ECONOMIC ANALYSIS OF QUAIL PRODUCTION AMONG SMALL HOLDER FARMERS INKADUNA METROPOLIS - KADUNASTATE, NIGERIA

BY

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A DISSERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES, AHMADU BELLO UNIVERSITY, ZARIA, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF SCIENCE DEGREE IN AGRICULTURAL ECONOMICS

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DECLARATION

I hereby declare that this dissertation titled "**Economic analysis of Quailproduction among small holder farmers in Kaduna metropolis-Kaduna State, Nigeria"**has been written by me and it is a record of my research work. No part of this dissertation has been presented in any previous application for another Degree or Diploma in this or any other institution. All borrowed information has been duly acknowledged in the text and a list of references provided.

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CERTIFICATION

This dissertation titled '**Economic analysis of Quail production among small holder farmers in Kaduna metropolis-KadunaState, Nigeria',** by Adetola HammedOkusaga meets the regulations governing the award of the Degree of Master of Science, Ahmadu Bello University, Zaria, and is approved for its contribution to knowledge and literary presentation.

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This dissertationis dedicated to my wife AdesolaAdeyombo and children Zainab and AishatOkusaga.

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ABSTRACT

The main focus of this study is the “economic analysis of Quail production among small holder farmers in Kaduna metropolis, Kaduna State.Two sampling techniques were used in selecting 122 farmersfor this study. Descriptive statistics, net farm income and stochastic frontier production function were used in analyzing the data. The result of the analysis shows that 34% of the farmers fell within the age range of 30 and 39years.Majority of the farmers (59%) did not have a formal education. The farmers with household size ranged from 1-10 persons having the highest frequency at 53% while 72%of the farmers were not members of anyCooperative Society. About 84% did not have access to extension services, 94% of the farmers did not have access to credit. The total revenue earned from Quail production was ₦41,400 and ₦44,750 for meat and egg respectively. The total cost of Quail production was ₦21,049 and ₦32,596 for meat and egg respectively. The net farm income was therefore ₦20,351 and ₦12,154 for meat and egg respectively. The estimated mean technical efficiency for Quail meat producers is 0.73 and that of Quail egg producers is 0.85. The mean allocative efficiency of Quail producers is 0.61while the mean allocative efficiency for egg producers is 0.64.The study shows that the mean economic efficiency for Quail meat farmers is 0.45, while the mean economic efficiency of the egg farmers is 0.55. The major constraints identified in Quail production in the study area were high cost of feeds (68%), inadequate extension services (58%), inadequate capital (44%), pest and diseases (31%) and poor pricing (29%). It is concluded that Quail production is profitable in the study area but the farmers are not economically efficient.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Agriculture still offers the leading source of livelihood, and contributes a great %age of national income for most developing countries around the world (Dugje*et al.*, 2009). ILO (2007) suggest that about 60% of African labor force still derive their livelihood from agriculture, making it the largest employer of labor in most developing countries.

Nigeria is among the least consumer of animal protein in the world (Ikheolaand Inedia 2005). The problem of malnutrition in Nigeria is attributable to low consumption of meat (Food and Agriculture Organization , 2011). Japanese quails are hardy birds that thrive in concrete and small cages and are inexpensive to keep; they are affected by common poultry diseases, but fairly resistant. Japanese quail birds mature in about six weeks and are usually in full eggs production at 50 days of age. Quails with proper care can lay 200 eggs in the first year of lay, life expectancy is 2-2.5 years (Food and Agriculture Organisation, 2011).

Quail eggs are also known to stimulate growth, increase sexual appetite, stimulate brain functions which improves intelligence quotient and generally rejuvenates the body. It is recommended for children whether cooked or raw (Bakoji*et al.*, 2013). The consumption of quail eggs fortifies the woman's body during pre and post-natal periods as well as after surgery and radiotherapy. It also has beneficial effects on the foetus (physical and mental balance) and for the mother after delivery (physical rehabilitation and rejuvenation of cells) (Bakoji*et al.*, 2013). Quail eggs also improve the quality of breast milk. Quail meat has a better taste than chicken and has less fat content. It promotes body and brain development in children (Onyewuchi*et al.*, 2013).

