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COST AND RETURN ANALYSIS OF BIOSECURITY MANAGEMENT IN POULTRY FARMS IN RIVERS STATE, NIGERIA

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Abstract

Cost of preventing disease incursion and containment in poultry management is gaining attention in scientific and public debates. Biosecurity involves the use of relevant resources to secure poultry-based food production system (products, producers and consumers health) from diseases. This study investigates whether biosecurity resources are efficiently utilized to enhance maximum profit in poultry-based food production. Primary data used for the study were obtained from 120 sampled poultry farms. Multi-stage procedure was adopted in the selection of the sampled farms. Structured questionnaire was the data collection instrument used for the investigation. Descriptive and inferential statistical tools were employed in data analysis. Also cost efficiency model and profit functions were usedto analyze data. The result shows that bio-secured poultry farms had a mean profit of ₦ 150,230 higher than ₦ 92,590 earned by bio-insecured farms. Profitability of biosecured poultry farms significantly and positively correlated (2.02)** with bio-security management index ($p<0.05$). The major constraints to bio-security management of poultry farms were high cost of effective disinfectant/vaccines and unwillingness of farmers to adopt effective biosecurity management practices. The researcher has sufficient reasons to conclude that biosecurity resources were efficiently utilized, hence the relative high profit that was realized. However, the biosecurity management index gap of 37.5% observed in the study suggests that there is still room for improvement.

Keywords: Biosecurity management, Resource use efficiency, Poultry-based food, Producers

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1. Introduction

The poultry industry plays important role in development of Nations including Nigeria. It is a major source of meat and egg for the supply of animal protein to households in Nigeria (Olagunju and Babatunde 2011).

Biosecurity involves the preventive measures designed and taken to reduce risk of transmission of infectious diseases in livestock including poultry birds (Koblentz, 2010). It is categorized into bio-containment and bio-exclusion. Bio-exclusion involves preventive measures taken to reduce the risk of incursion of disease causing organisms into a poultry farms. Bio-containment has to do with the measures taken to prevent an onward spread of

diseases to nearby poultry farms if infection has been confirmed. Biosecurity management involves all ordinances and acts of preventing the exposure of poultry birds to disease causing organisms by reducing incursion and spread of disease causing organisms into and between the farms. Biosecurity management involves efficient allocation of scare reduce.

In Bangladesh Ali, et al. (2012) investigated the relationship between productivity performance and profitability of poultry farming carried out with and without biosecurity management intervention in different locations of Bangladesh. They reported a positive relationship. They concluded that satisfactory output is achievable and profitability may be improved in poultry farming if biosecurity management measures are taken.

Globally, the challenges of poultry diseases in developed nations as Finland is relatively good compared to developing countries. This could be attributed to the intervention of food industry and government through policies and programmes that relate to preventive biosecurity, a result there is a general low trend of the dangerous poultry diseases in the country. Effective biosecurity in poultry farms can improve overall health of flock, farmers and consumers. It can reduce economic losses and improve the performance of poultry farms. Cost of treatment of diseases can be colossal. Effective biosecurity also involves practical steps to curtail the spread effect of pests and infectious diseases both within and between poultry farms. The degree of risk exposure experience by poultry enterprises varies according to mode of operation, enterprise type, size of farm, location of farm and management system. Egg layer enterprises are considered to be more exposed economic risk because of the lengthy duration of productive life (12 months), and broiler poultry farms are believe to experience less economic risk due to the short duration of productive life cycle of 6-8 weeks (Agriculture Victoria, 2008).

Biosecurity index of 27% was reported in South West Nigeria by Akintunde et al. (2015).

It implies that when biosecurity management is high disease occurrence will be low and output could increase. Poultry diseases remain one of the major setbacks to the progress of poultry business in Nigeria. The cost of disease treatment and control tends to raise total cost of production and hence could reduce profit earned by poultry farmers. According to Akintunde et al. (2015) majority of poultry egg farmers in South West Nigeria operated at low level of biosecurity management in poultry-based food producers system. They also reported poultry disease management index of 27% which had positive effect on profit efficiency in poultry-based food producers system.

