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A Stochatic Production Function Approach to Estimate the Effect of Cost of Resources among Indiginous Chicken Farmers in Kitui County, Kenya

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Abstract **Original Research Article**

Indigenous chicken production has become an important source of income and protein for many households especially in the developing economies. This study was conducted to identify the common resources used and determine their level of influence on indigenous chicken production in selected wards of Kitui county using the production function approach Primary data was collected by administering structured questionnaires on 120 respondents. A multistage sampling procedure was applied where four sub counties where purposively selected followed by random selection of four wards from each sub county. Finally, 10 respondents were randomly selected from each ward. The questionnaire response rate was 83% and therefore 100 questionnaires were used for analysis. The study established that, the resources used by the indigenous chicken farmers were; poultry house, feeds, feeding traps, water traps, veterinary services and hired labour. The results of the stochastic production frontier showed that the costs of the identified resources significantly influenced the level on indigenous chicken production in the study area. Based on the results, the study suggests that: 1. there was need to educated farmers on optimum production techniques in order to cut down on costs and adjust their scale of production to match the costs and 2. Extension officers should help in mobilizing farmers into small self help groups through which the government and nongovernmental organization can assist the farmers.

Keywords: Indigenous chicken, Resources, Farms, production function.

1.0. INTRODUCTION

Indigenous chicken production has become very important in wealth creation and animal protein supply at both national and household level in majority of developing countries (Mack *et al.,* 2005, Matiu *et al.,* 2021). Kenya has an estimated poultry population of 31 million birds. Of these, 75% consist of indigenous chicken, 22% of broilers and layers and 1% of breeding stock. Other poultry species like ducks, geese, turkeys, pigeons, ostriches, guinea fowls and quails make up 2% of the poultry production (padhi, 2016). According to Kamau *et al*. (2018) 70% of the rural inhabitant derives their livelihood from poultry production.

The declining trend in indigenous chicken population has been attributed to high disease incidences, inadequate nutrition, low genetic ability and poor marketing channels (Magothe *et al.*,2012). Research on challenges, factors and limitations of indigenous chicken production has been immensely done. However very little research has been done on the study of efficiency as a major determinant of indigenous chicken production in kenya.

A few studies available on cost efficiency level of poultry production in some developing countries concluded that the farms were relatively cost inefficient. A study by Ashagidigbi *et al*. (2011) on technical and allocative efficiency of poultry producers in Nigeria concluded that the farms were about 27% cost inefficient indicating that the production cost could be reduced by 27% if the farms were efficient.

Different authors have identified a number of factors influencing cost efficiency especially in a developing country's agriculture. According to Al-

hassan (2008), inefficiency can result from socioeconomic, demographic or environmental factors. However, some of the environmental/exogenous factors such as weather, government policies among others are outside the scope or the control of the farmers, and hence their impact cannot be considered as farmers' inefficiency. Ali and Byerlee (1991), stated that farm-specific efficiency or inefficiency is influenced by farmers' characteristics (socioeconomic and demographic factors) which encompass information status and managerial skills, such as level of education, farming experience, extension contacts, farm size, gender , age as well as system effects exogenous to the farm, such as access to credit.

This study sought to identify major resources that were being used by farmers in indigenous chicken production, estimate the production function and determine which of the identified resources significantly influenced indigenous chicken production in the study area.

2.0. MATERIALS AND METHODS

This study was carried in Kitui County. Kitui County covers approximately 30,520 square kilometers and has a population of approximately 1,012,709. The County has four ecological zones all depicting arid and semi-arid conditions; the semi-Arid farming zone, semi-arid ranching areas, arid-agro-pastoral area and arid-pastoral zone. The absolute poverty in the county stands at 63.8% (n=648,108) this is estimated to be 0.55% of the national absolute poverty. Additionally, the county is food insecure with food poverty rate reported at 55.5% (n=598,212) (ASDSP, 2013).

