British International Journal of Education and Social Sciences
Vol.09, No.8; August-2022;
ISSN (3342 – 543X);
p –ISSN 4519 – 6511
Impact factor: 9.82

PIG WASTE MANAGEMENT STRATEGIES FOR ECONOMIC SUSTAINABILITY OF RURAL WOMEN IN ENUGU STATE

Alio A. N, Ozougwu, L.O and Aneke C. U.
Department of Technology and Vocational Education (TVE), Enugu State University of Science and Technology (ESUT)

Abstract: *This study was conducted to determine the pig waste management strategies required of rural women for economic sustainability in Enugu State. Two research questions guided the study in line with two corresponding null hypotheses. The study adopted descriptive survey research design and was carried out in Enugu State. The pollution for the study was 54 respondents sampled purposively from the four out of six agricultural zones in Enugu state. A structured questionnaire containing a total of 15 items was the instrument for data collection. The instrument was validated by three experts and the reliability of the instrument was determined using Cronbach's Alpha reliability coefficient method which yielded 0.77. Data collected were analysed using mean with standard deviation while t-test was used to test the null hypotheses at 0.05 levels of significant. The study revealed that developing strategies for composting pig waste and anaerobic digestion of pig waste are required for economic sustainability of rural women in Nkanu West LGA of Enugu State. Based on the findings, recommendations were made which include; agricultural training and development in anaerobic digestion (biogas) should be encouraged to ensure adequate strategies for pig waste management. Loan and other forms of incentives should be made accessible to women in the rural areas to encourage them to participate more in utilizing pig wastes farming activities.*

Keywords: pig waste management strategies, Rural Women, Economic Sustainability.

Introduction

Livestock provide essential commodities and services to man in form of animal by-product especially manure to enhance soil fertility and serves as a capital reserve available during hard times. Among the livestock that is used to alleviate man's animal protein deficiency particularly in rural areas of most developing countries of sub-Sahara Africa and provide enough manure for soil fertility is pig (Tewe 2009). Ume, Ezeano and Gbughemobi (2018), noted that the wide acceptability of pig production especially by small holder farmers could be attributed to its' high survival rate and ability to utilize a host of agro-industrial by-products and crop residues with little or no processing and at minimal cost. Furthermore, pig is known to be prolific producer as it is capable of farrowing 20 to 30 piglets from 2 or 3 litters per year Ezike (2001) and is capable of attaining slaughter weight of about 80 to 90kg in about 7 to 9 months under good management (John 2011).

Furthermore, Lee (2009) observed that pig production industries have been growing as the demand for pork meat has increased, and as a result the waste management problem has become a serious concern. In line with this, Aarnink (2007) observed that the most common environment concern with animal wastes is that it affects the atmospheric air with offensive odours, release of large quantities of CO2 and ammonia which might contribute to acid rain and the greenhouse effect. It could also pollute water sources and be instrumental in spreading infectious diseases. If the disposal of water is not properly planned it might create social tension owing to the release of odours and contamination of water sources. Okolo (2011) stated that the land receiving the piggery wastes has already become over saturated with Nitrogen and Phosphorus in many

British International Journal of Education and Social Sciences
Vol.09, No.8; August-2022;
ISSN (3342 – 543X);
p –ISSN 4519 – 6511
Impact factor: 9.82

countries and the solution to the waste problem is further complicated as the land area utilised for disposal becomes restricted.

