EFFECT OF CLIMATIC AND ECONOMIC FACTORS ON PRODUCTION AND MARKETING OF GOATS IN SOUTH-EAST NIGERIA

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Abstract
The study analyzed the climatic and economic factors affecting goat production and marketing in South East Nigeria. A total of 360 respondents were selected from South East (Abia, Ebonyi and Enugu States) Nigeria. Data were elicited from primary source using structured and pretested questionnaire to collect data on goat production and marketing. Method of data analysis involved the use of descriptive (tables, mean, frequency, Gini coefficient) and inferential statistics (multiple regression). The result obtained showed that majority (64%) of the agripreneurs operated on a small-scale with flock size ranging between 5-10 goats. The average number of goats sold was four indicating that goat marketing is at micro-scale in the area. Many (37.54%) of the agripreneurs engage in extensive goat production system. The result further showed that out of 341 respondents interviewed, 227 (66.57%) marketers were in agreement that there is no barrier to goat market entry and exit, while the Gini coefficient was 0.5, indicating presence of average competition in goat marketing. The clustered mean of 3.41 implies that climate change element is a limitation to goat husbandry practice in South East Nigeria. The significant factors for production function include: feed, stock density, capital and medication. The study revealed that climatic and economic factors affect the productivity and marketing of goat in South East Nigeria. The study recommends that goat farmers should adopt intensive system of goat production and take advantage of different sources of finance, production and market information provided by the government and non-governmental organizations for enhanced productivity.

Keywords: Productivity, Market-structure, Climatic, Economic, South-East, and Nigeria

Introduction

Goat productivity and marketing is recognized for its contribution to livestock gross domestic earning in Nigeria. In 2017, the number of goats in Nigeria was about 78 million (FAO, 2019), with about 90% of these goats reared in the Northern region of Nigeria (Lawal-Adebowale, 2012), while the remaining 10% are reared in the South. In Nigeria, there are three major breeds of goat reared-West African Dwarf Goat commonly found in Southern Nigeria, Red Sokoto and Sahel goats mainly reared in Northern Nigeria. Goat production is mainly the occupation of farmers in the rural areas due to convergence of factors which include: availability of land, culture, and lack of other economic opportunities etc. Goat production plays a significant economic role in supporting the life of rural households (Yusuf *et al.*, 2018). Lebbie (2014) reported that goat production and marketing acts as a source of income, meat, milk, skin,

wool, manure and security against complement inadequate yield from crop. In many economies, goat does not only provide protein to the entire populace but also provide employment opportunity in form of production and marketing, and also contributes to the local economy (Asnakew, 2005). Goat production is known to have the several economic, climatic and managerial advantages over other livestock such as high prolificacy, low input requirement, low managerial capability, low initial capital investment, disease resistance, environmentally friendly and ease of marketing (Kumar, *et al*., 2011, Ayele *et al*. 2008; Legesse *et al.* 2008; Amankwah *et al*. 2012; Musara *et al*. 2013; Hailu 2014).

While many Nigerians consume and enjoy goat meat, not many are aware of its production system. In Nigeria, three major categories are mobile pastoral/agro-pastoral

system (mainly based on small and large ruminants in the Northern part of the country), traditional mixed crop-livestock system (mainly sedentary/ village-based, throughout the country) and commercial system (mainly semi-intensive peri-urban production system). These three categories have different strengths and weaknesses and require specific interventions. Interestingly, each production system adopted by the farmer affects scale of production and marketing of the goat. Kumar *et al.,*(2011), categorized the scale of production and marketing of goat according to flock size and size of land into very small scale, small scale, medium scale and large scale. With global market and consumer trends in meat demand. Antonio and Silver (2011) reported that demand for goat products will double in the next 20 years due to increase in population, urbanization, health concerns and economic growth, thereby providing large market opportunity for goat agripreneurs. In Nigeria, livestock contribute about 20% of the National Greenhouse Gas (GHG) emission, which constitute the major factor contributing to climatic change; goat, like other animals affect climate conditions and are affected by it. Abate (2009) indicated that drought and delay in the onset of rain led to poor regeneration of grass, water shortage and heat stress on livestock. This scenario leads to increased mortality of livestock, vulnerability to diseases and physical deterioration consequences. According to Nelson *et al.,* (2009), it is estimated that climate change will lead to significant yield losses of between 3 - 30 % and extinction of land plants and animal species by 15 -37% by the year 2050, leading to low productivity of these products with consequences on food security, price and demand issues unless adaptation and mitigation measures are taken into consideration. This shows the extent to which climatic change can affect agricultural productivity and marketing especially animal productivity and marketing. This study is an attempt to examine the issue of climate change and economic factors within a broader context as it affects production of goat and its marketing in Nigeria.

