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ORIGINAL RESEARCH ARTICLE

Analysis of risks in commercial poultry production in Oyo State, Nigeria: A Bayesian Decision Model Approach

***Adenegan, K. O and Musa, R. A.**
Department of Agricultural Economics, University of Ibadan, Ibadan, Nigeria.
**Email: bumkem@yahoo.com*

ABSTRACT
Poultry production, just like other biological activities, is characterized by high level of risk which has a negative implication on the willingness of the poultry farmers to invest fully in the enterprise. The study therefore identified and analyzed occurrence of risks in commercial poultry production in Oyo State. Primary data were collected on farm level with the aid of well-structured questionnaires. A multistage sampling procedure was employed to sample poultry farmers in the study area. Data collected were analysed using descriptive statistics and Bayesian decision model. The average number of birds raised by each farmer was 8652 and most farmers used battery cage system since a larger proportion of the farmers are involved in layer bird production. The identified risk factors were diseases/parasites, droughts, pilfering, pest attacks and unreliable sources of day old chicks. Unreliable sources of day old chicks and diseases/parasites had the highest posterior probabilities of occurrence of 0.495 and 0.435 respectively. Loss of birds due to unreliable sources of day old chicks was very severe in broilers /cockerels (B_5) enterprise with the posterior probability of 0.683, followed by layers/broilers/cockerels (B_3) enterprise with the posterior probability of 0.662. Occurrence of diseases/parasites was found to be very critical in layers/broilers (B_2) enterprise and layers enterprise (B_1) as indicated by their posterior probabilities of 0.652 and 0.577 respectively. These are preventable risk factors if appropriate management practices are adopted. The study therefore calls for policies aimed at reducing the risk in poultry production by developing cost efficient management strategies that would minimise the level of loss due to uncertainties. Adequate vaccination, farm bio-security measures, use of security guard and efficient feed formulation were the major risk management strategies adopted in the study area.

Key-words: Poultry production, Risks, Bayesian Decision Model, Nigeria.

INTRODUCTION

Poultry production is gaining popularity in the developing countries due to its role in bridging the gap in protein malnutrition, economic empowerment of the resource poor in the society and also because it fits well in the farming systems commonly practiced (King'ori, 2011). Poultry meat and egg provide the much needed animal protein and nutrition to mankind as it bridges the protein supply gap in Nigeria (Folorunsho and Onibi 2005). The importance of egg is also observed in its contribution as a major ingredient in the baking of confectioneries and the use of egg albumen in making shampoo and in book biding (Bamiro *et al,* 2001; Ojo, 2003; Okoruwa *et al,* 2005). Poultry products are in advantageous position because of the excellent feed conversion of broilers to flesh and that of laying hens to egg and the fact that no religious taboo constrains the consumption of chicken meat and eggs. They also have the advantage that they may have relatively little need for refrigeration as whole birds can be consumed in one meal. Poultry enjoys a relative advantage of ease of management, higher turnover, quick returns to capital investment and wider acceptance of its product for human consumption when compared to beef in the livestock industry (Haruna and Hamidu, 2004). The contribution of poultry industry towards reduction in the rate of unemployment in Nigeria cannot be overemphasized as many Nigerians are gainfully employed in the poultry sub-sector of agriculture. Research has shown that commercial poultry employs 25 million people in Nigeria in

about 8.5 million households (Omotoso, 2013). The poultry sector has developed such that large scale production is being practiced and poultry is probably one of the best researched of the domesticated farm animals in Nigeria (Musa and Olarinde, 2008). However, the ability of the current poultry production to meet the demand of the expanding population in Nigeria is still relatively low. This is due to the risk factors, such as diseases, associated with the enterprise which has discouraged many potential poultry farmers from investing optimally in the enterprise and the fact that most poultry farmers in Nigeria operate on a small scale with little opportunity for diversification and insurance (Adejoro, 2000). The unwillingness on the part of many poultry farmers to expand their scale of production might be due to the inherent risky nature of the enterprise.