More also, Oseghale, (2010) stated that the environmental and health concerns in all pig production businesses therefore, have to do with the waste management problems. Besides foul odour, the hydrogen sulphide, ammonia and other gases emitted by stored pig manure can diminish air quality. Spence, Whitehead, and Cotta, (2008) noted that the disagreeable odour can also lead to tension between pig producers and their neighbours, which can evoke litigations and risk of possible shut down of production. Another serious concern according to Iregbu, Kubkomawa and Okoli (2014), is the unscrupulous behaviour of some pig farmers who would indiscriminately dump faecal matter into nearby natural water supplies, thus making them unsuitable for human consumption. Okoli, Njoku, Chukwuocha, Njoku, Njoku, and Dike (2005), observed that manure generates heat as it decomposes, and can in fact ignite spontaneously should it be stored in a massive pile. Once such a large pile of manure starts burning, it fouls the air over a very large area and requires considerable effort to extinguish, thus polluting the air with attendant greenhouse gas effect. Equally, excessive accumulation of animal manure due to indiscriminate dumping over a large area of land as organic manure tends to pollute the land, and result to eutrophication owing to excess accumulation of nitrogen and phosphorus, which will rather be toxic to plants. Furthermore, Powers, Zamzow and Kerr (2011) observed that the foul odour, flies and mosquitoes breed in manure pit are grassed continually to the neighbouring communities. These flies and mosquitoes are capable of transmitting diseases such as cholera, dysentery, typhoid, and malaria and bilabial to man. In similar vein, Spence et al. (2008) stated that the environmental and health concerns in all pig production businesses therefore, have to do with the waste management problems. Besides foul odour, the hydrogen sulphide, ammonia and other gases emitted by stored pig manure can diminish air quality. Therefore, the major challenge of pig farming is management of waste from the farm.

Waste management as noted by (Brasil, 2010) are the activities and actions required to manage waste from its inception to its final disposal. These include the collection, transport, treatment and disposal of waste, together with monitoring and regulation of the waste management process. Waste management is necessary to eliminate threats of waste also upscaling, & modify the waste & to reduce the microbial load (Molomo, Madugu and Bolo, 2018). Generally, Brasil (2010) defined waste as the end of the product life cycle and is disposed of in landfills. Waste can be solid, liquid, or gaseous and each type has different methods of disposal and management. Waste management deals with all types of waste, including industrial, biological and household and farms. Waste management is intended to reduce adverse effects of waste on human health, the environment or aesthetics. According to Mac-Safley, Boyd and Schmidt (2011) animal waste management system can be described as a planned system with relevant components installed and managed to control and use by-products of animal production in a way that sustains and enhances the quality of air, water, soil, plant and animal resources. Animal manure management system is an integral part of the agricultural waste management system.

Molomo, et al., (2018) noted that many manure management strategies and technologies are applicable to a wide range of production environment and scales.

However, according to Iregbu (2011) the way and manner for the management and disposal of pig waste varies from locality to locality depending on the size of the farm, and the level of technology being applied at the farm. In Nigeria, the popular waste management system observed is the disposal of manure with effluent water through cemented drainage gutters. From here they enter into sectioned covered sewage pits where they undergo both aerobic and anaerobic decomposition. They are later evacuated to crop farms. A few dispose of theirs some distance from their farm

where they are exposed and burnt off to reduce the odour. Pig wastes contain three resources water, nutrients, and energy that can be recovered and recycled.

The adoption of sustainable manure management technologies holds a lot of direct and indirect benefits to the society. These include contributions to a clean environment, pollution reduction, job creation and the protection of biodiversity. Pig waste management according to Molomo et al (2018), is important because it significantly reduces the risks associated with manure handling and utilization. An efficient pig waste management system will limit or prevent manure or its constituents from gaining undesirable access to the larger environment. Sound manure management contributes to health and environmental, economic and social benefits. Ewuziem, (2008) stated that environmental pollution by pig production can be minimized through adopting the following strategies, include seeking permit for construction of standard pig building from environmental Protection agency, adherence to 500 metres from pig pen to residential houses, appropriate waste disposal or handling system and proper precision feed management. Furthermore, Molomo et al (2018) stated that sustainable management of manure requires a multi-pronged approach. These approaches include nutritional strategies, policy and legal framework as well as physical, biological and chemical manure treatment. However, both traditional & advanced methods like composting, recycling, rendering, bio-diesel are in practiced..