Methodology
Study area
This study was carried out in South-East Nigeria. The South-East is one of the six geo-political zones of Nigeria, consisting of Abia, Anambra, Ebonyi, and Enugu and Imo States. The population of the zone is estimated at over 16, 381, 729 persons, disaggregated into 8, 306, 306 males and 8, 075, 423 females with a population growth rate of 2.6% (425, 925) per year (NPC, 2006). The region lies in the humid ecological tropical zone of Nigeria, within the latitudes 5°N to 6° N and Longitudes 6°E and 8°E. The humid tropical ecology is characterized by two distinct seasons; dry season which starts from November to late March and the rainy season which starts from April to October. This has changed in recent times due to climate challenge making it difficult to identify different seasons. Also, there have been changes in almost all-weather elements like temperature, windstorms, rainfall, harmattan and disease outbreaks. The general vegetation consists of

woodland savannah in the Northern part of the Zone and mangrove forests in the deep Niger Delta area (Onyeneke and Madukwe, 2010). The predominant soil of the area is sandy loam with natural vegetation in the tropical rainforest. Farming constitutes one of the major predominant occupations of the people in the zone majority of who are small-holder farmers. Major food crop cultivated include: cassava, maize, rice, sweet potatoes, yam, plantain, banana and vegetables. The cash crops grown include: oil palm, cocoa, coconut tree, orange etc. and mixed farming and mono-cropping practiced in the area. The farmers are primarily involved in food production and animal husbandry such as poultry, piggery, sheep and goat rearing and domestic grasscutter farming. Goat agripreneurship is an old agribusiness venture in the South East Nigeria. Majority of the goats produced in the South East are the West African Dwarf goat specie. This is a choice meat in Igbo land during occasions and festivals. This and other benefits attract many households and individual farmers in goat animal husbandry.

Data Collection and Sampling Techniques
Data for this study were sourced from primary sources. The primary source of data involved the administration of well-structured and pretested questionnaire and market assessments. The questionnaire was used to collect data on goat production and marketing from South-East Nigeria. The study adopted a three multi-stage sampling strategy to select goat producers and marketers for the study. Stage 1 was purposive sampling to select three States (Abia, Enugu and Ebonyi) from the five states in the South East Nigeria. The choice of these states was based on advice from Agricultural Development Programme (ADP) as concentration of goat agripreenurs. Stage 2 was random sampling of three Local Government Areas (LGA) from each State, with large concentration of local goat production. Stage 3 was random sampling of 4 autonomous communities from each LGA to select 40 goat husbandry agripreneurs. In all 360-goat husbandry agripreneurs were sampled but only 341 copies of questionnaire were returned. The sample size for the study therefore was 341goat husbandry agripreneurs in South East Nigeria.

Data Analysis
The study employed a mixture of differential and inferential statistics. The differential statistics include: tables, frequencies and Gini Coefficient for market concentration; others are mean score analysis with a five-point Likert scale system; while the inferential statistics employed a multiple regression analysis.

Model Specification
The models for the analyses of the analytical tools are as specified:

Gini Coefficient Model
Following Habib(2017), the Gini coefficient model is represented as:

$$G.C = 1 - \sum_{ij=0}^{n}(Y_i + Y_j)(X_i + X_j) \ldots (1)$$

G.C = Gini coefficient, Y = cumulative percentage of goat sellers, X = cumulative percentage of sales

Mean Score
Following Mgbanya *et al.*, (2018), the Mean score is presented as:

$$X_i = \frac{\sum_{j=1}^{n} X_j N_j}{N_r} \dots \dots \dots \dots \dots \dots (2)$$

X_i = Mean score, Σ = summation, X_j= Likert value (1, 2, 3, 4, 5), N_j= Number of respondents who select the Likert value, N_r= Total number of respondents.