Poultry meat and eggs though the major source of animal protein is still unable to meet up the protein deficiency of the world (Igado and Aina, 2010). Commercialization of quail bird production is a recent development in Nigeria (Akpan and Nsa, 2009) while quail farming is an uncommon farming business in Kaduna State but with lots of potentials. For the few people that have embraced it, they are not only smiling to banks, they are also enjoying both the nutritional and health benefits derived from consuming it.

Quail birds have the capacity to lay 24 eggs in one month and 288 eggs in a year, it reaches maturity at 8 weeks.Quail birds are small body birds which require little space, it can start laying eggs in 6 weeks, and their natural foods are grains, seeds and oats e.t.c. However, quails birds grow faster eating poultry feeds, its meat is cholesterol free so it can be eaten by hypertensive people, young and the aged.

1.2 Problem Statement

The importance of protein in human nutrition cannot be over emphasized. In recent times, there has been a significant short fall between the production and supply of animal protein to feed the ever increasing population (Femi, 2011). The human population projection for the Sub-Saharan Africa is put at about one billion by the year 2020 (Winrock, 1992).

Nigeria at present with a population of over 170 million (NPC, 2012) is expected to contribute a significant %age of anticipated population growth. This means greater pressure on feeding the populace. The present rate of growth in the agricultural sector is considered too slow to match the expected population growth (Abu and Soetan, 2009). In Nigeria, there is high deficiency of animal protein consumption with the per capita consumption put at 9.3g/day as against the 34g/day recommended by the Food and Agriculture Organisation as the minimum requirement for the growth and development of the body (Lamorde, 1997; Esobhawan, 2007, Esobhawan*et al*., 2008).

This implies that only about 27.35% of the minimum requirement in animal protein intake is met in Nigeria. To arrest this unacceptable trend, efforts have been directed towards boosting the animal production industry with micro-livestock being more prolific with short gestation period, short generation interval and rapid growth. Among the micro-livestock animals is the Japanese quail (*Coturnixcoturnix japonica*) which falls within the above description and should therefore be the animal of choice in increasing animal protein base in the developing countries. Japanese quail husbandry is a means of increasing animal protein base in developing countries. Based on these, the following request questions were developed as follows:

(i) What are the socio-economic characteristics of quail farmers?

(ii) What are the costs and return associated with quail production?

(iii) What arethe resource-use efficiency in quail production?

(iv) What are the constraints faced by quail famers in the study area?

1.3 Objectives of the Study

The broad objective of this study was to examine economic efficiency of quail production among small holder farmers in Kaduna State. The specific objectives were to:

(i) describe the socio-economic characteristics of quail farmers;

(ii) determine the costs and return associated with quail production;

(iii) determine the resource-use efficiency in quail (meat and egg) production; and

(iv) describe the constraints faced by smallholder quail famers in the study area.

1.4 Justification of the Study

Quail production has low awareness and it is less practiced as compared to the large number of livestock farmers in Kaduna State due to lack of adequate information about the bird as well as its financial and health benefits. The high rate of return and low cost of investment in the production of quail meat and egg are some of the reasons many farmers are fast resorting to quail farming. The fact that the birds grow and reach maturity faster and lay eggs within two months, compared with the 6months maturity period of chicken for egg-laying and 2½ months for meat type chicken (broilers) will attract farmers who see the business as a better and more sustainable investment to explore (Femi, 2011).

The demand for quail birds and its products in the northern part of the country is increasing rapidly due to its medicinal, nutritional and economic benefits (Bakoji*et al.*, 2013). Therefore, to keep pace with this increasing demand effort must be intensified towards increasing the level of production of quails in the country. There are no adequate data on the costs and return and the production efficiency gap. The study is intended to provide useful information about quail production in the study area which in turn will be useful to policy makers, entrepreneurs, students and researchers alike.It will also serve as a reference material to those conducting research on quail bird production.

1.5 Hypothesis

i. there is no significant difference between costs and returns in quail meat and egg production in the study area.

