Agricultural Journal 5 (2): 37-44, 2010
ISSN: 1816-9155

Post-Avian Flu Profitability and Resource Use Efficiency of Broiler Farmers in Akwa Ibom State, South-South, Nigeria

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Abstract: The profitability, determinants of the viability and resource use efficiency of broiler farmers in Akwa Ibom state, South-South, Nigeria were evaluated in this study after the incidence of Avian-flu pandemic in parts of Nigeria. Multi-stage, random sampling technique was employed in selecting 72 broiler farmers comprising backyard poultry, semi-commercial and commercial broiler farmers. Cost route approach was used in data collection. The data were analyzed using cost and return analysis, financial and efficiency ratios; as well as descriptive and inferential statistics. The result of the analysis indicated that the broiler enterprise was profitable although production was at low capacity. The variable cost constituted about 83% of the total cost and feed alone made up about 60% of this cost. Fixed cost constituted about 17% of total cost. The returns on gross and net profits were about 30 and 15%, respectively. For every bird sold, the farmer made a profit of N435 and the breakeven point (volume) was 348 broilers. A striking difference of over 35% profitability was observed between this study and a previous study in the same state before the Avian-flu attack in Nigeria, thus raising grave concerns of any direct attack for the industry in the area. Further, the regression analysis showed that feed, equipment and labour were statistically significant at 5% level, thus enhancing the usage of these inputs would increase profitability. The farmers, who were mainly of middle age group and school certificate holders, were found to be allocatively inefficient and operated at an increasing return to scale. This implied that they were operating in Zone 1 or Irrational Zone of the production function. To be efficient, the broiler farmers need to re-adjust downwards the over-utilized inputs, namely feed, labour, equipment and drugs by 35, 79, 99.8 and 99.9%, respectively. In addition, the under-utilized input, namely, size of stock, need to be re-adjusted upwards by 56%. Allied to this, is the need to enhance the farmers' educational status (formal and informal) and encourage young graduates to take to farming. All stakeholders including the government, consumers and producers should synergize in the monitor and control of the Highly Pathogenic Avian Influenza (HPAI) strain H5NI, which rampaged parts of the country to stem possible morbidity of the disease.

Key words: Post Avian-flu profitability, resource use efficiency, broiler, farmers, Nigeria

INTRODUCTION

Poultry are chickens, ducks, geese, guinea fowls, turkeys and other related birds kept for their meat or/and eggs. In Nigeria, the poultry population is estimated to be 140 million (Ocholi *et al*., 2006). They are the most commonly kept livestock and over 70% of those keeping livestock are reported to keep chickens (Amar-Klemesu and Maxwell, 2000). Poultry production systems are multi-layered and deal with perishable or short shelf-life products, thus highly susceptible to various forms of risk (Cross, 1996). It is therefore considered appropriate to delayer or isolate forms of poultry for effective and clear-cut investigation. Chicken, *Gallus gallus* (domesticus) is one type of poultry. It belongs to the family *phasiendae* and it is estimated to be about 69% of the total number of birds kept in Nigeria (Sonaiya, 1990).

Broilers are chicken (apart from cockerels and layers) kept for meat production and by implication a source of protein.

They are young chickens suitable for broiling or roosting, at about 10 weeks old. Food and Agricultural Organization estimated the mean daily animal protein intake by Nigeria at about 10 g/capita/day, which is only 28.57% of the recommended minimum of 35 g/capita/day. Animal protein is crucial for normal physical and mental development of the human being. Its deficit has adverse effects on economic growth and development of the country in terms of reduction in human productivity,

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infant mortality, malnutrition and related diseases (Onyenweaku and Effiong, 2005). Poultry and in particular broiler production have the potentials to provide the major source of protein in Nigeria, among other sources like sheep, goats, cattle, fish, pigs and other non-ruminants. They also offer short-term investment opportunities (Onyenweaku and Awuja, 1991). Allied to this is its ability to provide jobs for the teeming population of unemployed youths especially graduates, because of its scale of operations, technical requirement, which is considered not too complex although, may be fraught with production risks in terms of incidence of diseases and pests.

The unemployment rate in Nigeria is currently put at 18% (CBN, 2007). Outstanding among the prospects of broiler and indeed the poultry sub-sector include; efficiency in feed conversion, consumption preference, high level of protein with mineral, cultural and religious encumbrances and relatively low cost of pre-establishment (Ohale, 1989). It also provide feathers for pillows and mattresses, manure, income as well as marketing related or incidental jobs like processing, etc. The structure of the poultry industry in Nigeria is represented by approximately 40% of commercial operations (15% semi-commercial and 25% commercial) and 60% of backyard poultry farmers (Watch, 2006).