Multiple Regression Model

The multiple regression model was used to estimate the production function for goat in South-East Nigeria. The model is explicitly modeled as follows

$$Y=B_0+B_1X_1+B_2X_2+B_3X_3+B_4X_4+B_5X_5+B_6X_6 + e_t \dots (3)$$

B_0 is the intercept, B_1 to B_6= the regression coefficients or the slope of the equation, Y = Goat production (total revenue from goat production in Naira), X_1 = Cost of labour (N), X_2 = Cost of feed (N), X_3 = Stock density (kg), X_4 = Water (Naira/liter), X_5= Capital (N), X_6= Cost of Medication (N), e_t= error term

The multiple regression model used to analyse the effect of climatic and economic factors on goat productivity, explicitly modeled as follows:

$$Y= B_0+B_1X_1+B_2X_2+B_3X_3+B_4X_4+B_5X_5+B_6X_6+B_7X_7 +B_8X_8 + B_9X_9 + B_{10}X_{10} +e_t \dots (4)$$

B_0 is the intercept; B_1 to B_{10} are the regression coefficients or the slope of the equation.

Y = Goat productivity (ratio of total revenue from goat production to total cost involve in goat production in naira), X_1= Cost of feed (N), X_2 = Housing/rent (N), X_3= Labour availability (Man-days), X_4 = Access to capital (amount), X_5= Cost of medication and services (N), X_6= Market infrastructure adequacy (Dummy: yes=1, No = 1), X_7= Extension service availability (Dummy: Yes=1, No=0), X_8 = Climatic stability (Dummy: Yes=1, No=0), X_9 = Climate change Mitigations/ Adaptability Efforts (Dummy: Yes = 1, No =1), X_{10} = Animal mortality (Number of mortalities), e_t= Error term

The multiple regression model used to analyse the effect of climatic and economic factors on goat marketing is explicitly modeled as follows:

$$Y= B_0+B_1X_1+B_2X_2+B_3X_3+B_4X_4+B_5X_5+B_6X_6+\dots+B_8X_8+ e_t \dots \dots \dots \dots \dots \dots ..(5)$$

B_0 is the intercept; B_1 to B_8 are the regression coefficients or the slope of the equation.

Y = Goat marketing (Number of goats sold per annum), X_1 = Transportation cost (N), X_2 = Proximity to market (yes=1, No =0), X_3 = Marketing tax and levy (N), X_4 = Market price of goat (N), X_5 = Market remoteness (measured as the ranked value from likert scale), X_6 = Seasonality of commodity (measured as the ranked value from likert scale), X_7 = Market information (measured as the ranked value from likert scale), X_8 = Mortality of animal (measured as the ranked value from likert scale), e_t= Error term

Results and Discussion
Goat Production and Marketing Scale
Descriptive statistics was used to analyze the flock size, production and marketing scales of goat agripreneurs in South-East Nigeria. This helped to categorize the agripreneurs according to scale of production and marketing into micro, small and medium scale. The results of the analyses are presented in Tables1 and 2 respectively.

Table 1: Distribution of the goat agripreneurs according to flock size and production scale

Flock Size	Number of Agripreneurs	Percentage	Mean	Scale
<5	42	12.3	**9**	Micro
5 – 10	223	**65.4**		Small
>10	76	22.2		Medium
Total	**341**	**100**		

The result showed that majority (65.4%) of the agripreneurs has flock size range of 5-10 goats with a mean flock size of nine (9) goats in the study area. This study adopted Kumar *et al*., (2011) categorization method that categorized the flock size in semi-arid zones of two major goat-keeping States of Uttar Pradesh and Rajathan, India. Their study discovered that the average flock size in Rajasthan were 3, 10, 22 and 45 of breeding goats for very small (micro), small, medium and large-scale categories respectively. This study best fit production strategy in the South-East Nigeria contrary to other categorizations in goat animal production literatures. There is no consensus among policy makers and researchers on categorizing flock size of goats into micro, small, medium and large production scale. For instance, an international survey by IFPRI/SARI (2013) on small, medium and large-scale goat production in Ghana categorized flock sizes of four (4), nine (9) and 35 goats for small, medium and large-scale sizes respectively. Cyber Livestock Communications and Extensions through Sharma (2019) categorized flock sizes of goat of less than 150 (<150) as small size, 150-400 as medium scale and greater than 400 as large scale.