This study employed a descriptive survey design chosen particularly since it is mainly looking at phenomena, events and issues the way things are (Mugenda and Mugenda, 2003). The study was based on a multistage selection of 120 indigenous chicken farmers in Kitui County. In the first stage four sub counties were randomly selected from the county. In the second stage three wards were randomly selected from each sub count and in the last stage ten farmers were selected from each ward. Simple random selection was used to pick the 10 farmer. The questionnaire return rate was 83.3% and therefore 100 questionnaires were used in analysis of the data. The study employed a stochastic frontier model to determine the effect of efficiency costs on indigenous chicken production in the study area. The frequency of the responses was determined using inferential statistics.

2.1 Production Function Analysis

Production technology of farmers is assumed to be specified by the linearized stochastic production function representing Cobb-Douglas production technology (Henderson and Quant
(1971)), which is specified as;

$$\ln Y = \ln + \beta 1 \ln X1 + \beta 2 \ln X2 + \beta 3 \ln X3 + \beta 4 \ln X4 + \ldots\ldots\ldots + \beta n \ln Xn + \mu - U \ldots\ldots\ldots\ldots\ldots\ldots 1$$

Where; Y = Amount of poultry products (e.g. eggs, chicken, broilers or manure) sold/produced per annum) in Kshs, X1 = Total number of birds purchased in Kshs, X2 = Amount of labour measured in man days, X3 = Cost of vaccines, drugs and Chemicals (Kshs), X4 =Amount of feeds in bags/Kilograms purchased (Kshs), X5= Years of experience in poultry production, X6=Education level of household head, X7= Cost of poultry Equipment in Kshs, X8= Other cost (Miscellaneous cost) in Kshs, μ= Random error term, U= Technical inefficiency effects, ß0= Constant term, ßis= Slope parameters, β0 represents the intercept while β1,….., βn are the Parameters which will define the transformation ratios when the Xs are at different magnitudes (Quantities) and (e) is the natural exponent. The estimated parameters could then be used to evaluate the factors that influence the supply of poultry and poultry products of the sampled farmers in the county.

3.0 RESULTS AND DISCUSSIONS

3.1 Major resources used by farmers in indigenous chicken production

The objective for this study was to identify the major resources that were being used by farmers in indigenous chicken production, estimate the production function and determine which of the identified resources significantly influenced indigenous chicken production in the study area. Table 1: shows that, 31% of the respondents which was the highest percentage had used Kshs 10,000 and above on construction of poultry house. The study also revealed that, majority (45%) of the respondents had used Ksh 1,000 and below on purchasing the feeding traps while majority (60%) of the respondents had used Ksh 1,000 and below. On veterinary, majority (55%) had used Ksh 1,000 and below. It was also established that majority (67%) of the respondents used free labour from their families. However, 33% were using hired labour which was costing between Kshs 1000.00 to above Kshs 2000.00 per month.

Table-1: Type of Resources for Indigenous Chicken Production

Variables	Frequency	Percentage
Poultry House Cost		
1000 and below	12	12.0
1001-5,000	20	20.0
5001- 10,000	25	25.0
10,000 and above	31	31.0
Total	100	100.0

Feeding Traps Cost

1000 and below	45	45.0
1001-1500	25	25.0
1501- 2000	20	20.0
2000 and above	10	10.0
Total	100	100.0

Water traps cost

1000 and below	**60**	**60.0**
1001-1500	21	21.0
1501- 2000	11	11.0
2000 and above	8	8.0
Total	100	100.0

Veterinary services cost

1000 and below	55	55.0
1001-1500	20	20.0
1501- 2000	20	20.0
2000 and above	5	5.0
Total	100	100.0

Labor Cost

Free (family)	67	67.0
1001-1500	21	21.0
1501- 2000	6	6.0
2000 and above	6	6.0
Total	100	100.0

Feed Cost

Free range	56	56.0
1001-1500	24	24.0
1501- 2000	12	12.0
2000 and above	6	6.0
Total	100	100.0