The ability of the poultry industry in enhancing the standard of living of Nigerians, panoptically is not in doubt and therefore poultry keeping should be done or conducted in the most appropriate and socio-economic way (Gueye, 2003).

However, few major glitches truncated the growth path of the industry, which was transiting from small-scale hybrid broilers and layers and backyard poultry enterprises/semi-commercial to medium scale commercial enterprises. First, was the very high input cost especially feed for broilers, which was recorded to constitute over 51% of total cost of production (Effiong and Onuekwusi, 2006). This partly resulted from policy inconsistencies and somersaults of the government. During the Structural Adjustment Programme (SAP) between 1987-1994, the industry almost collapsed due to the ban on raw materials for the poultry industry. This was followed by guided deregulation in 1994, which resulted in a breakthrough and subsequent increase in poultry meat production from 63,000 MT in 1994 to 73,000 MT in 1995, 1997. In 1998, the federal budget threw open the importation of live chilled frozen chicken and eggs at a tariff of 150%, which was later reduced to 55% in 1999. This led to reduction in local production which fell to 1.3% as compared with 2.7% in 1997. Similarly, the shift in lending policies in favour of food crops as against livestock industry exacerbated the situation. In this dispensation, banks were directed to increase lending to 50% for food crops production and distribution, 15% to livestock and 35% to other agricultural crops.

The outbreak of Highly Pathogenic Avian Influenza (HPAI) caused by virus sub-type H5N1 in commercial and backyard poultry in Kaduna, Jos and Kano states in the northern part of Nigeria, in early January 2006, was a watershed in the development of the poultry industry. The infection was characterized by very high morbidity and mortality in commercial layers. It was also observed to affect turkeys, broilers, cockerels, ostriches, pigeons, guinea fowls, geese, ducks (Kumbish *et al*., 2006). This first outbreak resulted in the death or culling of 785, 571 poultry in June, 2006 and it then spread to 13 other states of the country from these foci (Ocholi *et al*., 2006). A relief scheme was announced and paid to farmers (N250 ($1.92) per chicken, N1, 000 ($7.69) per duck, N1,000 ($7.69) per goose, N2,500 ($19.23) per turkey, N1,000 ($7.69) per emus and N20,000 ($15.38) per ostrich) whose flocks were affected to cushion the effects of losses incurred and encourage farmers to report cases of high mortality among their bird population.

In all, a total of N759, 682,580 equivalent to USD 5.8 million was paid to farmers as compensation. The Poultry Association of Nigeria reported that the loss incurred by its members amounted to N24 billion or USD 185 million (Ocholi *et al*., 2006). Apart from the colossal financial losses, consumers became scared of consuming or having anything to do with poultry products because infection would almost result to death and spread of the disease among family members and friends. The consequences was a sell-off of birds by farmers, even in areas unaffected or affected minimally as in the study area at prices as low as 40% of its actual cost.

There is no doubt that the impact of bird flu epidemic on household poultry consumption and poultry industry in Nigeria has both economic and social costs (Obayelu, 2007). Currently, the spread of the diseases appears to have been contained to a reasonable extent and there is urgent need to sustain the control measures (Bello *et al*., 2006). Consumers are now showing more interest in poultry and poultry products, although with caution. On the other hand, the producers have resumed production but are more inclined to broiler production as against the production of layers because of the short period involved in rearing them.

To embrace the challenges this industry will face, it is important to enhance the efficiency of production or the productivity of the enterprise. Productivity is defined as the index of the ratio of the value of the total output to inputs used in the farm operation (Olayide and Heady,

1982). In other words, productivity is the efficiency with which the factor inputs (land, labour, tools, equipment, etc.) are converted to output within the production process. Efficiency can be expressed in three related terms; namely technical, price and economic efficiencies. Technical efficiency refers to the input-output relationship, which produces higher output, comparatively. A firm is considered most technically efficient than others, if it employs the best practice in an industry such that a minimum set of inputs are used to produce the best level of output or the same output is produced with the smallest level of inputs.