The result presented in Table 2 shows the number of goats marketed and the marketing scale of agripreneurs in South-East Nigeria.

Table 2: Distribution of the goat marketers according to number of goats marketed and marketing scale in South East Nigeria

Number of goats marketed	Number of marketers	Percentage	Mean	Scale
<5	293	85.9	4	Micro
5 – 10	47	13.8		Small
>10	1	0.3		Medium
Total	341	100		

Source: Field Survey, 2019

The results show that marketers selling goats within a range less than five (<5) are in majority (85.9%)amongother goat marketers within the ranges 5 – 10 (13.8%) and 11 – 25 (0.3%) respectively. Categorizing the goat marketers according to their scale of marketing indicated that majorityof the marketers operated at micro scale level whereas, 13.8%, and 0.3% operated as small and medium scale respectively. This implies that greater percentage of the marketers operate as micro scale with an average of 4 goats marketed. The mean flock marketing size of 4is an indication of rudimentary marketing and a very under-developed marketing taking place mainly at the farm gate following Kumar *et al.*, (2011).

Production Systems
The goat producing agriprenuers in the study area were analyzed according to their production systems and the result is presented in Table 3.

Table 3: Distribution of goat producing agripreneurs according to production system

Production system	Frequency*	Percentage
Free range (no shepherd)	74	21.70
Extensive system (with shepherd)	47	13.78
Semi-intensive system (housing, tethering of animals, cut and carry and occasional free grazing)	128	37.54
Zero grazing or cut and carry system	98	28.74
Intensive system (commercial production)	25	7.33

Source: Field Survey, 2019. *multiple responses

The results of goat production system adopted by the goat producing agriprenuers in the study area indicate that many (37.54%) agripreneurs in the study area practice semi-intensive production. The semi-intensive system is practiced with a strategy that accommodates multi-dimensional grazing systems that allow housing, tethering, cut and carry and free grazing production systems. However, some agripreneurs do not practice the four systems together but allow element of housing plus any other component(s) such as tethering or cut and carry or occasional grazing. Also, apart from semi-intensive production system, most agripreneurs practice zero grazing system (28.74%) and free range without a shepherd (21.70%). This shows that majority of the goat producing agriprenuers prefer semi-intensive and limited free grazing goat production system while few practice free grazing system only. This could be because of inability of these farmers to buy concentrates and other resources that may improve feeding patterns. Ajala and Gefu (2003) indicated that goat production system in Northern Nigeria is mostly managed under free range system but not exactly the same in South-East Nigeria, though there were elements of occasional free grazing without a shepherd. Consistent with literature, this finding implies that goat production does not require much land space before venturing into the business. In addition, systematic study into goat production system is difficult since some animals are allowed to roam freely and scavenge for food and water while exposing them to diseases and pest attacks. It therefore implies that goat production systems involving zero grazing and intensive production system to mitigate undue climatic, environmental and disease exposures should be encouraged. This follows Yusuf, *et al.,* (2018), who reported that about 38% but not majority of semi-arid areas of Northern Nigeria, small ruminant farmers engage in intensive production system which is the dominant production system than free grazing.

Market Structure
Market structure for goat is a framework that shows the features and level of competition in goat market. The goat market structure studied include; type of sales, market participants, entry to the market, nature of goats sold, price and frequency of marketing. Table 4 shows the result of the percentage distribution of the market structure of goat marketing in the study area. In terms of participation, though the retailers are in majority (17.93%), but the entire participants have a fair, competitive and effective share of the market as follows: other producers of goat(13.63%), fatteners (15.06%), wholesalers (14.06%), butcheries (16.79%), hotels/restaurants (10.76%), brokers/agents (2.87%) and consumers of goat meat (8.90%). This implies good market and demand for goat but it appears that the animal product is in limited supply. The result also implies that the market for goat is well developed in the area with all the market participants represented.

