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Farmers use of improved animal health management technologies in small ruminant production in South East, Nigeria

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ABSTRACT
The study assessed the use of selected health management technologies for sustainable small ruminant production in South East Nigeria. The objectives specifically described the personal/household characteristics of the respondents in the study area, assessed the level of use of selected improved animal health management technologies, ascertained farmers' perception of the attributes of the technologies and the relationship between attributes of the technologies and use. A multi-stage sampling procedure using a structured questionnaire was employed for data collection and data were analyzed using frequencies, percentages, mean scores and Ordinary Least Square regression technique. Result showed that majority (56.4%) of the small ruminant farmers are male, with a mean age of 42.4. Most (99%) of the farmers kept small ruminants as savings, with a mean household size of 5.7 and 13.7 mean years of experience. Apart from Culling ($\bar{x}$=2.3) which recorded high use among the farmers, other technologies such as Animal Sanitation, Periodic deworming and Routine vaccination recorded low usage with mean scores of 1.7, 1.9 and 1.9 respectively. Culling ($\bar{x}$=3.1) and routine ($\bar{x}$=3.8) vaccination were perceived as being cost effective. The OLS result showed that at 5% probability level, Cost effectiveness (5%), environmental friendliness (5%), Similarity to local practice (5%), time saving (5%) were all significant factors influencing farmers' use of the health management technologies. The study therefore recommended an increase in livestock farmers' education on health management technologies, and a linkage between orthodox and traditional management technologies to integrate indigenous knowledge for enhanced small ruminant production in the region.
Keywords: livestock farmers, small ruminant, health, production

INTRODUCTION

Small ruminant (sheep and goats) production is a very significant component of livestock production throughout the world and more especially in the developing countries and are

producers of milk, meat, income generators and reservoirs of wealth (Coppock et al., 2006; Andrew and Flintan, 2007; Odeyinka, 2014). Nigeria has population of 73.8 million goats and 42.1 million sheep mainly indigenous breeds and it is reported that current and estimated meat supply does not meet growing demand (Lawal-Adebowale, 2012; NASS, 2011; Ugwu, 2007)). Small ruminant population is concentrated in the North of Nigeria and had a gross production value of US$373.1 and US$73.4 for goats and sheep respectively in 2016 (FAO, 2018). This makes sheep and goat potential contributors in improving the animal protein intake of Nigerians which is known to be far short of the recommended minimum level of 65.0 gm per caput per day.

According to Odeyinka (2014), sheep and goats have adaptive capacities to survive and produce in difficult environments be they arid, high altitude or extremely cold. The importance of small ruminants in income generation and households' social and financial security are well established in literature and their importance is primarily associated with their small size, which is significant and to the advantage of humankind for three important reasons: economic, managerial and biological (Tologbonse, *et al*., 2011; Workneh, 1999; Zelalem and Fletcher, 1993).

Other economic advantages as reported by Odeyinka (2014) include low initial investment and correspondingly smaller risk of loss from death. Currently, there are many technologies available to extension and have been disseminated to sheep and goat farmers in order to encourage production of these species which are common among many rural household in South Eastern Nigeria and they include: improved feeding options, improved husbandry, adequate housing and breeding programmes and without their uptake by farmers, the hope of increasing production of small ruminants may not be realized. (ABIAADP resource materials, 2015). It is on this premise that this study sought to investigate farmers' use of selected health management technologies in small ruminant production in South East Nigeria,

The study specifically;

1. described the personal/household characteristics of the respondents,
2. assessed the level of use of selected improved animal health management technologies,
3. ascertained farmers' perception of the attributes of the technologies and,
4. determined the relationship between attributes of the technologies and their use .