Iregbu (2011) stated that composting and anaerobic digestion of pig wastes is the best strategies for proper management of pig waste and utilization. This is because construction of biogas digester in rural households reduces green house gas emissions on different levels. The methane appearing as a result from the fermentation of the wastes in the traditional way escapes no longer into the air. The methane is used as energy source replacing firewood or charcoal and be utilized for lightening as well. The slurry from unfermented solid wasted is used as fertilizer for the crop. Ewuziem (2008) noted that Compost improves soil aeration, texture, & water retention capacity of soil, and also promotes better root growth and nutrient absorption.

Flavel and Murphy (2006) defined Composting as a natural process of aerobic decomposition or fermentation of manure by micro-organisms. Compost is rich in organic matter and has the ability to improve soil health. Compost can be made either through heap/pile or through pit method. Some of the benefits of compost in the soil include improved fertility, water-holding capacity, bulk density and biological properties. Food and Agricultural Organization (FAO) (2015), described composting as the microbiological breakdown of organic matter into compost or humus. Aerobic composting uses organisms that need oxygen to function. It minimises odour emissions from stored manure, emits carbon dioxide rather than methane and produces heat that can kill pathogens and weed seeds. However, it is more labour and capital intensive than simply stockpiling manure. Composting can be applied to separated solids, pond sludge, spent bedding and mortalities.

According to National Non-Food Crop Centre (2011), anaerobic digestion is a collection of processes by which microorganism breakdown biodegradable materials in the absence of oxygen. This process is used to manage waste and produce fuels. Teenstra, Buisonje, Ndambi and Pelster (2015) stated that anaerobic digestion is the processing of manure to produce energy, mainly biogas. Wastes from pigs in piggeries can be converted into biogas (a renewable energy source consisting mostly of methane and carbon dioxide), liquid fuel and/or nutrient-rich solids. Using simple bacteria to break down waste in oxygen-free (anaerobic) conditions is a process called anaerobic digestion. Ogejo (2015) observed that many pig owners already use anaerobic digestion to treat waste, so it is the most commonly used process for producing bio energy. Biogas from manure digester can be used for cooking instead of the direct burning of biomass (see

British International Journal of Education and Social Sciences
Vol.09, No.8; August-2022;
ISSN (3342 – 543X);
p –ISSN 4519 – 6511
Impact factor: 9.82

appendix 1). It can also be used to power the generator for electricity hence contributing to economic sustainability.

The concept of sustainability has in recent time received gratifying consent. This is because sustainability deals with the maintenance of certain state of affairs. Sustainability according to United Nations (2013) is the process of living within the limits of available physical, natural and social resources in ways that allow the living systems in which humans are embedded to thrive in perpetuity. Sustainability encompasses many aspects of life including economy.

Economic sustainability may be seen as the ability to maintain the resources of a nation without affecting its prospect for improving and simplifying living in future. According to University of Mary Washington (2016), economic sustainability refers to practices that support long-term economic growth without negatively impacting social, environmental, and cultural aspects of the community. Economic sustainability may also concern itself with the necessities for making a wealthy nation. This may include the areas of food, house and job.

However, Hawkins and Shaw (2004) pointed out that the ultimate goal of sustainable development is concerned with a better quality of life for present and future generations which must be given equal weight. Primarily, the objective of sustainable development is to promote and ensure a steady progress towards a future of universally shared human socio-economic well-being and prosperity (Brandon and Lombardi, 2011). The authors maintained that the concept is based on the knowledge that there is an ultimate limit to the availability of natural resources. A nation that is sustainably developed would invariably maintain a balance in her economy. Economic sustainability could be achieved through women such as empowerment programmes in pig waste management.

Women empowerment in developing countries has become the concern of many humanitarian aid organizations. Karl (2015) stated that women's participation is crucial in development process and to meeting the development goals. The author stated that development goals may not be achieved without their full involvement in agricultural activities. Omorode (2014) concluded that organising women is an integral aspect of socio-economic advancement of any nation. Women efforts in developing socio-economic development will be able to optimally utilize if they are empowered socially, culturally, politically and economically. According to Rajani and Sarada (2008), supplementing family income has become the most important factor of women in involving in entrepreneurship fields. Schwartz (2009) indicates that the main motivations in emerging towards entrepreneurship are the factor that related to the economic necessity. Both statement of Rajani and Sarada (2008) and Schwartz (2009) noted that there is awareness in society for women to involve in any venture in other to supplement their family financial condition by using skills that they acquired for poverty alleviation.