For the Cobb-Douglass function a higher intercept denotes a higher level of technical efficiency (Bagi, 1981; Onyenweaku, 1994; Nwaru, 2003). On the other hand, price efficiency is the measure of a firm's success in purchasing an optimal set of inputs (Olayide and Heady, 1982). It indicates the gains that can be obtained by varying the input ratios. Price efficiency is also known as allocative efficiency. It is purely a behavioural concept unlike technical efficiency, which is purely an engineering concept. It rests on an index of marginal product or opportunity cost. Economic or overall efficiency is the product of the two types of efficiency.

It is against this backdrop that the study was designed to investigate and assess the profitability and resource use efficiency of broiler farmers in Akwa Ibom state of Nigeria, soon after the incidence of the Avian-flu incursion. Emphasis on the study was on allocative efficiency. It was hypothesized that output was positively related to five variables, namely: feed, equipment, labour, drugs and stock of birds.

MATERIALS AND METHODS

The study was conducted in Akwa Ibom state, which is one of 36 states of Nigeria. The state is located in South-South zone of the country and is situated in the oil rich Niger Delta Area. The population of the state is put at 2.4 million persons (NPC, 1991). The state is divided into 31 administrative units called Local Government Areas (LGAs). These are grouped into six agricultural zones of Abak, Etinam, Ikot-Ekpene, Oron, Uyo and Eket. Uyo is the capital of the state. The state has favourable warm temperature and sufficient moisture. The annual total rainfall of the area is 3000 mm, the daily mean temperature ranges between 29 and 33°C with relative humidity of 50-60% during the dry season and 60-90% during the wet season. Despite the massive exploration and exploitation of crude oil in the area, the inhabitants are predominantly farmers. The state was purposively selected because of the potential market for broiler, made up of oil company workers, hotels, restaurants and higher institutions. In addition, by citing and promoting such projects in this area, will no doubt mitigate the high unemployment situation, especially of the youths, which is the basic cause of youth restiveness in the Niger Delta region.

Twelve broiler farmers were randomly selected from each of the six agricultural zones, thus giving a total of 72 broiler farmers in the state. The Block Extension Agents provided the list from where the samples were drawn and pre-tested questionnaire administered on the respondents. The secondary data were collected from journal and proceedings. The study was carried out in 2007 and lasted for a period of six months, effective April.

The data collected were analyzed using descriptive statistics (frequency distribution, percentages, etc.), budgetary technique, break even analysis, multiple regression analysis and marginal efficiency ratios. In the budgetary technique; Gross Margin (GM) was calculated thus:

$$GM = \Sigma PiQi - \Sigma PiXj \quad (1)$$

Where:

GM = Gross Margin (N)
Pi = Unit Price of output (N)
Qi = Output (No. of birds)
Pj = Unit price of each input (N)
Xj = Quantity of each input (kg)

$$NR = GM - TFC$$

Where:

NR = Net Return
TFC = Total Fixed Costs divided by depreciation of fixed assets, rent interest and miscellaneous expenses

The Breakeven analysis was computed using the formula stated as follows:

$$BEP\ (N) = \frac{FC}{1\text{-}VC/T} \quad (2)$$

Where:

BEP (N) = Breakeven Point (in Naira)
FC = Fixed Cost (N)
VC = Variable Cost (N)
T = Sale's turnover (N)

$$BEP(vol.) = \frac{BEP(N)}{\text{Output or no. of birds}}$$

The production function model used (Mbanasor, 2002; Onyeagocha *et al*., 2006) was implicitly stated as follows:

$$Y = F(X_1, X_2, X_3, X_4, X_5, e) \quad (3)$$

Where:

Y = Farm income per annum (Naira)
X_1 = Feed intake (kg)
X_2 = Equipment (Naira depreciation value)
X_3 = Labour (Mandays)
X_4 = Drugs (Naira)
X_5 = Stock of birds (Number)

Four functional forms used were explicitly stated as follows:

$$\text{Linear: } Y = bo + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + e$$

$$\text{Semi-log: } Y = \ln bo + b1\ln X_1 + b_2\ln X_2 + b_3\ln X_3 + b_4\ln X_4 + b_5\ln X_5 + e$$

$$\text{Double-log: } \ln Y = \ln bo + b_1\ln X_1 + b_2\ln X_2 + b_3\ln X_3 + b_4\ln X_4 + b_5\ln X_5 + e$$

$$\text{Exponential: } \ln Y = bo + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + e$$

Y and X were as formally defined, where;

bo = Intercept
b_1-b_5 = Regression coefficients

The lead equation was chosen based on the apriori expectation of the signs and magnitude of the coefficient of the explanatory variables, the coefficient of the multiple determination (R^2) and F-statistics.