METHODOLOGY

The study was carried out in the Southeast agro-ecological zone of Nigeria. The population for this study comprised all small ruminant farmers in the study area. A multi-stage and random sampling technique was employed for this study. The first stage was purposive selection of three states (Abia, Ebonyi and Imo) out of the states in the Southeast agro-ecological zone due to proximity. Out of the three states, the study purposively cut across two (2) agricultural zones in Abia, Ebonyi and Imo States, these were zones with notable presence of small ruminant farmers. Out of the two zones each from Abia, Ebonyi and Imo, two blocks were purposively selected for proximity and ruralness, making a total of 12 blocks, finally 2 circles were purposively selected from the blocks giving a total of 24 circles. The next stage involved a simple random selection of 10 goat farmers from each of the circles giving a total of 240 small ruminant farmers as the sample size for this study. A questionnaire was used to elicit responses from the respondents. The questionnaire was divided into sections in line with the stated objectives in order to elicit the right responses that aided in addressing the objectives.

Measurement of Variables

Five attributes were listed out in objective 3 and farmers asked to indicate their perception level of the attributes on the technologies. A five-point likert type scaling procedure was used which are 'Strongly agree = 5, Agree = 4, Not sure = 3, Disagree = 2, and Strongly disagree = 1. For the purpose decision-making, 1,2,3,4, and 5 were added and divided by 5 to give 3.0, but an upper limit was established by adding 0.05 that gives 3.05, and any mean score above this limit is considered as agree and otherwise as not agreed.

The Level of use was measured on a 3 point rating scale of '**Always use** (3) rarely use (2) never (1). In using this scale, a midpoint was determined by adding 1, 2, and 3 which gave 6 and when divided by 3 gave 2.0. For the purpose of decision making an upper limit was established by adding 0.05 to 2.0 = 2.05 implying that any mean score above 2.55 was adjudged high utilization whereas any mean score below the upper limit judged as low utilization.
Objectives, 1, 2 and 3 were realized using simple descriptive statistic, while objective four was realized using the ordinary least square regression model. The four forms were tested and the best fit chosen as lead equation.

Model Specification
The implicit form of the model is specified thus;

$$Y = f(x_1, x_2, x_3, x_4, x_5) \quad (1)$$

Where,
Y = Farmer's utilization of improved small ruminant production technologies (respondents ratings on extent of utilization of technology)
x_1 = cost effectiveness (mean ratings)
x_2 = Time saving attribute (mean rating)
x_3 = similarity to local practice (mean rating)
x_4 = environmental friendly attribute of technology (mean rating)
ei = error term

RESULTS AND DISCUSSION
Socioeconomic Characteristics of the Respondents
Table 1 showed a moderate proportion (45.0%) of the small ruminant farmers in the study area being between the ages of 31 – 40 years with a mean age of 42.4. This finding implies that small ruminant farmers in South East, Nigeria are in their active productive age with capacity to handle the labour demands of small ruminant production, and this corroborates with the findings of Nwachukwu (2017) who observed that most farmers in Nigeria are at the active stage of life and not relatively old, but differed from the findings of Ekwe, Ahumihe and Kalu (2017) who observed that farmers in South East Nigeria are relatively old. Majority (81.7%) of the small ruminant farmers are male, and male farmers also dominated the three States of Abia, Ebonyi and Imo covered in this study with 91.3%, 93.8% and 60.0% respectively. The result implies that small ruminant production is largely dominated by male farmers, possibly due to the roles of men as heads of households even where it is largely evident that the actual responsibility of managing the livestock is left in the hands of women.

This finding is in conformity with the findings of Akintayo (2011) who observed that agricultural production in Nigeria is dominated by males but differed from the findings of Tologbonse, *et al.*, (2011) who found that majority (51.7%) of small ruminant farmers in Abia State are females. Table 1 also showed that majority (89.6%) of the small ruminant farmers in South East Nigeria were married which is in agreement with Tologbonse, *et al.*, (2011) who observed most small ruminant farmers in South East Nigeria are married. The implication is that the chances of having more children are there, which may provide the family labour needed for small ruminant production. On level of education, 65.7%) of the respondents had primary education. This finding corroborates with the work of Tologbonse, *et al.,* (2011) who found that majority of small ruminant farmers in South East Nigeria have formal education. As opined by Asiabaka (2002), lack of formal and informal education leads to high resistance to change especially in the dissemination of information, and this opinion is in tandem with the assertion of Nwachukwu and Apu (2008). Majority (99%) kept the animals for Savings, followed by 96.3% others that kept the animals as Investments. Most (59.6%) of the respondents have had not more than 10 years of small ruminant production experience with a mean farming experience of **12.3**.