Risk in business terms, is a measure of the extent of variation between an expected outcome and the actual outcome of a given management decision (Hyman, 1997). According to Andres and Wall (2010), farmers face risk from a variety of sources including input price risk and production risk all of which causes uncertainty in profit and which will affect input choice decisions. Production activities of poultry farmers are characterised by high levels of risks, limited access to formal and informal systems for credit and insurance, negligible capital investment and low savings (Oparinde and Birol, 2008). Generally, farmers often face severe variations in output and prices of both input and output, they seldom use modern input, have difficulties in accessing loans due to lack of collaterals and have poor access to agricultural extension services. These problems have led to characteristic poverty: low income and vulnerability to risk in Nigeria (World Bank, 2001). Occurrence of risks is inevitable in poultry production. The reason is not far-fetched and this stems from the fact that poultry production is biological and characterised by high variability of production outcome such that, it is difficult for a farmer to predict with certainty the expected output. These production modifying eventualities or outcomes are risk factors that influence the decision making process in poultry farming. Some of these risk factors, as identified by Ojo (2005), are diseases/parasites, pilfering, windstorms, pest attacks and feed poisoning. Poultry farmers are at risk, mostly, from diseases outbreak as birds are susceptible to a number of diseases such as: New Castle Diseases (ND); Infectious Bouvine Diseases (Gomborro); Chronic Respiratory Diseases (CRD); parasitic diseases (helminthiasis); coccidiosis, fowl typhoid, bird flu (Avian influenza) among others. Uncertainty in the price of feed, sudden decrease in egg production, problem of procuring day old chicks, poor access to credit facilities are other identifiable sources of risk in poultry farming (Musa and Ojutalayo, 2013).

In Nigeria, the experience of farmers has shown that poultry production has been suffering some setbacks caused by various risks such as increasing costs of feed, high cost of veterinary services among others which reduce the net return from the business significantly. This situation threatens the survival of poultry industries and calls for an intensive and collaborative effort of all stakeholders involved to save the industry from total collapse (Aihonsu and Sunmola, 1999). Measurement of risk has a productive implication on the development of management strategies which are very crucial to production efficiency. According to Ojo (2005), knowledge of chances of presence of risk factors would enable the poultry farmers to take appropriate measure to minimise the effect of such risks by adopting better management practices. Thus, to promote the development of appropriate measures of managing the associated risks in poultry production, this study aims to analyse the risk factors associated with poultry production and to identify the risk management strategies adopted by poultry farmers in Oyo State.

METHODOLOGY

Study area: The study was carried out in Oyo State, one of the 36 states in Nigeria. The state is located in the South Western part of the country with its capital at Ibadan. The state has a land area of 28,454km^2 and a population of about 5.6 million (NPC, 2006). It has two ecological zones, rainforest to the south and derived savannah to the north. The climate of the state is equatorial, notably with dry and wet seasons with relative high humidity.

Figure 1: Map of Nigeria showing the study area

The dry season lasts from November to March while the wet season begins from April and ends in October. Average daily temperature ranges between 25^0C and 35^0C, almost throughout the year. The state comprises 33 Local Governments organised into four (4) agricultural zones under the Oyo State Agricultural Development Programme (OYSADEP). Agriculture is the major occupation of the people in rural communities of the state. Major arable crops cultivated in the state include cassava, yam, cocoyam, maize, okra and other vegetables. The plantation crops such as oil palm, cashew, and mango are also grown in the state. The people of the area are also involved in small scale production of pigs, sheep and goats while poultry is undertaken in small, medium and large scales.

Data collection and sampling procedure: A multistage sampling procedure was employed to sample the poultry farmers. The first stage involved purposive selection of two ADP zones: Ibadan and Ogbomoso, based on the knowledge that they are the leading poultry farming zones in the state by the Poultry Association of Nigeria (PAN), Oyo State chapter. Second stage involved purposive selection of two local government areas (LGAs) from each of the zones due to the dominance of poultry farmers in these areas, namely; Lagelu, Ido, Surulere and Orire LGAs. The third stage involved the stratification of poultry farmers into small, medium and large scale farmers. All farmers from large scale stratum constituted the sample frame. Finally, 22 poultry farmers from Lagelu, 25 farmers from Ido, 23 farmers from Surulere and 20 farmers from Orire LGAs were randomly selected by probability proportionate to their population, giving a total of 90 poultry farmers. However, only 80 questionnaires were usable for the analyses due to inadequate information and inconsistency of the others. Data were collected on socio-economic characteristics such as age, farming experience, years of schooling, and household size among others. Data were also collected on the following risk factors: number of birds lost to diseases/parasites, windstorms, heat intensity (droughts) unreliable source of day old chicks, feed poisoning, pilfering, pest attacks etc.