CHAPTER TWO

LITERATURE REVIEW

2.1 Quail Production in Nigeria

Quails are small game birds that are used for eggs and meat (DAFF, 2013). Quail is a collective name for several genera of mid-sized birds generally considered in the order Galliformes. Old world quail are found in the family phasianidae and new world quail are found in the family Odontophoridae (Cox, Kimball, and Braun 2007). The king quail, a member of the old world quail is often sold in the pet trade and within this trade is commonly referred to as "button quail". The collective noun for a group of quail is a covey or bevy. There are two mainkinds of quails suitable for breeding and they are the "Japanese" quail (Coturnix japonica) and the "American" quail (Coturnixcoturnix). Japanese quail (Coturnix quail) are from pheasant family and are migratory birds which migrate between Asia and Europe. The region of origin of these birds is believed to be south-east Asia. Back in history, the reference to quail can be traced back in the old testament of the bible (Manna from heaven). In the late 11^{th} century, quail was brought to Japan from China. The Japanese quail was introduced in Nigeria only in 1992 (National Veterinary Research Institute, 1994).

Young Coturnix is yellowish in appearance with stripes of brown and somewhat resemble turkey poults except for size. The newly hatched weigh about 6-8grams (Hall, 2012) but grow rapidly during the first few days and are fully feathered at about 4weeks of age. The adult male quail weighs about 100-130 grams (Mizutani, 2003). The male birds can be identified readily by the rusty dark brown colour of the breast feather. Males also have a cloacal gland, a bulbous structure located at the upper edge of the vent which secretes a white foamy material. This unique material can be used to access the reproductive fitness of the males. The young male begins to crow at 5 -6 weeks old. The adult female quail are slightly heavier than the male weighing from 120 - 160 grams (Ortlieb, 2013). The body colouration of the female bird is similar to the male except that the feathers on the throat and upper breast are long, pointed and much lighter Cinnamon. Also the light tan breast feathers are characteristically black-stripped. In order to produce fertile eggs, males and females should be enclosed with a maximum of two females per male (Ranklin*et al*., 1998).

Quail eggs are characterized by a variety of colour patterns; they range from snow white to completely brown. More commonly, they are tan and dark brown, speckled or mottled brown with a chalky blue covering (Randall and Bolla 2008). The average egg from mature female weighs about 10grams and contains 158callories of energy, 74.6% water, 13.1% protein, 11.2% fat and 1.1% total ash. The mineral content includes 0.59mg calcium, 220mgphosphorous and 3.8 mg iron (Shim kimfah 2005). The vitamin content is 300 iu of vitamin A, 0.12mg of vitamin B1, 0.85mg of vitamin B2 and 0.10mg nicotinic acid. Coturnix quail make excellent quail for beginners because they start laying eggs at a young age of approximately 6weeks (Chelmonska, *et al*., 2008) and can be prepared and eaten at 5weeks of age. According to Hemid, *et al* (2010), quails have early sexual maturity resulting in a short generation intervals, high rate of lay and much lower feed and space requirements than the domestic fowl. If you are raising quail for a strictly commercial and utilitarian purpose, you can turnover your cortunix quail quite quickly. There are many other types of quail including the popular bob white quail. There are different ways to house your quail but the easiest way is to use a rabbit hutch. Baby quails are fed with poultry starter feed. There are no known morbid diseases affecting them except respiratory disorder with very low mortality rate (Oluwatomi, 2011).

The eggs are rich in vitamin D, antioxidants which according to Sahin, *et al.*, (2008) improve animal origin food quality in terms of colour, oxidative stability, tenderness, storage properties, and has positive effects on people with stress problems, hypertension, digestive disturbance, gastric ulcer, liver problems, blood pressure and lipid control, migraine, ashma, anaemia, various types of allergies, eczema, heart problems, bronchitis illness, depression, panic and anxiety illness. The nutritional value of quail eggs is 3-4 times greater than chicken eggs (Tunsaringkarn*et al.*, 2013). Quails are now also commonly used as an experimental animal for biological research and for producing vaccines against many diseases which they themselves are resistant to (particularly certain strains of Newcastle disease) (Shanaway, 1994). Quail eggs are also known to stimulate growth, increase sexual appetite, stimulate brain functions which improves intelligence quotient and generally rejuvenates the body.

It is recommended for children whether cooked or raw. The consumption of quail eggs fortifies the woman's body during pre and post-natal periods as well as after surgery and radiotherapy. It also has beneficial effects on the foetus (physical and mental balance) and for the mother after delivery (physical rehabilitation and rejuvenation of cells). Quail eggs also improve the quality of breast milk. Quail meat is tastier than chicken and has less fat content. It promotes body and brain development in children.