Table 4: Market structure for goat marketing in South-East Nigeria

Features	Frequency	Percentage
Market Participants*		
Other producers of goat animal	55	7.89
Fattener	105	15.06
Wholesalers	98	14.06
Retailers	145	20.80
Butcheries	137	19.66
Hotel/Restaurants	75	10.76
Brokers/Agents	20	2.87
Consumers	62	8.90
Total	**697**	**100**
Entry to the goat market		
Presence of barrier (minimal)	114	33.43
Absence of barrier	227	66.57
Total	**341**	100
Nature of good(Goat) Sold*		
Doe	229	33.88
Buck	217	32.10
Kid	133	19.67
Castrates	97	14.35
Total	**676**	100
Price policymaking		
Negotiation between buyer and seller price	304	89.15
Producers price	37	10.85
Total	**341**	**100**
Frequency of the Market		
Daily market	0	0
Weekly	181	53.10
Monthly	57	16.70
Yearly	103	30.20
Total	**341**	**100**
Payment of levy on goat marketing		
Yes	341	100
No	0	0
Total	**341**	**100**

Source: Field Survey, 2019. * Multiple Responses

The result further showed that out of 341 goat agripreneurs studied, 227 (66.57%) indicated no barrier to market entry. Some of the marketers confirmed that the nature of the barrier was not burdensome but a situation where levies (N100-N200) are paid especially at the periodic markets. The absence of barriers in the many goat markets in the study area is in tandem with the characteristics of a competitive market. The result of the nature of goods (goat) sold revealed that all market sales are uniform as follows: does (33.88%), bucks (32.1%), kids (19.67%) and castrated goats (14.35%). The goats sold varied in sizes depending on the market location but majority of the marketed animals are does and bucks with minimal number of kids. The price policymaking strategy adopted in the market is by negotiation between buyers and sellers (89.15%) with producers who set price themselves alone in minority (10.85%). This indicates that both parties either take or set the price of the goat at the market. Market frequency practiced by marketers in the study area are daily marketing (0%), weekly(53.10%), monthly (16.70%) and yearly (30.20%). This implies that most of the goat producer marketers engaged in periodic (weekly) marketing of goats. The result also showed that all the respondents (100%) noted they pay levies whenever they bring goats for sale in the market. All these features of goat market structure conform to the perception of Kotler about market structure. Kotler (2008) defined market structure as those organizational characteristics of a market that direct the nature of competition and behavior of the market participants. Therefore, the market structure of goat in South-East is competitive following Habib (2017).

Market concentration
The Gini coefficient of goat marketers is referred to as the relative measure of goat farm concentration. It was conducted to analyse the market concentration of the goat marketers in order to identify presence of competition in the market. The result is presented in Table 5.

Table 5: Gini-Coefficient Estimates for goat marketers in the South-East Nigeria

Income	Freq.	% (X)	Cum. %	Revenue	%	Cum. %	XY
< 100000	49	0.14370	0.14370	73271	0.05003	0.05003	0.00719
100,001 – 150,000	50	0.14663	0.29032	118771	0.08110	0.13113	0.01923
150,001 – 200,000	51	0.14956	0.43988	152271	0.10397	0.23510	0.03516
200,001 – 250,000	45	0.13196	0.57185	211812	0.14463	0.37973	0.05011
250,001 – 300,000	49	0.14370	0.71554	254221	0.17359	0.55332	0.07951
300,001 – 350,000	53	0.15543	1.28446	302171	0.20633	1.44668	0.22485
>350,000	44	0.12903	1.00000	352011	0.24036	1.00000	0.12903
	341	1.00000	4.4457478	1464528.00	1	3.79599093	0.54508

Source: Field Survey, 2019

Gini- coefficient = 1 – Σxy = 1- 0.54508= 0.4549

The Gini coefficient (0.4549) computation of the goat marketers shown in Table 5 indicates low level of inequality in the sales revenue of the respondents. According to Pulaj and Kuma (2013), decrease in Gini coefficient shows that the market approaches to equality and higher intensity of competition and increase indicated inequality and lower intensity of competition. Gini coefficient greater than 0.5 but not equal to 1 indicates low inequality in the distribution of the market share. They reported that the gini coefficient of 0.139 indicates equal situation and a higher intensity of competition between concentrated firms. Therefore, the result of the analysis in Table 5 implies that there is 45.49% equality in sales revenue of goat marketers in the study area. Therefore, the market form is about 50% competitive (not highly perfect) indicating average concentration or equal market share among competing firms. A higher Gini coefficient implies poor or scattered level concentration and consequently high inefficiency in the market structure. The average concentration (equality) could be as a result of variations in participation and investment level of the respondents which are driven by farmers' interest, location, climate and economic factors.

