Michael Okpara University of Agriculture Umudike, Nigeria.
- Obikaonu, H.O., Okoli, I.C., Opara, M.N and Udedibia, A.B.I. (2004). Observation on the pathophysiological responses of pigs raised under integrated broiler/pig production system. *Bulletin of Animal Health and Production in Africa*, 52: 111-118.
- Ofomata, G.E.K. (1975). *Nigeria in maps; Eastern states*. Ethiope Publishing House, Benin City, Nigeria.
- Ogbuewu, I. P., Odoemenam, V. U., Omede, A. A., Durunna, C. C., Emenalom, O. O., Uchegbu, M. C., Okoli, I. C. and Iloeje, M. U. (2012). Livestock waste, and its impact on the environment. *Scientific Journal of Reviews*, 1(2): 17 – 32.
- Ogunlade, I., Adekunle, O. A. and Akangbe, J. A. (2005). Socio-economic effect of livestock operations on their neighbours in Ilorin Metropolis, Nigeria: Implication for extension programme development. *Livestock Research for Rural Development*, 17(12):142. Retrieved August 30, 2021, <http://www.Irrd.org/Irrd17/12/ogun17142.htm>.
- Ohanaka, A.U.C., Duruanyim, V.O., Etuk, I.F., Uchegbu, M.C. and Okoli, I.C. (2017). Physico-chemical composition of palm kernel shell ash (PKSA) as a potential mineral supplement in livestock nutrition. In: A.A. Adelaye (eds). Emerging challenges facing animal agriculture in Nigeria, and the way forward., 42: 785-789.

- Proceedings of the 42nd Annual Conference of the Nigerian Society for Animal Production*
- Ohanaka, A. U.C., Ukonu, E. C., Ogbuewu, I. P., Etuk, I. F., and Okoli, I. C. (2021). Evaluation of the physico-chemical properties of agro-waste derived activated charcoal as potential feed additives in livestock production. *International Journal of Agriculture and Rural Development*, 24(1): 5711 - 5719
- Okeudo, N.J. (2004). Empirical studies of the living conditions of the domestic animals in Nigeria: Results from Nigeria. In: U.C and F. Gottwald (Eds). Peter Lang GmbH Frankfurt, Germany, ISBN. 13: 978= 3631531389.
- Okoli, C.I. (2006). Tropical tips on intensive pig production: Animal Management, and Health Issues. Technical Notes: Tapas Institute of Scientific Research, and Development. Pp: 240-246.
- Okoli, C. G., Njoku, I. V., Chukwuocha, A. C., Njoku, P. C., Njoku, J. D., Dike, M. U. and Ojiegbe, R. U. (2005a). Quality characteristics of ground water utilized by resident students of Nigerian Universities. *Journal of Applied Science*, 35 (6): 1088-1091.
- Okoli, I. C., Aladi, N. O., Etuk, E. B., Opara, M. N., Anyanwu, G. A. and Okeudo, N. J. (2005b). Current facts about the animal food products safety situation in Nigeria. *Ecology of Food and Nutrition*, 44: 359 – 373.
- Okoli, I. C., Alaehie, D. A., Okoli, C. G., Akano, E. C., Ogundu, U. E., Akujobi, C. T., Onyicha, I. D. and Chinweze, C. E. (2006). Aerial pollutant gases concentrations in tropical pig pen environment in Nigeria. *Nature and Science*, 4(4): 1-5.
- Okoli, I. C., Alaoma, O. R., Opara, M. N. Uchegbu, M. C., Ezeokeke, C. T., Durunna, C. S., Nnadi, F. N., Iheukwumere, F. C. and Okeudo, N. J. (2009a). Socio-cultural characteristics of educated small-holder pig farmers, and the effects of their feeding practices on the performance of pigs in Imo State, Nigeria. *Report and Opinion*, 1(4): 59 - 65.
- Okoli, I.C., Uchegbu, M.C., Alaoma, O.R., Omede, A.A., Opara, M.N. and Ekenyem, B.U. (2009b). Compositional, and biochemical characteristics of grower pig rations compounded by small holder pig farmers in Imo State, Nigeria. *Proceedings of the 3rd International Conference on Sustainable Animal Agriculture for Developing Countries*, July 26 – 29, 2011, Nakhon Ratchasima, Thailand.
- Okoli, C. G., Edo, F. A., Ogbuewu, I. P., Nwajiobi, I. J., Enemor, V. H.A. and Okoli, I. C. (2019). Biochemical values of pig dung collected from different locations in Imo state, southern Nigeria. *Asian Journal of Biological Science*, 12: 470 – 476.
- Oseghale, C. (2010). Community at war with bank manager's wife, over stench from piggery. *Saturday Punch*, June 5, 2010. p.12.
- Sillar, B. (2000). Dung by preference: The choice of fuel as an example of how Andean pottery production is embedded within wider technical, social, and economic practices. *Archaeometry*, 42(1): 43-60.
- Sloan, D. R., Kidder, G. and Jacobs, R. D. (2008). Poultry manure as fertilizer. <http://edis.ifas.Nfl.edu>
- Steinfeld, H., Gerber, P., Wassenaar, T., Castel, V., Rosales, M. and De Haan, C. (2006). Livestocks long shadow – Environmental issues and options. Food and Agriculture Organization of the United Nations, Rome, Italy.
- Tiquia, S. M. (2005). Microbiological parameters as indicators of compost maturity. *Journal of Applied Microbiology*, 99: 816-828.
- Tonukari, N. J., Oliseneku, E. E., Avwioroko, O. J., Aganbi, E., Orororo, O. C. and Anigboro, A. A. (2016). A novel pig feed formulation containing *Aspergillus niger* CSA35 pretreated-cassava peels and its effect on growth, and selected biochemical parameters of pigs. *African Journal of Biotechnology*. 15: 776 – 785.
- Uddin, I. O. and Osasogie, D. I. (2006). Constraints of pig production in Nigeria. A Case Study of Edo Central Agricultural Zone of Edo state. *Asian Research Journal of Agriculture*, 2(4): 1 – 17.
- Ume. S. I., Ezeano, C. I. and Gbughemobi, B. O. (2018a). Analysis of the environmental effect of pig production in Okigwe Local Government Area of Imo State, Nigeria. *International Journal of Environmental & Agriculture Research*, 4: 2454-1850.
- Ume, S.I., Ezeano, C.I., Chukwuigwe, O., Gbughemobi, B.O. (2018b); Effect of climate change on pig production, and choice of adaptation strategies by farmers in southeast, Nigeria. *International Journal of Academic Research and Development*, 3(2): 858-868.