Most of the developing countries are presently at a stage of perpetual protein hunger. Poultry meat and eggs though the major source of animal protein is still now unable to meet up the protein hunger of the world (Igado and Aina, 2010). Commercialization of quail bird production is a recent development in Nigeria (Akpan and Nsa, 2009) while quail farming is an uncommon farming business in Imo State but having a lots of potentials. For the few people that have embraced it, they are not only smiling to banks, they are also enjoying both the nutritional and health benefits derived from consuming it.

2.2 Challenges of Quail Production in Nigeria

In spite of the exceptional attributes and advantages of keeping Japanese quail, its productionin Nigeria is still comparatively rudimentary. Among the major challenges of quail productionin Nigeria are high cost of concentrates, non-readily available market when the farmersare ready to sell their stock and inadequate knowledge and information about the advantagesof eating quail meat. Domesticated quail do not have the tendency for broodiness andhence eggs must be incubated under broody hen or by artificial incubation (Naibi,Zahraddeen, Kalla, and Nathaniel, 2009). However, because of their short generationinterval and an average production of 250-280 eggs per bird yearly, artificial incubationis the surest choice for commercial farmers.

The high proportion of eggs discarded due to infertility and embryonic mortality inhatcheries have been associated with low quality facilities and poor incubation techniques(Chang, Martella, Navarro and Robles, 2001). Little is known about the factors thataffect the fertility and hatchability of quail eggs (Abatcha*et al*.,2009). However, it isreasonable to expect that many of the common factors known to influence incubationsuccess in eggs of commercial poultry may likely affect quail eggs hatchability (Gonzalez,Satterlee, Moharer, and Cadd,1999).

2.3 Potentialities and Opportunities of Quail Production in Nigeria

Ani and Adiegwu (2005) suggest that a solution to the problem of inadequate consumptionof animal by an average Nigerian is to increase the level of highly reproductive animals withshort generation intervals such as poultry, pigs and rabbits (Fielding, 1991; Serres, 1992;and Smith, 2001). Poultry is the quickest source of meat and its production involves theleast hazardous and arduous process in relation to other livestock enterprises (Obioha,1992). Poultry are able to adapt to most areas of the world, have a low economic value,rapid generation time and a high rate of productivity (Smith, 2001). The genus of poultrybeing studied is the Japanese quail (Coturnixcoturnix japonica) which was introducedinto Nigeria to expand the poultry sub-sector and help supplement the domestic chickenproduction through meat and eggs (Ani, Okeke and Emeh, 2009). Commercialization ofquail bird production is a recent development in Nigeria (Akpan and Nsa, 2009). Emphasishas been on domestic fowl production, whereas nutritive and economic benefits can bederived from quail production since the quail is fast growing and resistant to many diseasesthan domestic fowls (Oluyemi and Roberts, 2000). Japanese quails are hardy birds thatthrive in small cages and are inexpensive to produce. They require less floor space; about 8-10 adult quails can be reared in a space meant for one adult chicken (Haruna*et al*.,1997). They are said to have less feed requirement, according to Ani, Okeke and Emeh.,(2009) an adult quail requires only 20-25g feed per day compared to chicken (120-130g) per day.

Other unique characteristics and advantages of quails over other species of poultryinclude early attainment of sexual maturity, being able to come to lay as early as 5-6weeks of age, having short generation interval making it possible to have many generationsin a year (Robbins, 1981; Annon, 1991), attaining market weight of 150-180gbetween 5-6- weeks of age and a high rate of egg production between 180-250(Garwood and Diehl, 1987; Shwartz and Allen, 1981) and 200-300 eggs in their firstyear of lay (NRC, 1991). Reports by Haruna*et al*., (1997a) and Olubamiwa*et al*., (1999)show that quail meat and eggs are renowned for their high quality protein, high biologicalvalue and low caloric content, making it a choice product for hypertension prone individuals.According to Babangida and Ubosi (2005), the Japanese quail has the potential to serveas an excellent and affordable source of animal protein in Nigeria.

2.4 Overview of Quail Farming

Quail is one of the poultry birds. Chibe (2009) defined poultry as any of the domesticated and commercialized types of birds used for production of eggs and (or) meat for human food. According to the same author, poultry includes birds like chickens, turkeys, pigeons, doves, ducks, geese, upland game birds (quail, pheasant, and partridges) and ratites (ostriches, emu and rhea). Poultry are widely acknowledged as the livestock of the poor, providing a source of income and a tool for poverty alleviation. According to Food and Agriculture Organisation (2010), 85 % of rural households in sub- Saharan Africa keep chickens or other types of poultry.