Disease attack is a challenge to poultry-based food producers in Nigeria (Adewole, 2012; Alalade et al., 2018). Diseases tend to reduce meat and egg production in quantity and quality. Poultry biosecurity management involves taking steps to ensure proper hygiene and increasing the level of cleanliness so as to reduce the risk of diseases introduction and spread in poultry-based food producers system. Application of standard biosecurity measures is vital in protecting poultry birds from any disease (Dorea et al., 2010).Economic losses encountered by poultry farmers between the period of (2009- 2011) amounted to over three billion Nigeria Naira due to infectious Bursal Disease outbreaks alone.

The operational cost of biosecurity management if not well managed tends to increase production cost and hence reduce profit earned by poultry farmers in Nigeria. Some of the operational cost may include cost of vaccination, eradication and restocking. This study however, is aimed at examining the contribution of efficient biosecurity management to poultry productivity. It is against this background that the study examined the effect of biosecurity management on profitability of broiler and egg production in Rivers State, Nigeria (Figure 1).

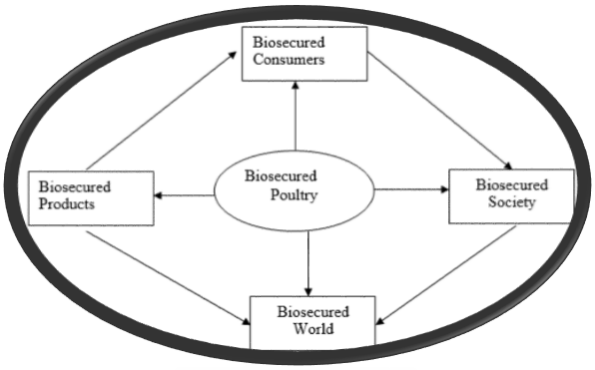

Figure 1. Conceptual Framework showing a chain of biosecurity in poultry production system.

A biosecured poultry farms will generate biosecured products and biosecured poultry products will translate to biosecured consuming society, which will ultimately lead to biosecured world.

The poultry-based food enterprise is one of the main farming activities among rural and urban dwellers. They depend on poultry industry for their livelihood (some as producers, veterinary service providers, marketers and transporters). Despite the importance of poultry industry, the cost of biosecurity management is a major source of worry to producers and a threat to the growth of poultry enterprise in the study area.

Similarly, the study will prove invaluable to the government of Rivers State, as a basis for rational and empirical policy formulation for biosecurity management in the poultry industry in Nigeria.

The broad objective of the study was the analysis of efficiency of biosecurity management and effect on profitability in poultry-based food producers system. The specific objectives of the study were to:

I. Examine the return on investment as measure of biosecurity management efficiency in poultry farms;

II. Estimate level of biosecurity management index in poultry production system;

III. Determine the biosecurity cost factor that significantly influence profitability in poultry; iv.identify the constraints faced by farmers in biosecurity management in poultry production.

2. Material and Methods

2.1. Study Area

The study Area was carried out in River State. The study area was chosen because a good number of poultry farms are available in the location. It is one of the major centres of economic activities in Nigeria.

2.2. Sampling Technique and Sample Size

A two stage sampling procedure was employed in the study. The first was obtained from a list of poultry farmers in Area. This was selected randomly from the list of registered poultry farmers in Ministry of Agriculture Rivers State, Department of Planning Research and Statistics, Rivers State which constituted the sampling frame. The second stage involved a systematic random sampling of 120 respondents from the sampling frame in the following ways.

Out of the seventeen (17) wards in the Area, six (6) wards were randomly selected. The communities selected randomly include; Rukpoku, Rumukwuta, Rumuodara, Rumuomasi, Rumuigbo and Choba. In each of the 6 selected communities 20 poultry farmers were selected to give a total of 120 respondents that participated in the study.

2.2. Data Collection Techniques

Structured questionnaire and interview schedule were adopted as an instrument for data collection where necessary. Some questions were asked in the native language (Ikwerre dialect) and information retrieved was filled into questionnaire. Therefore, primary data were used for the study, while secondary data were obtained from published and unpublished materials such as journals, textbooks and the internet.