Method of data analysis: Data collected were analysed using descriptive statistics (means, frequency tables, standard deviation and percentages) and Bayesian decision model.

a) Descriptive analysis: Descriptive statistics was used to examine and describe the systems of production, sources of risk to which the poultry farmers were exposed and the adopted risk management strategies in the study areas.

b) Bayesian decision model analysis: Bayesian model is a revisional probability. It could be used to measure the occurrence of risk factors in management decision-making processes (Ojo, 2005). It involves three kinds of probabilities: Prior, conditional and posterior probabilities. Posterior probabilities are obtained by combining prior probabilities of occurrence of risk factors with their conditional probabilities (Ossenbruggen,

1984). Prior probability of an event 'A' is the probability of occurrence of that event 'A' (Olayemi and Onyenwaku, 1999). The conditional probability of event 'A' occurring, given that 'B' has occurred is given as:

$P(A/B) = P(AB)/P(B)$…….. (1)

Where:

$P(A/B)$= Conditional probability of event 'A' occurring given that event 'B' has occurred.

$P(AB)$=Joint probability of event 'A' and 'B'

$P(B)$ = Marginal probability of event 'B'

The posterior probability is the revised probability of state A:

Generally, the Bayesian formula as defined by Hoel (1976); Spiegel (1980) and Olayemi, (1982) is as written below:

$$P(Ai/Bj) = \frac{P(Ai)\,P(Bj/Ai)}{P(Bj)} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

Where:

$P(Ai)$ = Probabilities of occurrence of the state of nature (event Ai)

$P(Bj/Ai)$ = Conditional probabilities of occurrence of state of nature (event Ai) given that event B has occurred.

$P(Bj)$ = Marginal probabilities which is the sum of all the joint probabilities for a particular predicted state Bj and are arrived at using the formula below:

$P(Bj) = \sum [P(Ai)\,P(Bj/Ai)]$……..…..... (3)

Theoretically, in most applications of the theorem to decision problems, the Bj represents events which precede the occurrence of the observed Ai (Ojo, 2005). For decision making, the posterior probability distribution $P(Ai/Bj)$ and the marginal probability distribution $P(Bj)$are required (Morris, 1970). In order to determine these distributions, a prior probability $P(Ai)$ must be assigned and a simple likelihood (conditional) distribution $P(Ai/Bj)$ must be known (Ossenbruggen, 1984). Events B_j represent the decision of the poultry farmers as to what types of poultry enterprises to produce while events Ai represent the identified risk factors in the poultry business.

The identified poultry enterprises in the study area were:

B_1 = Layers production

B_2 = Layers + Broilers production

B_3 = Layers + Broilers + Cockerels production

B_4 = Broilers production

B_5 = Broilers + Cockerels production

The identified risk factors include:

A_1 = Disease/parasites

A_2 = Droughts (high heat)

A_3 = Pilfering (theft)

A_4 = Pest attacks

A_5 = unreliable day old

RESULTS AND DISCUSSION

Poultry management systems of the respondents

The study revealed that different poultry enterprises exist in poultry business as shown in the Figure 7. About 38.8% of the respondents were involved in layers production only, 16.3% were involved in the production of layers and broilers, 15.0% of the respondents were involved in layers/broilers/cockerels' enterprise, and 18.8% were involved in broilers production only while 11.3% of the respondents were involved in broilers and cockerels' production. This implies that majority of the poultry farmers in the study area were in egg production and used battery cage system. This could be attributed to the decision to attain management efficiency and productivity of the system, which was also justified by the number of farmers involved in egg production in the study area. The average number of birds raised by the farmers was 8652± 4501 implying that most of the respondents were commercial poultry farmers.

The result in Figure 7 also showed that 78.5% of the respondents stocked their birds at day old while just 2.5% stocked their birds at point-of-lay. This implies that majority of the respondents acquired their birds at day-old. The study also revealed that 23.8% of the respondents obtained their feed from commercial feed mill while 76.3% formulated their feed themselves. This is an indication that self formulation of feed is very common among the poultry farmers, which could enable the farmer to prevent occurrence of risk due to feed poisoning emanated from wrong feed formulation. It was further revealed that 10.0% of the respondents employed family labour while 90.0% employed hired labour. This confirmed the assertion that the respondents in the study area are mostly commercial in their orientation which is

characterised by hired labour (Iwena, 2008). The major source of credit to poultry farmers in the study area was personal savings as 60.0% of the respondents had no access to external finance.