Production function

The estimated production function for goat production is shown in Table 7.

Table 7: Estimated Production Functions of the goat farmers

Variables	Linear	Exponential	Double log+	Semi log
Intercept	108985.1	12.03	3.77	-25305524
	(3.01) ***	(110.32) ***	(14.05)	(-16.05) ***
Labour (X_1)	787.02	0.00089	0.0010	13095.64
	(0.67)	(0.25)	(0.08)	(0.17)
Feed (X_2)	6.89	0.000017	0.84	275047.5
	(21.75) ***	(17.68) ***	(38.94) ***	(21.71) ***
Stock density (X_3)	23595.76	0.058	0.13	108845.7
	(5.48) ***	(4.49) ***	(3.92) ***	(5.59) ***
Water (X_4)	1956.06	0.00091	0.038	92154.85
	(4.38) ***	(0.67)	(1.34)	(0.54) ***
Capital (X_5)	-5.53	-5.18e-06	-0.026	-18012.91
	(-7.72) ***	(-1.55)	(-5.81) ***	(-6.94) ***
Medication (X_6)	-2.44	0.000011	0.032	-23297.57
	(-5.41) ***	(2.45)	(2.71) ***	(-3.31)
R^2	0.7935	0.6726	0.9068	0.8162
R^{-2}	0.7898	0.6667	0.9052	0.8129
F-ratio	213.89***	114.36	541.88***	247.22***

Source: Field survey (2019), +=lead equation, *** =Significant at 1%, ** =Significant at 5%, * =Significant at 10%

The double log functional form was chosen as the lead equation. The choice of the lead equation was based on the number of significant variables, magnitude of the coefficient of multiple determinations (R^2), and conformity with *a priori* expectations. The R^2 value of 0.9068 implies a90.68% of the total variation in the farmers output explained by the independent variables. Feed, stock density, capital and medication were the significant variables influencing the output of the goat farmers. Feed was significant at 1% and positively related to output; this implies that a 1% increase in quantity of feed will lead to a 0.84% increase in output. This is in contrast with Ogunniyi (2010) who observed that feed has negative relationship with total revenue of goat production in Oyo state Nigeria. It may be noted here that feed fed to goats in the study area are mainly processed and unprocessed stuffs of plant origin. The coefficient of the stock density was significance at 1%

and directly related to output of the agripreneurs. This implies that output increased by 0.13% with a 1% increase in stock density. Coefficient of medication was significant at 1% and directly related to output. This indicates that an increased cost of medication in goat production by 1% led to an increase in the output levels of the agripreneurs by 0.032%. The implication is that with more medications in goat production, ill-health is mitigated and output of the agripreneurs enhanced. Capital was significant at 1% and negatively related to the level of output. This indicates that an increased capital (farm tools) by 1% in goat production led to a decrease in the output level of the agripreneurs by 0.026%. This might be because of inadequate capital due to lack of access to credit support and information. The agripreneurs with poor capitalization and training access crude inputs and farm tools which is a limiting factor in production.

Climate change elements militating against Goat husbandry practices

Likert rating scale was used to elicit data from the respondents on climate change elements militating against goat production in the study area. The result of the analysis is presented in Table 6.

Table 6: Climate change elements militating against goat husbandry practices in the study area

Climate change element	SA	A	UD	D	SD	Mean	Decision
Floods	140	88	58	34	38	3.50	Accepted
Sea level	58	34	129	158	41	2.97	Rejected
Heavy Rainfall	99	119	76	72	11	**3.76**	Accepted
Average temperature	81	111	84	112	9	3.58	Accepted
Sunlight/Day length	89	115	77	88	16	3.64	Accepted
Relative Humidity	87	123	91	66	7	**3.73**	Accepted
Strong wind	109	127	70	58	6	**3.89**	Accepted
Salinity of Sea water	32	51	117	186	48	**2.78**	Rejected
Landslide	47	40	106	198	49	2.82	Rejected
Clustered Mean						**3.41**	**Accepted**