However, Adegoroye (2008) observed that in Nigeria, some poverty alleviation or reduction programmes have been designed to support rural women empowerment especially in agricultural practices. Agriculture plays a vital role in addressing the issue of poverty and food security in sub-Saharan Africa. In Nigeria, the major occupation of rural women is farming. Fabiyi and Akande (2015) observed that women in rural communities play significant roles in achieving the transformation necessary for economic and social changes for sustainable national development. Empowering rural women will go a long way to improving the economic life of the women and the well-being of individual families and the rural communities.

With the majority of the women population living in rural areas, pig waste management will create employment avenues for the unemployed. Again, people living in these areas with their main source of income from farming can use pig waste products to supplement their income and enhance their agricultural activities.

British International Journal of Education and Social Sciences
Vol.09, No.8; August-2022;
ISSN (3342 – 543X);
p –ISSN 4519 – 6511
Impact factor: 9.82

Consequently, many women in rural areas especially in Enugu state are poor despite their huge contribution to agricultural activities. Most of these women now go into pig production but lack the skill and knowledge on pig waste management which would have added to their income for economic sustainability. Hence the need of the study is to determine the pig waste management strategies required by rural women for economic sustainability in Enugu State.

Purpose of the Study

The main purpose of this study was to determine the pig waste management strategies for economic sustainability of rural women in Enugu State. Specifically, the study sought to determine;

1. Composting strategies of pig waste management for economic sustainability of rural women in Nkanu West LGA of Enugu State.
2. Anaerobic digestion strategies of pig waste management for economic sustainability of rural women in Nkanu West LGA of Enugu State.

Research Questions

The following research questions guided the study.

1. What are composting strategies of pig waste for economic sustainability of rural women in Enugu State?
2. What are anaerobic digestion strategies of pig waste for economic sustainability of rural in Enugu State?

Hypotheses

The following null hypotheses guided the study;

$H0_1$: A significant difference does not exist in the mean ratings between agricultural extension workers and pig farmers regarding composting strategies of pig waste for economic sustainability of rural women in Nkanu West LGA of Enugu State.

$H0_2$: A significant difference does not exist in the mean ratings between agricultural extension workers and pig farmers regarding anaerobic digestion strategies of pig waste for economic sustainability of rural women in Nkanu West LGA of Enugu State.

Research Method

The study adopted a descriptive survey research design and was carried out in Enugu State. A population of 54 respondents which was made up of 14 agricultural extension workers and 40 pig farmers sampled purposively from Enugu state agricultural Zone. The instrument for data collection was a 15-item questionnaire structured after extensive literature in line with the two research questions that guided the study. The instrument was dully validated by 3 research experts. The instrument has response options of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD) with the numerical values of 4, 3, 2 & 1 assigned to the instrument respectively. The reliability index of 0.77 was established for the instrument using Cronbach Alpha. Cronbach alpha reliability estimate was used on the instrument because the instrument has multiple options (Uzoagulu, 2013).

However, mean and standard deviation were used to answer the research questions. Real values of the mean responses were used as basis for decision. This is as follows; strongly agree (SA): 3.50-4.00. Agree (A): 2.50-3.49, disagree (D): 1.49-2.49 and strongly Disagree (SD): 1.00-1.49. The null hypotheses were tested using t-test at .05 level of significance and at appropriate degree of freedom. The null hypotheses were not rejected when t-calculated value was les than t-table value and not accepted when t-table value is less than t-calculated value.

Results

The results are presented in Table 1 to 4 according to the research questions and hypotheses that guided the study below.

Research Question 1

What are composting strategies of pig waste for economic sustainability of rural women in Nkanu West LGA of Enugu State?