Sources of risk to poultry farmers in the study area

Different sources of risk encountered by poultry farmers in the study area were identified and categorized (based on the existing literatures) as follows:

Production risks: The result in Table 1 reveals that 71.0% of the respondents lost their birds to droughts (natural risk) and 49.0% of them experienced sudden decline in egg production due to the same event. Lack of access to credit facilities was experienced by 60.0% of the respondents which denied them the opportunity for further expansion of their levels of production. 65.0% of the respondents were affected by problem of day old procurement which rendered their sale plans against festive season unrealistic. Vaccine failure, particularly Infectious Bursa Diseases (IBD) vaccine was experienced by 52.5% of the respondents. It was also found as a source of risk against optimum production. Drought is the most severe risk in this category due to the number of respondents affected and its consequences.

Economic risks: This includes input prices fluctuation, unstable market for poultry produce and interest fluctuation on borrowed capital. About 93.8% of the respondents experienced input prices fluctuation, 47.5% were faced by unstable market or low demand for poultry produce and 43.8% of the respondents, who had access to credit facilities, were faced by interest fluctuation on borrowed capital. Input prices fluctuation is the most prominent economic risk among others.

Health risk: Health risk encompasses disease outbreak/parasite infestation, pest attacks and day old mortality due to unreliable sources of day old. The result reveals that 63.8% of the respondents experienced disease outbreak due to vaccine failure, 12.5% experienced pest attacks while 65.0% suffered day old mortality due to unreliable source of day old chicks.

Social risk: The only social risk identified in the study area was pilfering. About 54.0% of the respondents were found to be victims of this circumstance.

Risk factors analysis

The Bayesian decision model was adopted for analysing the occurrence of risk factors in poultry production. The probability values obtained for the identified risk factors at different levels of the analysis are computed and presented in tables as shown below:

Table 1: Sources of risks to poultry farmers in Oyo State

Sources of risk	Frequency	Percentage
Production risk		
Mortality due to droughts	71	88.75
Sudden decline in egg production	49	61.25
Lack of access to credit	48	60.00
Problem of day old procurement	52	65.00
Vaccine failure	42	52.50
Economic risk		
Input prices fluctuation	75	93.75
Unstable market for poultry produce	38	47.50
Interest fluctuation on capital	14	43.75
Health risk		
Disease outbreak/parasites	51	63.75
Pest attacks	10	12.50
Day old mortality due to unreliable sources	52	65.00
Social risk		
Pilfering (theft)	43	53.75

Source: Field Survey, 2014.

Table 2: Prior probabilities of occurrence of risk factors $P(Ai)$

Poultry enterprises Bj	Number of birds lost to state of nature (Risk factor) Ai					
	A_1	A_2	A_3	A_4	A_5	Total
Layers only B_1	290	87	23	05	156	531
Layers +Broilers B_2	653	259	15	00	246	1173
Layers +Broilers + Cockerels B_3	172	124	27	00	444	767
Broilers only B_4	129	33	10	02	176	350
Broilers + Cockerels B_5	119	40	08	02	295	464
Total birds lost	1333	543	83	09	1317	3285
Prior probabilities $P(Ai)$	0.406	0.165	0.025	0.003	0.401	1.000

Source: Authors' Computation, 2014.

The computation of the prior probabilities from the mean value of birds lost by each identified poultry enterprise relative to each of the identified risk factors is shown in Table 2. Out of the 3,285 birds lost to the risk factors, 1,333 birds were lost to diseases/parasites, 543 birds todroughts,83 birds to pilfering,9 birds to pest attacks and 1,317 birds to unreliable sources of day old chicks. Thus, diseases/parasites and incidence of unreliable sources of day old chicks had the largest prior probabilities of occurrence at a very close range. The computation of the conditional probabilities from the joint probabilities of occurrence of risk factor is presented in Table 3. The mean value of the conditional probabilities of occurrence of risk factors distinguished the risk associated with unreliable source of day old chicks to be the largest, followed by diseases/parasites. Table 4 shows the computation of marginal probabilities which is the sum of all the joint probabilities of occurrence of risk factors given the poultry enterprise. The posterior probabilities were computed from the conditional probabilities and marginal probabilities. The Posterior probabilities of the occurrence of risk factors were obtained by dividing the product of prior probabilities and conditional probabilities of occurrence of risk factors by the marginal probabilities. The values of the posterior probabilities of loss due to unreliable day old chicks of 0.495 and 0.435 for diseases/parasites were found to be the largest among the identified risk factors. The loss of birds due to unreliable source of day old chicks was very severe in broilers/cockerels (B_5) enterprises with the posterior probability of 0.683, followed by layers/broilers/ cockerels (B_3) enterprise with the posterior probability of 0.662.