Poultry form the most important sector of livestock worldwide and the production of poultry meat and eggs is a major contribution to human nutrition. A report by Food and Agriculture Organisation (2010), stated that in 2007, some 269 million tons of meat were produced globally, of which 88 million tons were poultry meat and represented about 33% of global meat production. According tothe same report, globally, chickens and turkeys and ducks are the most common sources of poultry eggs producing 87% and 6.7% and 4% of total poultry production, respectively. The others like geese, pigeons, quails, pheasants, ostriches and emus all combined produce about 2.3% of total egg production. These alternative bird eggs may represent a smaller proportion of total worldwide egg production, yet they continue to have importance in many countries with worldwide production increasing to 29.9% from

2000 to 2010, which is more than the 24.7% growth in egg production over the same time period (Arthur , 2013).

Quails are small game or hunting birds which are used for eggs and meat production (DAFF, 2013). MOLD (2012) states that in the wild, quails are migratory birds living in grassland and cultivated fields. The quail is the smallest and least sedentary of the game bird. It belongs to the same family as the domestic fowl, the pheasant and the peacock (Wilkinson, 1999). At first quails became popular as game birds but at later stage in 1910 the commercial keeping of quail kicked off because of their tasty meat, low feed consumption and excellent layering (Shanaway, 2008) . Quail is an ideal food as authenticated in the Holy Bible and theHoly Koran and has no religious taboos. Quail farming involves raising quails commercially for the purpose of profitable eggs and meat production. There are 18 species of quails suitable for profitable quail farming business. Quail breeds are of two types; broilers (meat production) and layers (egg production). Popular layer quail breeds include; Tuxedo, Pharaoh, British Range, English White and Manchurian Golden. Popular broiler quail breeds include; Bobwhite (American) and White Breasted (Indian)(McNaughton and Haymes, 1978).

According to OnyewuchiOffor, and Okoli (2013), quail farming is more profitable than other poultry. Quails has various benefits such as: quail birds mature earlier; they start laying eggs after 5 - 6 weeks; they lay a greater number of eggs 280-300 in a year; their eggs takes about 16 to 18 days to hatch; they have high immunity against diseases; they are poor feeders and they require small floor space. Their meat is low in fat and the eggs are perceived to have nutritional and medicinal value (MOLD, 2012). Quails produce 220 to 250 grams of meat from 7 to 7½ weeks and they are also used in animal research and hunting in many countries (View West Marketing; Zeetnoff Agro-EnvironmentalConsulting, 2002). Meat and eggs of quail are very tasty, delicious and nutritious and are source of high quality protein (Bakoji*et al.*, 2013). Quails are very hardy and almost all types of weather conditions are suitable for starting quail farming business (NRC, 1991).

Quailfarming has been widely acknowledged as a great agro-business (Heft*et al.*, 2008). In the USA, commercial quail production is concentrated on a few large farms and the game bird industry in the USA raises 37 million quails (USDA, 2011). In Europe, common quail is very abundant and widespread (Rodriquez *et al.*, 2012) and the estimated population is 300,000,000 birds. According to a report by Arthur (2013), in North America, duck and quail eggs and egg products are not traditional nor common foods and typically they are found only in metropolitan areas like British Columbia which boast ethnic and immigrant populations from areas of the world that have traditionally used these eggs in their cuisines who represent a strong market opportunity. The same report indicates that there is little production of fresh quail eggs and duck eggs in British Columbia but on commercial basis, the market for salted and preserved duck eggs as well as processed quail eggs (typically pickled, canned, or smoked) is served by and dominated by imported products from Asia. The report concludes that very little is known about the market for these products. Scant y scholarly or agricultural extension research has been conducted on the consumer market for salted and preserved duck eggs and fresh or processed quail eggs in British Columbia.

Dozier*et al.*, (2010) reported that in Georgia, approximately 5 million Bobwhite quail are produced and marketed each year for use at hunting preserves and

Plantations. According to the same report, the total number of hunting preserves and plantations in the southern region provides an excellent market for Bobwhite quail producers. With recent droughts, volatile market prices and other problems associated with agronomic crops in Georgia, Bobwhite quail production has received attention as an alternative enterprise for many farming operations.