Table 1: Percentage Distribution of the Respondents' Socioeconomic Characteristics

Variables	Abia (N=160)	Ebonyi (N=160)	Imo (N=160)	S.E Zone (N=240)
Sex				
Male	91.3	93.8	60.0	81.7
Female	8.8	6.3	40.0	18.4
Age (Years)				
0-30	8.8	7.5	1.3	5.9
31-40	17.5	60.0	57.5	45.0
41-50	45.0	23.8	31.2	33.3
51-60	22.5	6.2	7.5	12.1
≥61	6.2	2.6	2.6	3.8
Mean	**45.9**	**39.8**	**41.6**	42.4
Marital Status				
Single	18.8	7.5	5.0	10.4
Married	81.3	92.5	95.0	89.6
Level of Education				
No formal education	6.3	16.3	22.5	15.0
Primary	72.5	67.5	57.0	65.7
Secondary	6.3	11.3	10.0	9.2
Tertiary	15.0	5.0	10.5	10.2
Farming Experience in years				
0-10	33.8	70.0	75.0	59.6
11-20	33.7	27.5	12.5	24.6
21-30	30.0	2.5	11.3	14.6
≥31	2.5	0.0	1.3	1.3
Mean	**16.6**	**9.8**	**10.6**	**12.3**

Source: Field Survey Data, 2019

Level of Utilization of the Small Ruminant Production Technologies

The result in Table 2 shows the mean scores distribution of the respondents on the use of the four improved small ruminant production technologies studied. The level of utilization of the technologies shows that respondents highly utilized Culling ($\bar{x}$ = 2.3). However, respondents recorded low utilization in the other health management technologies such as Routine vaccination ($\bar{x}$=1.9), Periodic deworming ($\bar{x}$=1.9) and Animal Sanitation ($\bar{x}$=1.7). The result implies low compliance to health management technologies by small ruminant farmers. The situation here is a reflection of the poor management information available to the farmers. Most of the farmers complained of not having access to either extension or qualified animal health management experts who should provide such services as vaccination of the animals. The findings here is in consonance with the study conducted by Ibrahim and Bene (2011) were it was observed that one of the pressing challenge facing small ruminant farmers are issues related to drugs and vaccines. Fabusoro, *et.al*, (2007) also reported the challenge of poor access to veterinary services by small ruminant farmers in Nigeria.

Table 2 Mean Distribution of the Respondents Based on their Level of Utilization of the Small Ruminant Production Technologies/Technologies in South East Nigeria

Improved Technologies	Abia	Ebonyi	Imo	South East	Remark
Culling to remove unproductive females and slow growing, weak animals,	**2.2**	**2.3**	**2.3**	**2.3***	**High**
Routine vaccination against peste de petits ruminants (PPR), diarrhoea etc,	**1.6**	**2.1**	**2.2**	**1.9**	**Low**
Periodic deworming	**1.9**	**2.1**	**1.8**	**1.9**	**Low**
Animal sanitation (Animal sanitation involves washing animals periodically to control ectoparasites like ticks, mites, lice and fleas	**1.5**	**1.3**	**2.2**	**1.7**	**Low**

Source: Field Survey Data, 2019

Farmers' Perception of Attributes of Technologies

Cost effectiveness of Technologies: From Table 3, two technologies; Culling ($\bar{x}$=3.2), and Routine vaccination ($\bar{x}$=3.8) were perceived as being cost effective. The assessment is largely based on the perceived relevance of the technology irrespective of the actual monetary implication of using the technology. Farmers would most probably accept innovations when they are fully aware of the relevance of the innovation (Rogers, 2003; Nwachukwu, 2017).

Time Saving: Table 3 also showed that the respondents assessed Routine Vaccination ($\bar{x}$=3.4) as being time saving in application by the small ruminant farmers in South East Nigeria. Time is a very important economic factor in any productive venture. It is a resource that influences the use of many other factors of production. In the view of Nwachukwu and Ekwe (2007), farmers are engaged in many on-farm and off-farm economic activities competing for time, and would prefer technologies that have time saving attributes.