3.2 Estimation of Stochastic Production Frontier Function

The estimates of the stochastic production frontier function (Table 2) indicate that, all the coefficients carried the expected positive signs. The coefficients of poultry house (X_1), Feeding traps (X_2), water traps (X_3), verterinary services (X_4), labour (X_5), extension services (X_6) and Cost of Feed (X_7) were significant at 5% level. The gamma (γ) was 0.633 which was high enough and significant at 5% level. It gives an indication that the unexplained variations in output are the major sources of random errors. It also shows that about 63.3 percent of the variations in output of poultry farmers are caused by technical inefficiency. The sigma square (δ^2) estimate was 0.622 and significant at 1%, and therefore, assures of the goodness of fit and correctness of the distributional assumptions of the composite error. The variables with the greatest influence on poultry production were labour with a factor 0.775. Labour is needed in sweeping the poultry houses, providing feeds and water, collecting eggs and administering drugs and vaccines among many other duties. Poultry feed had a coefficient of 0.619 which depicts the importance of feeding chicken with sufficient feed at optimum levels. Farmers opted to feed their birds in the morning and leave them to scavenge the rest of the day. This practice was very common among farmers in the study area and significantly reduces the cost of feeding the chicken. Poultry house also greatly influenced poultry production with a factor of 0.571. Poultry houses provide shelter to the birds during the night. They also reduce loss of chicken through theft and predators. Quality poultry houses enhance hygiene in poultry production and reduce disease infection significantly. The generalized likelihood test gave a value of 21.6 which indicates that the indigenous poultry farmers in Kitui County are not fully technically efficient in use of the estimated resources. These results agree with Ashagidigbi *et al*., (2011) who argued that the cost of poultry production inputs like poultry house, drugs and feeding traps significantly influence the indigenous chicken production.

Table-2: MLE of the stochastic production frontier function in poultry production in Kitui County

Variables	**Coefficients**[a]	t-ratio
Constant	6.646	4.452
Poultry house (X_1)	.571	1.109
Feed traps (X_2)	.053	2.851
Water traps (X_3)	.187	1.104
Veterinary Services (X_4)	.105	2.085
Labour (X_5)	.776	2.120
Extension services (X_6)	.435	3.338
Feeds (X_7)	.619	6.561
Diagnostic statistics		
Gamma (γ)	0.633	1.899**
Sigma square ($\delta 2$)	0.622	2.113*
Log likelihood function	-96.42	
LR test	21.63	

**significant at 5%,*significant at1% Source: output of Frontier 4.1 by (30)

4. CONCLUSIONS AND RECOMMENDATIONS

The study established that, the resources used by the poultry farmers were; poultry house, feeding traps, veterinary services and hired labour. All these resources required money to acquire hence attracted certain amount of cost of production with majority (31%) of the respondents indicating that, they had used Kshs 10,000 and above on the construction of poultry house. This seemed to be the most costly resource. However, it was established that majority (67%) of the respondents used free labour from their families. All identified resources significantly influenced the level of indigenous chicken production in the study area. The also revealed that increasing the cost of labour by one unit labour by one unit would increase total level of output by a factor of 0.776. This means that indigenous chicken farming is a labour intensive enterprise and therefore farmers could introduce early maturing birds to reduce the costs. Farmers also had the option of engaging family in most of the production practices which could only possible if they sought training on veterinary skills and any other specialized knowledge. The results also indicate that an increase in cost of feed by one unit could transform to an increase of total production by 0.619 and therefore farmers could be advised to produce at optimum levels. This could be achieved by educating farmer on maximum number birds to be kept within a specified period of time depending on the level of farmers' financial ability to purchase the feeds. Constructing of poultry houses is increasing becoming costly owing to the fact that farmers are transiting from traditional method of housing birds to semi permanent and modern poultry houses. However, the results indicate that it is worth undertaking an extra cost because it translated to an incremental factor of 0.57.

This study therefore recommends that:

1. The county government of Kitui through relevant departments and agencies assist farmers to construct moderate poultry houses
2. Extension officers to help in mobilizing farmers into small self help groups through which the government and nongovernmental organization would assist the farmers.

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