In Japan, the poultry meats and eggs available in pockets in the market are not adequate to meet the increasing demand of the people and poultry eggs are imported from the neighbouring states. Commercial quail farming in Japan has spread tremendously. In a study done in Japan on quail meat and eggs availability by Singh (2005), the study indicated that the present scale of quail industry is far below the potential . According to the same report though quail farming has reached the international markets, the awareness of it is yet to be spread to some states in Japan and the report recommends that there is a need to promote quail production programme in these regions. The report concludes that promotion of quail farming in the rural area will not only supplement the shortages of animal proteins but will also generate supplemental income for improvement of the rural people socio-economic status.

According to prefeasibility study on quail farming in Pakistan, quails have been introduced to the Pakistan in the last ten years as an alternative of chicken to mitigate chronic protein deficiency among the Pakistani population (Government of Pakistan, 2009). According to the Agriculture Statistics of Pakistan the per capita consumption of quail meat is increasing at a rate of 4% per annum. The existing daily availability of protein quantity per capita in Pakistan deriving from animal source including beef, mutton, poultry and fish combined amounts to 11 grams per person per day. This is far less than the recommended daily dietary protein allowance from animal source of

26 grams per person per day according to the Food and agriculture Organization standards. The same report states that in Pakistan quail meat is the cheapest source of animal protein available in the country. There are about 3,000 quail farms in Pakistan and a total of 50,000 to 100,000 birds are consumed daily in Pakistan as cutlets, fingers, noodles, soup powder and egg puff.

Quail production is gaining popularity in the developing countries due to its role in bridging the protein malnutrition, economic empowerment of the resource poor segment of the society and also fits well in the farming systems commonly practiced. Quail production is practiced at levels ranging from subsistence to large scale commercial operations (Kingori, 2011).

In Nigeria, more emphasis is laid on domestic fowl to the neglect of other types of poultry. Of the 150 million poultry population, domestic fowl constituted 91% while guinea fowl, duck, turkey and others were 4%, 3% and 2% respectively. The most commonly used bird eggs are those from chickens. Duck and goose eggs, and smaller eggs such as quail eggs are occasionally used as gourmet ingredients (Adeyeye, 2012). Bakoji*et al*.,(2013), a large number of poultry farmers in Kaduna, Zaria, Bauchi and Kano states in North Nigeria have embraced quail farming, which is gradually taking over chicken poultry business in most parts of the north. Quails high return rate, low cost of investment, high nutritional value and market value are some of the reasons many poultry farmers are resorting to quail farming (Obiona, 1992). A study done in Nigeria by Onyewuchi, Offor, and Okoli (2013) with the objective to determining the profitability of quail bird and egg production in Imo State found out that quail meat and egg production is a profitable business. However, due to the lack of awareness amongst farmers in the study area, its production is still very low. It is therefore recommended that extension agents should reach out to farmers in Imo State and enlighten them on quail bird production to help alleviate povertyamongst farmers in Imo State and enable them to enjoy the health benefits associated with its consumption.

2.5 Concept of Efficiency

The decline in output of quail production over the years may not only be connected with deviations of farmer's practices from technical recommendations, but also with the use of resources at sub-optimal levels which ultimately leads to technical and allocative inefficiency (Coelli and Battese, 1998). An underling premise behind much of research in efficiency is that farmers are not making efficient use of existing technology, then efforts designed to improve efficiency would be more cost-effective than introducing new technologies as a means of increasing agricultural output (Belbase and Grabowski, 1985: Huynh, 2008: Adeleke. 2008). Production efficiency has two components: technical and allocative efficiency. Technical efficiency is the extent to which the maximum possible output is achieved from a given combination of inputs or the ability of a firm to obtain maximum output from a given set of input. Allocative efficiency is the ability of a firm to use inputs in optimal proportions given their respective prices and production technology (Coelli*et al.*, 1998). Technical inefficiency occurs when the level of production for the firm is less than the frontier output and it increases when timing and methods of application of production inputs are mismanaged. Allocative inefficiency increases when the ratio of marginal products of input is not the same to the ratio of market prices (Bashkh, 2007). Another definition exits which looks at relative technical efficiency. A producer is fully efficient on the basis of available evidence if and only if the performance of other producers does not show that some inputs or outputs can be improved without worsening some of its other inputs or outputs. With this definition, there is no need for recourse to prices and other assumptions of weights which are supposed to reflect the relative importance of the different inputs and outputs (Adeleke. 2008). The measurement of technical efficiency is important. According to Alvarez and Arias (2004), technical efficiency reduces production costs and makes a firm more competitive.