British International Journal of Education and Social Sciences
Vol.09, No.8; August-2022;
ISSN (3342 – 543X);
p –ISSN 4519 – 6511
Impact factor: 9.82

Table 1: Mean and standard deviation of the respondents on composting strategies of pig waste for economic sustainability of rural women in Nkanu West LGA of Enugu State

S/N	composting strategies of pig waste for economic sustainability include the ability to:	Extension workers (14)		Pig farmers (40)		Overall (54)		Decision
		$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	$\bar{X}$	SD	
1	locate a suitable place for compost pile	3.25	0.75	3.35	0.62	3.30	0.69	Agree
2	Create a drainage system for the compost pile	3.57	0.75	3.35	0.59	3.46	0.67	Agree
3	Cover the base of the compost pile with thin layer	3.32	0.99	3.25	0.93	3.26	0.96	Agree
4	Add organic material to the compost	3.26	0.76	3.32	0.73	3.29	0.67	Agree
5	Moist the organic layers with water	3.65	0.68	3.18	0.90	3.42	0.79	Agree
6	Leave the compost pile to decompose for one month	3.38	0.61	3.26	0.73	3.32	0.67	Agree
7	Turn the compost pile frequently	3.49	0.71	3.48	0.50	3.49	0.61	Agree
	Grand Mean/SD.	**3.33**	**0.77**	**3.27**	**0.77**	**3.30**	**0.77**	**Agree**

Data as presented in Table 1, the mean rating of respondents on all the items nubere 1 to 7 ranged from 3.0 to 3.49 indicating that the respondents agreed on the itemized strategies is required by rural women for economic sustainability in Nkanu West LGA of Enugu State. The table shows that the identified strategies as agree by the respondents with the mean rating of 3.12 to 3.49.

The Table therefore shows that composting strategies of pig wastes are required by rural women rural women for economic sustainability in Nkanu West LGA of Enugu State. The grand mean value of 3.30 affirms to that with the grand standard deviation of 0.77 signifying that respondents did not differ remarkably in their opinions regarding composting strategies of pig wastes required by rural women rural women for economic sustainability in Nkanu West LGA of Enugu State.

Hypothesis One

There is no significant difference in the mean ratings between agricultural extension workers and pig farmers' regarding the composting strategies of pig waste for economic sustainability of rural women in Nkanu West LGA of Enugu State.

Table 2: t-test analysis between agricultural extension workers and pig farmers regarding the composting strategies of pig waste for economic sustainability of rural women in Nkanu West LGA of Enugu State.

Respondents	N	$\bar{x}$	SD	Df	Prob.	t-tab.	t.cal.	Decision
Ext. workers	14	3.33	0.77	59	.05	2.000	0.282	**NS**
pig farmers'	40	3.27	0.79					

Table 2 shows that t-calculated value of 0.282 was obtained at 59 degree of freedom and .05 significance level with the t-table value of 2.000 for the 7 items statement (research question 1 items). Hence, the null hypothesis is not rejected for these items. This invariably denotes that there is no significant difference

British International Journal of Education and Social Sciences
Vol.09, No.8; August-2022;
ISSN (3342 – 543X);
p –ISSN 4519 – 6511
Impact factor: 9.82

in the mean ratings between agricultural extension workers and pig farmers' regarding the strategies required by rural women in composting of pig wastes by rural women for economic sustainability in Nkanu West LGA of Enugu State.

Research question 2

What are anaerobic digestion strategies of pig waste for economic sustainability of rural in Nkanu West LGA of Enugu State?