The Allocative efficiency (Eij) was determined by computing the ratio of Marginal Value Product (MVP) of the ith input and its price or Marginal Factor Cost (MFC) (Onyenweaku and Awuja, 1991).

$$Eij = \frac{MVPxi}{Pxi} = \frac{PiFi}{Pxi} \quad (4)$$

A farmer was considered efficient in the use of a particular input, if the ratio of MVP to MFC equal to one i.e.,

$$\frac{PxFi}{Pxi} = 1 \quad (5)$$

Using absolute figures, the value of the required percentage change in the use of resource from optimality (OPxi) in each resource use was calculated, thus:

$$OPxi = \frac{MVPi - MFCi}{MVPi} \times 100 \quad (6)$$

The Return on Scale (S), which is the relationship between the scale on which a firm operates and level of its cost was derived by the summation of the elasticity of the production:

$$\sum_{i=1}^{n} S = \sum_{i=1}^{n} \frac{nMPP}{APPi} \quad (7)$$

$$\text{Indoublelog. } Si = \frac{MPPi}{APPi} = bi$$

Where:

MPP = The marginal physical product
APP = The average physical product

It is constant when the value is equal to one, decreasing when the value is <1 and increasing when the value is >1.

A ratio less than unity suggests over utilization of these resources and profit would be increased by decreasing the quantity of the input used. A ratio greater than unity indicates under-utilization of input and increasing the rate of use of that input would increase the level of profit of the firm (Onyenweaku and Awuja, 1991; Onyeagocha *et al*., 2006).

RESULTS AND DISCUSSION

Profitability: Table 1 shows the cost and returns of average broiler farmer in the study area for a ten-week cycle. It also showed the figure for the year's production, since the average broiler farmer in the area produced three cycles in a year. The variable cost constituted about 83% of the total cost with feed accounting for 49% of this and about 60% of the variable cost.

This result agrees with the high proportion of cost of feed (51.6%) in three small-scale broiler enterprises, as reported by Effiong and Onuekwusi (2006) in a comparative study of the profitability of small and large scale broiler farmers in Uyo, Akwa Ibom state in 2004, two years before the Avian-flu attack in Nigeria. The next important variable cost item was cost of day old chick, which constituted about 15% of the total cost and 18% of the variable cost.

The fixed cost constituted about 17% of the total cost. This is low because the broiler farmers were made of 55.5% backyard system of poultry farmers, 27.8% of semi-commercial and 16.7% commercial poultry farmers. Family resources, especially labour and land were extensively used to reduce both variable and fixed costs. The return on every one naira invested was 18 Kobo. The breakeven points were N347, 484 (i.e., N104, 200/1-0.7) and 348 broilers for sales turnover and sales volume, respectively. This probably explains why one-production

Table 1: Cost and return of average broiler farmer

Items	Value (N) one production cycle of 10 weeks	Value (N) 3 production cycles	Percentage of total income/cost (%)
Output (No. of birds)	250	750	100.00
Mortality (No. of birds)	15	45	6.00
Net output (No. of birds)	235	705	94.00
Income:			
Sale of birds at N1,000 (at 1.5 kg bird^{-1})	235,000	705,000	99.32
Sale of droppings (N100 bag^{-1})	1,000	3,000	0.42
Sale of empty feedbags (N20 bag^{-1})	600	1,800	0.26
Total income	236,000	709,800	100.00
Variable costs:	30,000	90,000	14.97
Day old chicks at N120			
Feed:			
Starter mash (12.5 kg day^{-1} for 28 days i.e., 14 bags at N1,350 per 25 kg bag)	18,900	56,700	
Finisher mash (32.5 kg day^{-1} for 42 days i.e., 55bags at N1, 450 per 25 kg bag)	79,750	239,250	
Total cost of feeds	98,650	295,950	49.23
Medication/vaccines	4,500	13,500	2.25
Wages	22,500	67,500	11.23
Energy/utilities/maintenance	10,000	30,000	4.99
Total variable cost	165,650	496,950	82.67
Gross margin	70,950	212,850	30.00
Fixed costs:			
Deprecation charges (equipment and structures)	15,000	15,000	2.50
Interest charges	19,200	19,200	3.19
Rent	10,000	10,000	1.66
Miscellaneous (Electricity, transport)	60,000	60,000	9.98
Total fixed costs	104,200	104,200	17.33
Total costs	269,850	601,150	100.00
Net profit	(33,250)	108,650	15.31
Return on every N1 invested		0.18	
Return on sales		15.31%	
Profit per bird		N435	
Break even point (N)		347,484	
Break even point (vol.)		348 broiler	