Similarity to Local Practice: Table 3 also ascertained farmers' perception of the similarity of the improved technologies for small ruminant production. Farmers' will most probably adopt any innovation which is not totally strange to them in terms of socio-cultural and technical make-up. The result as presented showed that Routine vaccination ($\bar{x}$=3.5) and Periodic deworming ($\bar{x}$=3.8) were similar to farmers' local technologies. It was observed from further interaction with the farmers through focused group discussion and key informant interview that most of the technologies had their local alternatives (indigenous knowledge) that the farmers have been using, which are similar to the improved technologies recommended from research and extension.

Environmental Friendliness: Table 3 showed the result of the perception of the respondents on the environmental friendliness of the improved technologies of small ruminant production studied. Three out of the four technologies had mean score ratings above the cut-off point of 3.0. From the result, Routine vaccination ($\bar{x}$=3.1), Periodic deworming ($\bar{x}$=3.8) and Animal Sanitation ($\bar{x}$=3.6) were perceived as being environmental friendly. However, culling ($\bar{x}$=2.5) was considered as not being environmental friendly. A change to positive perception of the respondents of some of the technologies requires concerted exposure to information that will help them evaluate the implications of the technologies appropriately.

Table 3: Mean Distribution of Respondents Based on Perceived Attributes of the technologies/Technologies

Attributes	Cost Effectiveness				Time Saving				Similarity to local Practice				Environmental Friendly			
State	AB	EB	IM	**SE**	AB	EB	IM	**SE**	AB	EB	IM	**SE**	AB	EB	IM	**SE**
C	3.5	2.9	3.1	**3.2***	2.2	1.9	1.8	**2.0**	3.2	2.8	2.8	**2.9**	2.7	2.4	2.3	**2.5**
RV	3.6	4.1	3.8	**3.8***	3.6	3.5	3.2	**3.4***	3.4	3.5	3.6	**3.5***	2.8	3.2	3.3	**3.1***
PD	2.7	2.9	2.9	**2.8**	2.0	2.4	2.5	**2.3**	3.7	3.9	3.8	**3.8***	3.4	3.9	4.2	**3.8***
AS	3.3	3.0	2.7	**3.0**	2.2	1.8	2.3	**2.1**	2.4	2.5	2.4	**2.4**	3.6	3.6	3.7	**3.6***

Source: Field Survey Data, 2019

Relationship between farmers' perception of the attributes of Small Ruminant Production technologies and use

The result presented in Table 4 shows the relationship between farmer's perception of the attributes of the technologies and their use. The Semi Log model was chosen as the lead equation for the test of significant relationship between farmers' perception of technology attributes and the use of Culling (to remove unproductive females and slow growing and weak animals), due to the highest number of significant variables, high R^2 value of 0.461 implying that 46% of the total variation in the dependent variable was accounted for by the explanatory variables. Also, the F-ratio (28.320) was significant at P<0.01 which reflects the overall significance of the regression line and a constant significant at P<0.05. From the result, all the attributes were significant at P<0.05. Such variables as; Cost effectiveness (1.997) and Environmental friendly (2.374) were significant and positively related to the use of Culling as an improved technology. However, other attributes such as; Time saving (-7.984), Similar to local practice (-2.189) were also significant but negatively related to the use of the practice. The results obtained are in agreement with the findings of Ekwe and Nwachukwu (2006) who observed that farmers adopt innovations that they perceive as being able to reduce the drudgery that is associated with farming while ensuring safe environment and increased output.

The Semi log model was chosen as the lead equation for the test of significant relationship between farmers' perception of technology attributes and the use of Routine vaccination (against peste de petits ruminants-PPR-, diarrhoea etc,), due to the highest number of significant variables, high R^2 value of 0.374 implying that 37% of the total variation in the dependent variable was accounted for by the explanatory variables. Also, the F-ratio (12.533) was significant at P<0.01 which reflects the overall significance of the regression line and a constant significant at P<0.05. The result shows that while Cost effectiveness (2.029) was significant at P<0.05 and positively related to the use of the technology, perceived Environmental friendliness (-2.784) was also significant but negatively related to the use of the technology.