2.3. Data Analysis

Data were analyzed using descriptive and inferential statistics. Descriptive statistics used were: mean, frequency tables and percentage distribution, cost efficiency model and profit function approach.

2.3.1. Cost efficiency model specification

Examination of the proportion of operational cost of bio-security management with regards to total cost (TC) using cost efficiency model specifically (Akintunde et al., 2015) as:

$$\Pi = F(\sum PiXi, BMIik) + ei \quad (1)$$

Where:

Π = Profit of bio-secured farm (naira)

$PiXi$ = Cost of biosecurity management (naira)

BMI = Biosecurity management index of farm

ei = Error term

The scoring the level of biosecurity management techniques with respect to the identified standard biosecurity measures was achieved using biosecurity management index (BMI) equation. It is specified as:

BMI= No. of Adopted Biosecrity measures / Identified standard biosecurity measures × 100 / 1 (2)

From the above given, any farm that scored below the average score 3.5 or 50% is regarded as bio-insecured while any farm that scored above 3.5 of 50% is considered as bio-secured farm.

Determination of whether the identified biosecurity cost factors have significant effect on the profitability in poultry farms was attained using multiple regression model as specified below

Linear form:

$$II=b_0+b_1X_1+b_2X_2+b_3X_3+b_4X_4+b_5X_5+b_6X_6+b_7X_7+b_8X \quad (3)$$

Semi-log form:

$$II=\log b_0+b_1\log X_1+b_2\log X_2+b_3\log X_3+b_4\log X_4+b_5\log X_5+b_6\log X_6+b_7\log X_7+b_8\log X_8+ei \quad (4)$$

Double-log form:

$$\text{Log}II=\log_0 b_0+b_1\log X_1+b_2\log X_2+b_3\log X_3+b_4\text{Log} X_4+b_5\log X_5+b_6\log X_6+b_7\log X_7+b_8\log X_g+ei \quad (5)$$

Where:

Y_i = Gross margin in naira per enterprise

X_1 = Quantity of feed consumed (Kg)

X_2 = Cost of litter management (₦)

X_3 = Expenses on drugs and medication (₦)

X_4 = Cost of veterinary services (₦)

X_5 = Expenses on stocking

X_6 = Cost of labour (₦)

X_7 Security infrastructure cost (₦)

Xs =Biosecurity management index

ei = Error term

The model with the best fit was chosen as the lead equation. The decision rule was based on the size of the coefficient of multiple determination (R^2) as well as the number of significant variables in the model.

Biosecurity indicators as earlier identified by Achoja and Okpara, (2016) are:

1-litter management

2-relevant vaccines/medication

3-routine cleanliness

4-veterinary service

5-foot deep

6-biosecurity infrastructures

7-feeding

8-breed

Biosecurity management efficiency level in poultry farms was achieved using the cost efficiency model specified as:

Cost efficiency of biosecurity = (Net Return) / (Investment in Bio-security) × (100) / 1

The distribution of identified constraints faced by farmers in biosecurity management in poultry production systems was carried out using descriptive statistics (Mean, frequency, mode and percentage).

The following hypotheses were tested in the study:

$H0_1$: There is no significant relationship between efficient bio security management and profitability in poultry-based food producers.

$H0_2$: The identified biosecurity variables have no significant effect on the profitability of poultry-based food producers.

3. Results and Discussion

The result in the Table 1 shows the production of cost of biosecurity management in total cost of poultry-based food producers. The cost of bio-security management was ₦ 2,037,000 with a total cost of ₦ 5,304,000 with a proportion of 38.40% of bio-security cost.