Table 3: Mean and standard deviation of respondents regarding the anaerobic digestion strategies of pig waste for economic sustainability of rural women in Nkanu West LGA of Enugu State

S/N	Anaerobic digestion strategies of pig wastes required by the rural women include the ability to:	Extension workers (14)		pig farmers (40)		Overall (54)		Decision
		$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	$\bar{X}$	SD	
8	Chose a suitable digester container	3.40	0.63	3.22	0.68	3.31	0.66	Agree
9	Add feed inlet and slurry outlet	3.09	0.65	3.09	0.92	3.09	0.79	Agree
10	Add biogas outlet and supply line	3.28	0.78	3.26	0.78	3.27	0.78	Agree
11	Build biogas collector	3.42	0.79	3.12	0.82	3.27	0.81	Agree
12	Add biogas inlet to the collector	3.54	0.66	3.92	1.05	3.23	0.86	Agree
13	Connect the digester to the collector	3.40	0.70	3.02	0.84	3.21	0.77	Agree
14	Feed the digester with pig waste	3.68	0.47	3.44	0.66	3.56	0.57	Strongly Agree
15	Measure biogas production	3.22	0.94	3.60	1.05	2.91	1.00	Agree
	Grand Mean/SD.	**3.35**	**0.74**	**3.09**	**0.85**	**3.22**	**0.80**	**Agree**

Data as presented in Table 3, shows that mean rating of respondents on items number 14 is 3, 56 indicating strongly agree response while the rest of the anaerobic digestion strategies of pig waste identified as agree by the respondents respectively. However, the table shows that all the itemized strategies are required by rural women for economic sustainability in Nkanu West LGA of Enugu State. The cluster mean of 3.22 attested to that with the cluster standard deviation of 0.80 indicating that the opinion of the respondents is homogeneous.

Hypotheses Two

There is no significant difference in the mean ratings between agricultural extension workers and pig farmers' regarding the anaerobic digester strategies of pig waste for economic sustainability of rural women in Nkanu West LGA of Enugu State..

Table 4: t-test analysis between agricultural extension workers and pig farmers regarding the anaerobic digester strategies of pig wastes for economic sustainability of rural women in Nkanu West LGA of Enugu State

Respondents	N	$\bar{x}$	SD	Df	Prob.	t-tab.	t.cal.	Decision
Ext. workers	14	3.35	0.74	59	.05	2.000	0.009	**NS**
pig farmers'	40	3.09	0.85					

NS: Not Significant. SD: standard deviation. Df: Degree of freedom.

British International Journal of Education and Social Sciences
Vol.09, No.8; August-2022;
ISSN (3342 – 543X);
p –ISSN 4519 – 6511
Impact factor: 9.82

Table 4 shows that t-calculated value of 0.009 was obtained at 59 degree of freedom and .05 significance level with the t-table value of 2.000 for the 8 items statement (research question 2 items). Thus, the null hypothesis is not rejected for these items. This therefore shows that there is no significant difference in the mean ratings between agricultural extension workers and pig farmers regarding the strategies required by rural women in anaerobic digester of pig wastes for economic sustainability in Nkanu West LGA of Enugu State.

Discussion of Findings

The study revealed that strategies like ability to locate a suitable place for compost pile, create a drainage system for the compost, cover the base of the compost, add organic material to the compost and others are the strategies in composting of pig wastes for economic sustainability of rural women in Nkanu East LGA of Enugu State. However, the integration of the itemized strategies would enhance proper pig waste management in pig farms for economic sustainability of rural women in Nkanu East LGA of Enugu State. This is in harmony with the findings of the study conducted by Malomo et al (2018) which state that prior to the introduction of inorganic fertilizers, animal manure played the central role in enhancing soil fertility. In spite of the role of inorganic fertilizers in agricultural production, manure remains an important fertilizer resource especially in areas where inorganic fertilizers are not readily available or accessible to farmers. The corresponding t-test result shows that t-calculated value is less than t-tabulated value at appropriate degree of freedom and significant level. Hence, the null hypothesis is not rejected. This implies that the status of the respondents had no significant influence on their opinions regarding the composting strategies of pig waste for economic sustainability of rural women in Nkanu East LGA of Enugu State.