The Exponential model was chosen as the lead equation for the test of significant relationship between farmers' perception of technology attributes and the use of periodic deworming, due to the highest number of significant variables, high R^2 value of 0.434 implying that 43% of the total variation in the dependent variable was accounted for by the explanatory variables. Also, the F-ratio (5.123) was significant at P<0.01 which reflects the overall significance of the regression line and a constant significant at P<0.05. The result shows that Similar to local practice (3.631) was significant at P<0.05 and positively related to the use of periodic deworming, while environmental friendly (-2.931) was also significant at P<0.05 but negatively related to the use of the technology. This result corroborates with the findings of Ekwe and Nwachukwu (2006) and Ekwe, *et al.,* (2017) that farmers' perception of the attributes of an innovation are major determinants of acceptance of innovations.

Table 4: Ordinary Least Square Regression Model to determine the Relationship between farmers' perception of the attributes of Small Ruminant Production technologies and use of technologies.

Variables	Culling Semi-Log	Routine Vaccination Semi-Log	Periodic Deworming Exponential	Animal Sanitation Linear
Constant	3.820 (15.040)***	2.217 (5.728)***	0.945 (2.716)**	1.254 (5.074)***
Cost Effectiveness	0.183 (1.997)**	0.519 (2.029)**	-0.015 (-0.208)^{ns}	0.173 (5.545)***
Time Saving	-0.673 (-7.984)***	0.026 (0.148)^{ns}	-0.059 (-0.944)^{ns}	-0.230 (-10.6257)***
Similar to Local Practice	-0.217 (-2.139)**	-0.289 (-1.111)^{ns}	0.147 (3.631)***	-0.102 (-3.006)***
Environmental Friendly	0.239 (2.374)***	-0.353 (-2.784)**	-0.075 (-2.931)**	-0.032 (-0.787)^{ns}
R^2	**0.461**	**0.374**	**0.434**	**0.450**
Adjusted R^2	**0.444**	**0.252**	**0.308**	**0.434**
F-ratio	**28.320*****	**12.533*****	**5.123*****	**27.160*****

Source: Field Survey Data 2019; Figures in parenthesis are t-values; *** = 1% significant level, ** = 5% significant level

Other attributes; Cost effectiveness (-0.208), Time Saving (0.944) were not significant at P<0.05 but had negative relationship with the use of the improved practice. The linear model was chosen as the lead equation for test of significant relationship between farmers' perception of technology attributes and the use of Animal sanitation (Animal sanitation involves washing animals periodically to control ectoparasites like ticks, mites, lice and fleas), due to the highest number of significant variables, high R^2 value of 0.450 implying that 45% of the total variation in the regression line was accounted for by the explanatory variables. Also, the F-ratio (27.160) was significant at P<0.01 which reflects the overall significance of the regression line. The constant was also significant at P<0.05.

At P<0.05, Cost effectiveness (5.545) was significant and positively related to the use of Animal Sanitation. Similarly, other attributes as; Time Saving (-10.626), Similar to Local practice (-3.006) were also significant at P<0.05 but negatively related to the use of the improved practice. However, the overall result as presented shows that there is a significant relationship between farmers' perception of the attributes of improved small ruminant production technologies and use. As opined by Rogers (2003) and Nwachukwu (2017), farmers acceptance of innovations is a function of how relevant they perceive the innovation, in terms of cost effectiveness, time saving, environmental friendliness among other attributes.

CONCLUSION/RECOMMENDATION

The study concludes that small ruminant farmers are relatively young with moderate years of experience. The level of use of improved health management technologies is relatively low, and use of technologies by farmers is significantly related to their perception of the attributes of the technologies, in terms of cost effectiveness. The study therefore recommends an increase in livestock farmers' education on health management technologies, and a linkage between orthodox and traditional management technologies to accommodate indigenous knowledge for enhanced small ruminant production in the region.

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