Field survey data, 2006. The broiler farmers produced an average of 3 cycles in a year, mainly during festival celebration seasons, religious (Christmas, Easter, Ed il Fitir, etc.), Cultural (new year festivals) and national (independence and democracy days); family labour is used extensively by the respondents and average of two labour hands, usually women were employed; exchange rate was N125 for 1 USD; taxes could not be determined and as such not included; Where broiler production was carried out together with layer production, the fixed cost was shared accordingly in proportion to usage of the facilities

cycle, which was below the breakeven point volume by 113 birds, was unprofitable. The average broiler farmer made a gross profit of N212, 850 and a net profit of N108, 650, annually. This net profit is about 36% of total emolument for Grade Level 08 annual salary (N300, 000) in the government civil service for fresh graduates.

The net profit of N435 per bird per year matches the net profit of N434.59 per bird for backyard poultry, as reported by Amos (2006). However, the net profit of N108, 650 for the study differs sharply with the mean net profit of N170, 846 and 13,099,344 for small and large scale broiler enterprises, respectively (Effiong and Onuekwusi, 2006).

This situation is also reflected in the profitability of 15.31% of the study as against the mean profitability of 53.93 and 51.17% for small and large scale broiler enterprises, respectively (Effiong and Onuekwusi, 2006). The difference of profitability of over 35% in the two studies suggests that the influence of Avian-flu was striking and debilitating to the growth of poultry industry in Akwa Ibom state and perhaps Nigeria in general. The respondents spent an average of 10 years in school and were made up of 70% males, with 45% carrying out the activity on part-time basis, possibly a coping strategy. About 20% of the farmers were graduates of tertiary institutions, while about 60% were school certificate holders. The average age of the farmers was 45 years.

Determinants of profitability: Table 2 shows the results of multiple regression analysis of the determinants of profitability of the broiler farmers. The double log functional form was found to be the lead equation as it produced the best fit for the equation, with highest Coefficient of Multiple Determination (R^2) and F-value, lowest standard error, among the functional forms with

Table 2: Multiple regressions of the determinants of profitability of broiler farmers in Akwa Ibom State, Nigeria

Variables	Linear	Semi-log	Double-log	Exponential
Constant	212.668	-2276.247	-8.359	6.051
Feed (X_1)	-47.652	-169.442	1.047	1.536E-02
	(-3.133)*	(-0.613)	(2.218)*	(0.710)
Equipment	315.765	3024.039	3.940	0.129
cost (X_2)	(5.626)*	(5.338)*	(5.008)*	(1.613)
Labour (X_3)	296.120	-175.512	1.446	-5.26E-02
	(2.556)*	(-0.350)	(2.496)*	(-0.320)
Drug (X_4)	-33.285	-194.561	0.7662	1.045E-02
	(-0.423)	(-0.374)	(0.528)	(0.093)
Stock of	-30.654	-3.80E-01	3.13E-01	-3.80E-01
birds (X_5)	(-0.389)	(-0.339)	(0.359)	(-0.339)
R^2	0.519	0.489	0.588	0.116
F-value	13.835	12.269	18.242	1.676
Standard error	572.431	1520.608	2.261	0.814

Level of Significance (LOS) = * 5%; Computed from survey data, 2006

Table 3: Marginal analysis of input employed by the broiler farmers

Resources	MPP (Co-efficients)	MVP (N)	MFC (N)	Price efficiency Eij = MVP /MFC
Feed	1.047	785.0	1,200	0.6500
Equipment cost	3.940	3.940	2,400	0.0016
Labour	1.446	1,085	5,000	0.2100
Drug	0.766	0.766	500	0.0015
Stock of birds	0.313	235.0	150	1.5600

P_y = N750; Field survey data, 2006

the highest significant variables and is inconsonance with apriori expectations. The equation is represented thus:

$$Y = -8.359 + 1.047X_1 + 3.940X_2 + 1.446X_3 + 0.7662X_4 + 3.13E - 01X_5 + 2.261 \quad (8)$$

The functional form showed that feed (X_1), equipment (X_2) and labour (X_3) out of the five variables used were positive and statistically significant at 5% level. This suggested that these variables are important determinants of profitability of the broiler farmers. Drugs (X_4) and stock of birds (X_5) were not statistically significant. It therefore follows that to increase the output of the broiler farmers would require enhancing/increasing the quantity of feed, equipment and labour used.