The allocative efficiency index measures a production unit's ability to choose the input combination that minimizes cost given the best available technology. It is the ratio between the minimum costs if it were technically efficient. Because allocative efficiency implies substituting or intensifying the use of certain inputs based on their prices, inefficiencies may stem from unobserved prices, from incorrectly perceived price or from lack of accurate and timely information (Bashkh, 2007).

Efficiency measurements involve a comparison of actual performance with optimal performance located on relevant frontier. Since the true frontier is unknown, an empirical approximation is required. The approximation is normally called a "best practice" frontier. Approximation of the best practice frontier can be done using parametric or non-parametric techniques. Both techniques put emphasis on optimizing behaviour subject to constraints.

Data Envelopment Analysis (DEA) is a Non-parametric technique. It builds a linear piece-wise function from empirical observations of inputs and outputs, without assuming any a priori functional relationship between the inputs and outputs.Efficiency measures are then calculated relative to this surface. Testing of hypothesis is not possible and this method does not suffer multicollinearity and heteroscedasticity. The Stochastic Frontier Approach (SFA), also referred to as the econometric frontier approach, specifies a functional form for the cost, profit, or production relationship among inputs, outputs, and environmental factors, and it allows for random errors.

Parametric methods are susceptible to misspecification errors. The advantage is that it becomes possible to test hypotheses.

Variation in output by different producers, caused by technical inefficiencies can be captured through specification of production function. Technical efficiencies can be estimated using Stochastic Frontier Approach (SFA) or Data Envelopment Analysis (DEA), which is non-parametric approach. DEA assumes that there are no random effects in production. The current study therefore employed the stochastic production frontier approach because most farmers operate under uncertain condition (Abedullah and Ahmad, 2006). Review of literature revealed that Cobb-Douglas and Translog production function are the widely used forms in agriculture. However, Translog production function specification suffers from multicollinearity problem as a result of the square and interaction terms of the inputs used (Hussain*et al.*, 2012). The estimated Cobb-Douglas production function, specified as:

$$Yi = (xi\,\beta) + vi – ui \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Where:

$Y_i$is the output;

$X_i$is a vector of inputs quantities used in production;

β is a vector of parameters of the production function. The frontier production function {f ($x_{i,}$ β)} measures the maximum potential output from a vector of inputs. The error component $v_i$andu_i causes deviations from the frontier.

$v_i$is the systematic error component which captures random deviations from the frontier, caused by factors beyond the farmers' control such as temperature and natural hazards. It is assumed to be independently and identically distributed with a mean of zero and constant variance –N (0, σ_v^2) and independent of $u_{i.}$

$u_i$is a non-negative error component that captures deviations from the frontier caused by controllable factors. It represents the inefficiencies in production. It is assumed to be half normal, identically and independently distributed with a mean of zero and constant variance –N (0, σ_v^2).

Cobb-Douglas functional form is used in this study because the coefficient estimated directly represents elasticity of production (Abedullah and Ahmad, 2006). Cobb-Douglas production function is adequate in the representation of the production process since we are only interested in the efficiency measurement, and not production structure (Taylor and Shonkwiler, 1986). Furthermore, Cobb-Douglas production function has been widely applied in estimating farm efficiencies (Ahmad *et al.,* 1999; Abedullah and Ahmad, 2006; Ogundari and Ojo, 2007; Abedullah and Mushtaq, 2007; Oladeebo and Fajuyigbe, 2007; Narala and Zala, 2012; Hussain*et al.,* 2012). The empirical result showed that the estimated farm level of technical efficiency ranged from 47.0% to 97.1% while majority of the farmers (90%) had technical efficiency exceeding 0.71. the study also found fingerling, labour and pond size being efficiently allocated while gender, household size and education were found to be negatively related to technical efficiency; and experience and age were found to be positively related to technical efficiency.