Source: Field Survey, (2019) SA = Strongly agree, A= Agree, UD = Undecided, D= Disagree SD = Strongly disagree

From the result, nine (9) item questions were designed in the questionnaire to ascertain climate change elements limiting goat husbandry practices in the study area. Six of the variables were accepted (mean range used for decision which is 3.0 and above). Strong wind has on the average, the highest mean ($\overline{X}$ = 3.89) i.e. the most important element militating against goat production in the study area. This was followed by Heavy Rainfall ($\overline{X}$ = 3.76); Relative Humidity ($\overline{X}$ = 3.73) while Sea level, Salinity of Sea water and Landslide have means less than 2.5 which were rejected. Furthermore, the clustered mean of 3.41 implies that climate change generally is limiting goat husbandry practices in the study area. This is consistent with report of the FAO (2008), that among the direct effects of climate change are high temperatures and changes in rainfall patterns, translating in an increased spread of existing vector-borne diseases and macro parasites of animals and emergence and spread of new diseases. Furthermore, climate change elements such as rainfall shift, droughts, and floods were reported to affect yields in Africa (Zoellick, 2009 and UNFCCC, 2007). Khanal (2009) noted that biophysical impact of climate change elements include physiological change in goat performance, change in soil and water resources, pest infestation, increase in weed germination, rise in sea level and temperature.

Effect of climatic and economic factors on goat productivity

Multiple regression result on effects of climatic and economic factors on productivity of goat were summarized and presented in Table 8.

Table 8: Multiple regression estimates of effect of climatic and economic factors on productivity of goat

Variables	Linear	Exponential	Double log	Semi log +
Intercept	72.154(28.147)***	11.500(71.354)***	4.904(8.937)***	2.416(1.647)
Cost of feed (X_1)	1.007(0.902)	.001(.847)	0.003(0.941)	0.037(10.234)***
Housing/rent (X_2)	1.847(7.140)***	1.467E(6.991)***	0.068(14.750)***	0.842(14.550)***
Labour availability(X_3)	-2.003(-0.524)	0.000(-0.448)	-0.001(-0.490)	-0.019(-.613)
Access to capital (X_4)	0.000(0.128)	4.891(0.020)	-0.001(-0.181)	0.001(0.020)
Cost of medication(X_5)	7.272(.444)	5.297(0.398)	0.009(1.219)	0.114(1.288)
Market infrastructure(X_6)	-1.190(-1.267)	-1.040(-1.364)	-0.003(-1.042)	-0.028(-0.785)
Labour (X_7)	-1.992(-0.834)	-1.703(-0.879)	-0.013(-0.906)	-0.145(-0.814)
Climatic stability (X_8)	0.024(2.308)**	0.002(2.375)**	0.006(2.742)**	0.071(2.484)**
Climate change mitigation(X_9)	0.043(1.545)	0.003(1.430)	0.010(1.751)*	0.147(1.980)*
Animal mortality (X_{10})	2717.241(1.140)	0.018(1.290)	0.075(1.173)	11193.284(1.007)
R^2	0.587	0.572	0.789	0.890
R^{-2}	0.531	0.513	0.781	0.881
F-ratio	10.219***	10.367***	38.562***	38.897***

**Source*: Field survey (2019)*

The semi-log functional form was chosen as the lead equation. The choice of the lead equation was based on the number of significant variables, the magnitude of the coefficient of multiple determination (R^2), and agreement with *a priori* expectations. The coefficient of multiple determination was 0.89 which implies that 89% of the variation in goat productivity was explained by the independent variables included in the model. Cost of feed, housing/rent, climatic stability and climate change mitigation were significant variable that influenced the productivity of the goat agripreneurs in the area. Cost of feed was significant at 1% risk level and positively related to productivity of the goat farmers. This implies that an increase in value of feed (such as hay, supplementary feed) will enhance productivity level of the goat agripreneurs in the area. Housing/rent was significant at 1% risk level and positively related to goat productivity. This implies that as rent increases, the productivity of the goat agripreneurs is expected to increase. Also, climate stability was significant at 5% risk level and positively related to goat productivity. This indicates that as stability of climate variables in goat farming increases, the productivity level will increase also. Furthermore, the coefficient of climate change mitigation was significant at 10% risk level and positively related to product infrastructure development support from government. This will enhance productivity ability level of the goat agriprenuers in the area.