This agrees with the results of Ohajianya (2005), which stated that labour, capital, day old chicks, feeds, drugs and utilities constituted the major factors influencing output in poultry. It also agrees with the findings of Echebiri *et al.* (2006), that feeds, drugs and day old chicks are the major determinants in broiler production in Akwa Ibom state. However, the R^2 indicated that about 59% of the increase in the output was explainable by these variables. The balance suggests that there may be other variables not included in the estimation.

Allocative efficiency: Table 3 shows the marginal analysis of input utilization by the broiler farmers. It suggested that the broiler farmers were price inefficient. This was because the ratio of the marginal value product of the inputs to its price or marginal factor cost was not equal to one. They were <1 as in the case for feed, labour, equipment and drugs and above one in the case of stock of birds. In other words, the farmers were over-utilizing the feed and labour and under-utilizing equipment, drugs and stock size. To be efficient allocatively and in order to maximize their profit margins or put succinctly, to produce in stage II of the production function (the rational region), the farmers need to reduce the magnitude of the usage of feed by 35%, labour by 79%, equipment by 99.8% and drugs by 99.9%. On the other hand, they need to increase stock of birds by 56%, in order to attain optimality as shown in Table 4, which presented the percentage deviation from optimality.

Table 4: Percentage deviation from optimality

Variables	Required percentage change $\delta p = \frac{MPP}{APP}$
Feed	35.0
Equipment cost	99.8
Labour	79.0
Drug	99.9
Stock of birds	56.0

Field survey data, 2006

Table 5: Elasticity and return to scale of broiler farmers in Akwa Ibom State, Nigeria

Variables	Elasticity $\delta p = \frac{MPP}{APP}$	Return to scale $\sum_{i=1}^{1} \delta P$
Feed	1.047	-
Equipment cost	3.940	-
Labour	1.446	-
Drug	0.766	7.512
Stock of birds	0.313	-

Field survey data, 2006

Elasticity and return to scale: Table 5 shows the elasticity and returns to scale of the broiler farmers. The summation of the elasticity of the input was >1, suggesting that the broiler farmers were operating at increasing returns to scale. In other words, they are producing at stage one of the production function (i.e., irrational zone).

CONCLUSION

The results of the study showed that broiler production in the study area was profitable, not with standing the shock and scare generated by the bird flu. However, the level of production or capacity utilization was low. Only three production cycles were employed out of about six production cycles possible in a year for the production of broilers. The break even points for sales turn over was N347, 484 and 348 birds for stock size. The

effects of Avian-flu in the area was made manifest by 35% difference in profitability of the enterprise between this study and previous study conducted in 2004 by Effiong on broilers. Three variables, namely; feed, equipment and labour, out of five used in the multiple regression analysis was found to be positive and statistically significant at 5% level.

This suggests that improvement in the usage of these inputs would improve output and hence the profitability of the broiler farmers. Furthermore, the farmers were found to be inefficient in resource allocation. They were over utilizing inputs such as feed, labour equipment and drugs and under-utilizing others, such as size of stock. The return to scale of 7.512 indicated that they were producing at an increasing return to scale which is in Zone 1 or Irrational zone of the production function.

To enhance their productivity and hence, the profitability, there is need to increase their production cycle well above the break even point from the present three cycles to at least four. In addition, they need to adjust the usage of the resources, appropriately. Feed, labour, equipment and drugs should be re-adjusted downwards by 35, 79, 99.8 and 99.9%, respectively while size of stock need to be adjusted upwards by 56%. These would result in the shift of the production function of these broiler farmers from the current production in Zone 1 (i.e., irrational region of increasing return) to Zone II (i.e., rational region) and in that process increase their profitability.

RECOMMENDATION

Finally, it is recommended that all stakeholders, including the government, producers, consumers, poultry associations and foreign partners should synergize in the fight against the spread of bird flu, even though it has oblique effects in the study area. Effective monitoring of birds is crucial in the fight against Avian bird flu as well as the improvement of the educational (formal and informal) status of the farmers.

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