Table 3: Conditional probabilities of occurrence of risk factors $P(Bj/Ai)$

Poultry enterprises Bj	**Risk factors**					
	A_1	**A_2**	**A_3**	**A_4**	**A_5**	**Total**
B_1	0.490	0.164	0.043	0.009	0.294	1.000
B_2	0.557	0.221	0.013	0.000	0.209	1.000
B_3	0.224	0.162	0.035	0.000	0.579	1.000
B_4	0.368	0.094	0.029	0.006	0.503	1.000
B_5	0.256	0.086	0.017	0.004	0.636	1.000
Cond. prob. $P(Bj/Ai)$	**0.379**	**0.145**	**0.027**	**0.004**	**0.444**	**1.000**

Source: Authors' Computation (2014).

Table 4: Marginal probabilities of occurrence of risk factors $P(Bj) = P(Bj/Ai)\,P(Ai)$

Poultry enterprises B_j	**Risk factors**					
	A_1	**A_2**	**A_3**	**A_4**	**A_5**	**$P(Bj)$**
B_1	0.19890	0.02710	0.00110	0.00003	0.11790	**0.34500**
B_2	0.22610	0.03650	0.00033	0.00000	0.08380	**0.34670**
B_3	0.09090	0.02670	0.00088	0.00000	0.23220	**0.35070**
B_4	0.14940	0.01550	0.00073	0.00002	0.20170	**0.36740**
B_5	0.10390	0.01420	0.00043	0.00001	0.25500	**0.37350**

Source: Authors' Computation (2014).

Table 5: Posterior probabilities of occurrence of risk factors
$P(Ai/Bj) = P(Ai)\ P(Bj/Ai)[P(Bj)]^{-1}$

Poultry enterprises Bj	**Risk factors**					
	A_1	**A_2**	**A_3**	**A_4**	**A_5**	**Total**
B_1	0.576500	0.078500	0.003200	0.000087	0.341700	1.000000
B_2	0.652100	0.105300	0.000950	0.000000	0.241700	1.000000
B_3	0.259200	0.076100	0.002500	0.000000	0.662100	1.000000
B_4	0.406600	0.042200	0.001990	0.000054	0.549000	1.000000
B_5	0.278200	0.278200	0.001100	0.000032	.682700	1.000000
Posterior Probabilities	**0.434500**	**0.068000**	**0.001950**	**0.000035**	**0.495400**	**1.000000**

Source: Authors' Computation (2014).

On the other hand, occurrence of diseases/parasites was found to be very critical in layers/broilers (B_2) enterprise as indicated by their posterior probabilities of 0.652. These are preventable risks if appropriate measures are put in place. A number of risk management strategies were employed by the respondents in the study area. The proportion of the respondents who adopted a particular strategy is discussed using percentages and presented in Table 6.

Enterprise diversification: Enterprise diversification assumes income from different crops and livestock activities, which do not move up and down in perfect correlation, so that low income from some activities would likely be offset by higher income from others. According to Ellis (1998), people diversify their assets, activities and income because of several reasons: to manage risk, to handle seasonality in farming activities, credit market failures (by investing to increase income generating capabilities in the future) and iron out problems in labour markets. The study reveals that 60.0% of the respondents diversified their resources into other enterprises. Some of them were involved in other livestock production, such as fish farming, cattle, sheep and goat production as well as crop production alongside their poultry enterprise.

Contacting: Contacting reduces risk by guaranteeing prices, market outlets or other terms of exchange in advance. Production contracts typically give the contract (the buyer of the commodity) considerable control over the production process (Perry, 1997). The study reveals that 77.5% of the respondents in the study area have contact buyers and thus face less risk of unstable market or low demand of poultry products.