Table 1. Proportion of cost of biosecurity management in total cost of poultry production

S/No	Variable	Cost of biosecurity management	Total cost of production	Proportion of cost of biosecurity management in total cost of production
1	Bio-insecured farms	₦2,037,000	₦15,304,000	38.40%
2	Bio-secured farms	₦11,267,000		

The result in the Table 2 shows that any farm with BMI 50% and above was considered bio-secured and any farm below 50% is bio-insecured. The study revealed that seventy five farms were bio-secure while twenty-two farms were bio-insecure. There were eight bio-security indicators with a total of forty (40), any farm with twenty (20) and above was considered as a bio-secure farm while any farm below the midpoint (20) was considered bio-insecure. From the analysis carried out seventy five farms beat cut off mark while twenty-two farms fell below cut off mark.

Table 2. Biosecurity management index (BMI) in poultry production.

Classes of BMI	Frequency	Percentage	Mean/Mode
<20	5	5.15	
20-49	17	17.53	
50-79	45	46.39	64.5%
80 and above	30	30.93	
Total	97	100	

Note: BMI score of 50% and above indicates a of biosecured farms.

The exponential function outperformed the semi log function double log function, and linear function on the basis of R^2 value (29%) and the number of significant variables (Table 3). T-Statistics was used to test the significance of the parameter coefficient ($p<0.05$). These factors were cost of labour and bio-security management index.

3.1. Test of Hypothesis ($H0_2$)

The selected biosecurity operating factors have no significant effect on the profitability of poultry farms. The significant F. statistics (4.63**) indicates that the selected bio-security factors have significant joint effect ($p<0.05$) on the profitability in poultry farms.

The result indicates that two selected factors, cost of labour (3.72)***, and bio security management index (2.02)***, shows positive and significant relationship with profitability of poultry farmers. While cost of feed, cost of litter management, expenses on drugs and medication, cost of veterinary services, expenses on stocking, and biosecurity infrastructures a negative relationship with profitability of poultry farmer.

The R2value of 29% shows that 29% of the variance in poultry farm profitability was accounted for by the impact of cost of labour and bio-security management index.

3.2. Cost of Labour Utilization for Biosecurity Management

The result of the study indicated that cost of labour utilization for biosecurity management (3.72)*** had a positive relationship with the profit level of poultry farms. Similar result was found by Alalade et al., (2018).

3.3. Bio security Management Index

The result of the study showed that bio-security management index (2.02)** has a positive relationship with the poultry farms profitability in study area. This finding implies that degree of biosecurity management is an important determinant of profitability in poultry farms. This finding is in agreement with Agriculture Victoria (2008) who reported that effective biosecurity management can reduce losses in poultry production system.

3.4. Efficiency of Biosecurity Management in Poultry Production System.

The net return on investment in biosecurity management was used as a measure of efficiency of biosecurity management in poultry-based food producers system

BM Efficiency = (Net Return)/(Investment in Bio-security) × 100/1

= 150,230/754,220 × 100

= 19.29%

This results indicated that every N100 invested in biosecurity management yielded or generated approximately ₦ 20 to revenue of poultry farms. Biosecurity management is financially or economically rewarding or worthwhile in poultry production system in Rivers State, Nigeria.

Table 3. Regression result on relationship between bio-security cost and profitability in poultry-based food producers

Variables	Linear	Double log	Semi Log	Exponential
Constants	853065.7 (5.55)	16.572 (6.65)	4390 (3.69)	13.845 (44.47)
Cost of labour	-52.013 (0.01)	-0.346 (0.24)	-140221.4 (-0.28)	-0.0001108 (3.72)**
Cost of litter management	4.740 (0.17)	0.072 (0.48)	-13136.11	0.0000369
Expenses on drugs and medication	-4.675 (0.18)	-0.039 (-0.26)	-5387.122 (-0.07)	-.0.0001(0.66)
Cost of veterinary service	-0.905 (-1.24)	-0.019 (-0.21)	-838551.49 (-1.92)*	1.343-07(0.09)
Expenses on stocking	-21.24208 (-1.23)	-.016 (-0.13)	-108867.8 (-1.88)	-1.78e-06
Bio-Security Infrastructure	-1.859 (-1.03)	-.0802 (-0.84)	-66183.96 (-1.45)	-2.44e-06(-0.67)
Bio-security management Index	620.122 (0.01)	-0.029 (-1.63)	4341.423 (0.50)	-0.239(-2.02)*
R^2	0.274	0.26225	0.2963	0.2870
R. Adj.	0.208	0.195	0.232	0.222
F-Statistics	4.16*	3.92	4.63**	4.43**