The study in research question 2 revealed that ability to chose a suitable digester container, add feed inlet and slurry outlet, add biogas outlet and many more are anaerobic digestion strategies of pig wastes for economic sustainability of rural women in Nkanu East LGA of Enugu State. This is in harmony with the findings of Marshal (2007) who noted that construction of biogas digesters in rural households entails choosing the correct container, making holes, fixing the inlet and outlet pipes, making gas holder tank. In hypothesis 1, the t-test result showed that t – calculated value is less than t-tabulated value at appropriate level of significance and degree of freedom. Hence, the null hypothesis is therefore not rejected. This therefore means that a significant difference does not exist in the mean ratings between agricultural extension workers and pig farmers regarding anaerobic digestion strategies of pig wastes for economic sustainability of rural women in Nkanu West LGA of Enugu State. By implication, the status of the respondents has no significant influence on their opinions.

Conclusion

The study emphasized on pig waste management strategies for economic sustainability of rural women in Nkanu West LGA of Enugu State. The study thus identified composting of pig waste and anaerobic digestion of pig waste strategies as requirement for economic sustainability of rural women in Nkanu West LGA of Enugu State. In view of the findings of this study, proper composting of pig waste will enhance crop production. Also construction of biogas digesters in rural households will reduce green house gas emissions and used as energy source to replace firewood or charcoal and can utilized for lighting as well. Thus, pig waste management strategies adopted should efficiently mitigate the negative impact of pig waste on the environment and the general public. Several benefits are derivable from sustainable manure management leading to economic sustainability in Nkanu West LGA of Enugu State. On this note, it is therefore believed that if these strategies are acquired and utilized, there will be economic sustainability of rural women in Nkanu West LGA of Enugu State.

Recommendations

The following recommendations were made in view of the findings of the study:

1) Identified pig waste management strategies should be integrated into the curriculum of agricultural education programme.
2) Skill development programme should be organized by the government and appropriate authorities for capacity development of pig farmers especially in pig waste management strategies.
3) Attention should be given to rural women by government for economic empowerment.
4) More awareness should be made on pig waste management strategies to enlighten the on its benefits to health and economic sustainability.
5) Rural women should be adequately trained in modern agricultural discoveries.

References

Aarnink, A.J.A. (2007). Ammonia emission from houses for growing pigs as affected by pen design, indoor climate and behaviour. PhD thesis, Wageningen, The Netherlands,175

Adegoroye, A. A. (2008). The roles of selected NGOs in economic empowerment of rural women in Ibadan land. *Journal of Gender and Behaviour, Ife Centre for Psychological Studies, Ile-Ife, Nigeria, 6 (2): 45.*

Brandon, P. & Lombardi, P. (2011). *Evaluating sustainable development: in the Built Environment*, 2nd ed, Wiley and Sons Ltd Publication, UK.

Brasil. 2010. Ministry of Agriculture, Livestock and Food Supply. Brazilian Agribusiness in Figures. http://www.agricultura.gov.br. [accessed February 10, 2014.

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 Agric. Journal* 40(1): 137-143.

Fabiyi, E. F. & Akande, K. E (2015). Economic empowerment for rural women in Nigeria: Poverty alleviation through agriculture. *Journal of Agricultural Science, 7 (9); 236 – 241.*

Fabiyi, E. F. (2015). *Home economics for agricultural sciences in tertiary institutions* (p. 197). Ibadan, Abbey Printing Press.

Flavel TC, Murphy DV. (2006). Carbon and nitrogen mineralization rates after application of organic amendments to soil. Journal of Environmental Quality; (35), 183-193.

Food and Agriculture Organisation (FAO, 2015). *Illegal huntIng & the bush-meat trade in Savanna Africa.* Retrieved from: http://www.fao.org/3/a-bc609e.pdf

Iregbu, G.U, Kubkomawa, I.U, Okoli, C.G, Ogundu E.C, Uchegbu M.C, Okoli ,I.C. (2014), Environmental Concerns of Pig Waste Production and its Potentials as Biofuel Source. *Journal of Animal and Veterinary Sciences*. Vol. 1, (3),17-24.

Hawkins, R.G.P and Shaw, H. (2004). Sustainable development: A monument for eternity. *Engineering Sustainability,156 Issue ESI, 3-5.*

Iregbu, G. U. (2011). Determination of the energy value of pig dung produced in Imo state, Nigeria. A seminar presented to the Department of Animal Science and Technology, Federal University of Technology, Owerri, Imo State, Nigeria.