Adequate vaccination: The result obtained shows that all the respondents (100%) have good vaccination programme for different classes of birds raised and thus, often vaccinate their flock against prevalent diseases in the study area. This is because the poultry birds are very susceptible to diseases and as a result, birds' vaccination is inevitable in poultry business for the success of the enterprise.

Poultry farm bio-security: Bio- security means protecting the health of poultry by preventing the introduction of infectious agents. Preventing diseases from entering farm is very crucial. Adedeji *et al.* (2005) noted that bio-security practices can eradicate or reduce pathogens to non-infectious level.

Table 6: Risk management strategies adopted by the respondents

Risk management strategy	**Frequency**	**Percentage**
Enterprise diversification	48	60.00
The use of contact buyers	62	77.50
Adequate vaccination programme	80	100.00
Poultry farm bio-security guard	78	97.50
The use of security guard	76	95.00
Efficient feed formulation	61	76.25
Poultry farm insurance	5	6.25

Source: Field survey (2014).

Table 7: Distribution of poultry management systems of the respondents

Management system	Frequency	Percentage	
Poultry enterprise			
Layers only	31	38.75	
Layers +Broilers	13	16.25	
Layers +broilers +Cockerels	12	15.00	
Broiler only	15	18.75	
Broilers + Cockerels	9	11.25	
Total	**80**	**100**	
Housing System			
Battery cage	31	38.75	
Deep litter	24	30.00	
Both	25	31.25	
Total	**80**	**100**	
Flock Size			
5,000 – 9,500	61	76.25	
10,000 – 14,500	9	11.25	**(Mean: 8652 birds)**
15,000 – 19,500	8	10.00	**(S. dev: 4501 birds)**
≥ 20,000	2	2.50	
Total	**80**	**100**	
Age of initial flock			
Day old	78	97.5	
Point of lay	2	2.5	
Total	**80**	**100**	
Source of feed			
Commercial	19	23.75	
Self formulated	61	76.25	
Total	**80**	**100**	
Labour used			
Family labour	8	10	
Hired labour	72	90	
Total	**80**	**100**	
Source of credit			
Commercial Banks	11	13.75	
Government	5	6.25	
Cooperative Societies	7	8.75	
Friends	5	6.25	
Relatives	4	5.00	
Personal Savings	48	60.00	
Total	**80**	**100**	

Source: Field survey (2014)

The study reveals that 97.5% of the respondents were monitoring their farm using bio-security measures properly. This was observed in the farmers' attitude towards cleanliness and disallowing visitors from gaining entrance into their poultry houses. Some of them made use of foot bath containing germicide solution at the entrance of every pen in which visitors dip feet before entering.

The use of security guard: The service of security guards was employed by the respondents in the study area. The study reveals that 95.0% of the respondents had security guards to prevent loss of poultry birds and their products to theft either by poultry attendants or outsiders.

Efficient feed formulation: Feed poisoning is one of the risk factors in poultry production. This was prevented in the study area by self-formulation of feeds. The study reveals that 76.3% of the respondents have adequate knowledge of feed composition required by various classes of poultry birds. The field survey also showed that other

respondents who obtained feed from commercial sources often present the feed millers with their formulae upon which feed composition is based. This might account for no case of feed poisoning in the study area.

Poultry farm insurance: Farm Insurance offers compensation for loss in case of any eventuality. However, this risk management strategy was not adequately utilised by the respondents in the study area as only 6.3% of the poultry farmers in the study area made use of this strategy.

CONCLUSION

The study revealed identifiable sources of risk in poultry production and predicted the chances of occurrence of losses due to unreliable sources of day old chicks and diseases/parasites in subsequent production cycles.Thus, production and productivity would be enhanced and appreciable returns would be achieved if appropriate risk management strategies are developed to minimise the occurrence of diseases/parasites and loss due to unreliable sources of day old chicks. It is therefore recommended that poultry farmers should always investigate the pedigree of their day old chicks upon receipt through laboratory procedure so that they could detect the hereditary diseases of the flock earlier and so as to administer vaccines accordingly, instead of giving only antibiotics and vitamins at reception. Likewise, the key stakeholders in poultry production (farmers, extension workers, researchers and government) should come together and put a policy/programme in place that ensures the breeding of good breeds of layers and broilers that can withstand diseases/parasites and extreme weather conditions and also performs well in these risky situations. This becomes imperative since findings show that unreliable sources of day old chicks and diseases/parasites had the highest probability of risk occurrence in poultry production in the study area.

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