Table 4. Constraints of bio-security management

S/N	Variables	Very serious	Serious	Moderately serious	Not serious	Not very serious	Total	Mean	Remark
1	cost of veterinary services	70	142	141	30	6	389	3.24	Serious
2	Expenses on drugs and medication	75	130	81	50	36	372	3.10	Serious
3	Bio-security infrastructure	90	112	84	66	22	374	3.12	Serious
4	Cost of feed	103	96	102	60	16	377	3.14	Serious
5	Cost of operating battery cage	60	119	78	76	40	373	3.11	Serious
6	Lack of fund (finance)	90	136	93	70	44	433	3.61	Serious
7	Lack of awareness	60	119	78	76	40	373	3.11	Serious
8	Violation of bio-security standards	75	130	81	50	36	372	3.10	Serious
9	Infective medication /risk of vaccine failure	75	120	92	78	55	420	3.50	Serious

Note: A mean score of 3.00 and above indicates a serious constraint.

The result in the Table 4 shows that constraints of bio-security management. Cost of veterinary services; the result indicated that cost of veterinary service was a serious constraint in the study area in (poultry farm) this was so because (3.24) is greater than the cut off (3.00).

Expenses on drugs/vaccines and medication; the result indicated that expenses on drugs and medication was a serious constraint in the study area (in poultry farm) because (3.10) is greater than the cut off (3.00).

Biosecurity infrastructures/disinfectants cost; the findings indicated that bio-security infrastructure/Disinfectant cost was a serious constraint in the study area (poultry farm) because the mid-point was (3.12) and is higher than the cut off (3.00).

Cost of feed; the result indicated that cost of feed is serious constraint in the study area (poultry farm) this is so

because (3.14) was greater than the cut off (3.00).

Cost of operating battery cage; the result indicated that cost of operating battery cage was a serious constraint in the study area (poultry farm). This is so because (3.11) is greater than the cut off (3.00).

Lack of fund (finance); the study indicated that lack of fund was a serious constraint in the study area (poultry farm). This is so because (3.61) is greater than the cut off (3.00).

Lack of awareness; the study indicated that lack of awareness was a serious constraint in the study area. This was so because (3.11) is higher than the cut off (3.00).

Violation of Biosecurity Standards: This study indicated that violation of biosecurity standards was a serious constraint in the study area. This was so because (3.10) is higher than the mid-point (3.00).

Infective medication/risk of vaccine failure; the study indicated the infective medication/risk of vaccine failure was a serious constraint in the study area because (3.50) is greater than the cutoff of (3.00).

4. Conclusions

In the world, poultry is an important industry from economic stand point. Therefore an evidenced based biosecurity management poultry system in Nigeria was considered important and investigated. The study revealed that 77.32% of the surveyed farms were bio-secured at different degrees while 22.68 % farms were not biosecured. Further result revealed that bio-secured farms earned more profit than bio-insecured farms. It was also shown that the major constraint's encountered by most poultry farmers were the cost of veterinary service and cost of disinfectants. The bio-security management cost efficiency and effect on profitability in poultry system was significantly influenced by bio-security management index. About 38.40% of total cost of production is attributed to expenses on biosecurity management. This study has successfully factored biosecurity management into the profit equation since it explained growth in profitability of poultry farms in Nigeria. The study suggests that to ensure more profitability in poultry production system, farmers should adopt strict biosecurity measures in their farms. Farmers should be educated by livestock-specific extension officer on the cost-effective utilization of biosecurity resources in their farms. This will help to bring about innovations and current information on biosecurity management that will harness the growth and profitability of poultry farms in Nigeria. Poultry development programme of the government should incorporate the provision of – biosecurity infrastructures.

Conflict of interest

The author declare that there is no conflict of interest.

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