John, G. (2011). Modern pig production technology, Nottingham: Nottinghom University of Press, 137-139.

Karl, M., (2005). *Women and empowerment: Participant and decision making*. London and New Jersey: Zed Books Limited.

Lee, D.P., (2009). Odour from pig production: Its relation to diet. PhD thesis, WIAS, Wageningen, The Netherlands, 206 .

Mac-Safley LM, Boyd WH, Schmidt AR. (2011). Agricultural waste management systems. Agricultural Waste Management Field Handbook, Chapter 9. USA: USDA; (47), 9-31

Malomo G. A, Madugu A. S, & Bolu S. A., (2018). Sustainable Animal Manure Management Strategies and Practices, Agricultural Waste and Residues p. 120-133

Marshal, A. T.(2007).Bioenergy from waste: A growing source of power, Waste Management World Magazine, 34-37.

Ogejo J.A.(2015). Manure Production and Characteristics, http://articles.extension.org, manure-production-and-characteristics, 15375.

Okoli, C. G, Njoku, I. V, Chukwuocha, A. C, Njoku, P. C, Njoku, J. D, & Dike, M. N. (2005). Quality characteristics of ground water utilized by resident students of Nigerian Universities. J. of Applied Science. 35 (6): 1088- 1091.

Okolo, C.I. (2011). Tropical tips on intensive pig production: Animal Management and Health Issues. Technical Notes: Tapas Institute of Scientific Research and Development, 240-246.

Omorode, C. K., (2014).Organising rural women for socio-economic development and self-reliance in Nigeria: Challenges and prospects. *Business and Management Research, 3(2), 47-59.*

Oseghale, C. (2010). Community at war with bank manager, wife, over stench from piggery. Saturday Punch, .12.

Poeschl, M, Ward, S & Owende, P. *(*2012). Environmental impacts of biogas deployment Part I: life cycle inventory for evaluation of production process emissions to air. *Journal of Cleaner Production (*24)168-183.

Powers, W, Zamzow, S. & Kerr, B. (2011). Effect of diatry air emissions from pigs. Ammonia conference (2)21-30.

Rajani, N. A. Sarada, D., (2008). Women entrepreneurship and support systems. *Study Home Comm Sci, 2(2), 107-112.*

Schwartz,S. H., (2009). *Cultural value orientations: Nature and implications of national differences.* Publishing House of SU HSE, Moscow.

Spence, C, Whitehead, T. and Cotta, M. (2008). Treating hog manure with borax, cuts odour.World Vet. Assoc., USA-ARS

Teenstra E, Buisonjé F, Ndambi A, Pelster D. (2015). Manure Management in the Sub-Tropics; Training Manual for Extension Workers. Wageningen: (University & Research Centre) Livestock Research, 56.

Tewe O. O, Ogrodgo, M.W and Adesehinwa, A.O.K., (2009). Resources requirements for profitability pig farming in Nigeria, National. Pig prod. Training Manual, NAERLS/ABU, 16-26.

Ume, S., Ezeano, C., Gbughemobi, B. (2018). Analysis of the Environmental Effect of Pig Production in Okigwe Local Government Area of Imo State, Nigeria International Journal of Environmental & Agriculture Research (IJOEAR) Vol-4.

United Nations (2013). *Our common future: Report of the world commission on environment and development.* UN Documents. n.d. Web. Retrieved 27 March, 2019. http://www.un-documents.net/ocf-02.htm

University of Mary Washington (2016). *Economic sustainability*. Retrieved from: https://sustainability.umw.edu/areas-of-sustainability/economic-sustainability/

World Bank (2007). The 2008 world development report presented compelling empirical evidence from a wide range of countries that supports this finding.

British International Journal of Education and Social Sciences
Vol.09, No.8; August-2022;
ISSN (3342 – 543X);
p –ISSN 4519 – 6511
Impact factor: 9.82

Appendix 1