Effect of climatic and economic factors on goat marketing

The results in Table 9 show the multiple regression estimates of effect of climatic and economic factors on goat marketing in the study area.

Table 9: Regression Estimates of the effect of climatic and economic factors on goat marketing

Variables	Linear	Exponential+	Double log	Semi log
Intercept	131513.382 (3.583)***	11.819 (54.456)***	10.198 (4.383)***	-169982.588 (-0.423)
Transportation cost(X_1)	-524.538 (-0.766)	-0.003 (-0.681)	-0.021 (-.672)	-4643.147 (-0.864)
Proximity to market (X_2)	-0.366 (-1.665)	-2.419 (-1.861)*	-0.059 (-1.178)	-7910.278 (-0.912)
Marketing tax & levy(X_3)	-280.255 (-0.507)	-0.003 (-0.786)	0.007 (0.271)	1949.461 (0.413)
Market price of goat (X_4)	254.222 (1.002)	0.002 (1.193)	0.087 (1.565)	12213.319 (1.278)
Market remoteness (X_5)	0.943 (0.773)	5.514 (0.695)	0.538 (0.013)	90262.596 (0.813)
Seasonality of commodity (X_6)	1.402 (1.755)*	9.861 (2.088)**	0.042 (1.357)	5124.780 (0.947)
Market information (X_7)	-0.376 (-0.1851)*	-2.385 (-1.987)*	-0.375 (-2.424)**	-59706.574 (-2.233)**
Mortality of animal (X_8)	-1531.589 (-1.746)*	-0.010 (-1.923)*	-0.032 (-1.283)	-4384.802 (-1.019)
R^2	0.683	0.748	0.707	0.687
R^{-2}	0.626	0.683	0.653	0.629
F-ratio	11.976***	13.126***	9.071***	11.928***

Source: Field survey, 2019

The exponential functional form was chosen as the lead equation. The choice of the lead equation was based on the number of significant variables, magnitude of the coefficient of multiple determination (R^2), conformity of signs with *a priori* expectation and significant F-ratio. The coefficient of multiple determination was 0.748 which implies that 74.8% of the variation in the revenue level was explained by the independent variables included in the model. Proximity to market, seasonality of commodity, market information and mortality of animal were significant variables that influenced the marketing revenue of the goat agriprenuers in the area. The coefficient of proximity to market was significant at 10% level and negatively related to revenue but this is against the expectation of a positive relationship. This might be because some of the marketers did not take advantage of spatial/location utility and the potential to increase market revenue. Seasonality of commodity was significant at 5% risk level and positively related to revenue, this implies that seasonality of commodity has direct influence on revenue. This suggests that the revenue generated from the sale of goats would increase during festive periods. Also, the coefficient of market information was significant and negative. This implies that information on prevailing market condition may not have been properly decoded to influence their market revenue positively. The coefficient of mortality of animal was significant at 10% level and negatively related to revenue. This implies that revenue of the farmers decreased with increase in death of animals. This might be because the marketers did not have adequate capital to buy needed farm inputs (vaccines and drugs) and tools.

Conclusion
The study revealed that majority of the agripreneurs practiced semi-intensive system of production thereby leading to low productivity and marketing in the study area. The study further showed that the market structure is competitive and climate change elements militates against goat husbandry practices in South-East Nigeria. The production factors such as feed, stock density, capital and medication significantly influenced goat husbandry in the study area. The study also revealed that climatic and economic factors significantly influenced the productivity and marketing of goat in South-East Nigeria. The study recommends that goat farmers should adopt intensive system of goat production to mitigate the adverse effects of climatic factors on goat productivity and marketing. Also, the agriprineurs should take advantage of different sources of capital, production and market information provided by the government and non-governmental organizations to boost goat productivity and marketing. Stakeholders can adopt palliative approaches such as reduction in cost of feed, provision of production houses/ranches, and medications and veterinary services to encourage participants in goat production and marketing.

Acknowledgments

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