2.6 Stochastic Frontier Analysis

The stochastic frontier production function is a method of economic modeling. It has its starting point in the stochastic production frontier models simultaneously introduced by Ogundari (2006), Rahman and Umar (2009), Thomas (1990), Emokaro and Ekunwe (2009) and others which derived from the error model of Aigner*et al*. (1968) and Meeusen and Van den Broeek (1977). The stochastic frontier production function is specified as:

$$Yi=f(xi.\beta)+e_i \quad \ldots\ldots(2)$$

$$e_i=V_i-U_i \quad \ldots\ldots(3)$$

Where:

Y_i =outputof the i^{th} farm

x_i= vector of the inputs used by the i^{th} farm

β = a vector of the parameters to be estimated

e_i = composed error term

v_i= random error outside farmer's control

u_i =technical inefficiency effects

f (x_i, β) = a suitable function of the vector

This according to Ogundari (2006), it has been used by many empirical studies, particularly those relating to agriculture in developing countries and also that the functional form meets the requirement of being self-dual (allowing an examination of economic efficiency):

$$\ln Y = \beta o + \beta_1 \ln X_1 i + \beta_2 \ln X_2 i + \beta_3 \ln X_3 i + \beta_4 \ln X_4 i + \beta_5 \ln X_5 i + (Vi\text{-}Ui) \ldots\ldots\ldots (4)$$

Where,

ln = the natural logarithm

Y = output of Quail (kg)

βo = constant term

β_1- β_3 = regression coefficients

X_1 = quantity of chicks (kg)

X_2 =quantity of feed (kg)

X_3 = total labour used (man days)

X_4 =capital (₦)

X_5 = Drug (mg)

Vi = random variability in the production that cannot be influenced by the farmer.

U_i = deviation from maximum potential output attributable to technically inefficiency.

The inefficiency of production, U_i was modelled in terms of the factors that are assumed to affect the efficiency of production of farmers. Such factors are related to the socio-economic and management variables of the farmers. The determinant of technical inefficiency is defined by:

$U_i = \delta_0 + \delta_1 1nZ_1 + \delta_2 lnZ_2 + \delta_3 lnZ_3 + \delta_4 lnZ_4 + \delta_5 lnZ_5 + \delta_6 lnZ_6$.................................. (5)

Where:

U_i = inefficiency effects

Z_1 = Age of farmer (years)

Z_2 = Household size (number)

Z_3= Education (years)

Z_4 = Amount of credit (amount of credit obtained)

Z_5 = Access to extension services (number of times have contact)

Z_6 = farming experience (years)

δ_0 = constant

δ_1-δ_6 = Parameters to be estimated.

These variables are assumed to influence technical efficiency of the catfish farmers. The gamma ($\gamma = \sigma^2\ \mu / (\sigma 2\ \mu + \sigma\ \nu)$ which is the ratio of the variance of U $\sigma^2\ \mu$ to the sigma squared ($\sigma^{2)}$ which is a summation of variances u and v of U and V ($\sigma^2 = \sigma^2\ \mu + \sigma^2\ \nu$) were also determined.

On the other hand, u_i is a non-negative truncated half normal random variable associated with farm- specific factors which lead to the ith farm not attaining maximum efficiency of production. U_i is associated with technical inefficiency of the farm and ranges between zero and one. $U_i$follows an independent and identical half-normal distributed N $(0.\delta^2 u)$. N represents the number of the farms involved in the cross-sectional survey. According to Bakhsh (2007), stochastic frontier production function model is estimated using the maximum likelihood estimation procedure (MLE).The stochastic frontier cost function is defined by:

C = F (Wi, Yi; α) expei,i = 1,2 ….n ---(6)

Where,

C = Represents the minimum cost associated with quail production

W= Vector of input prices

Y = (output of Quail and Egg)

α = Vector of parameters

ei = Composite error term

Using Sheppard's Lemma we obtain

$$\frac{\partial C}{\partial P_i} = X_i(W, Y; \alpha) \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots.\dots\dots\dots\dots\dots.\,.\dots \quad (7)$$

This is a system of minimum cost input demand equations (Bravo –Ureta and Evenson, 1994; Xuand Jeffrey, 1995 and Bravo-Ureta and Pinheiro, 1997). Substituting a farm's input prices and quantity ofoutput in equation (6) yields the economically efficient input vector Xc.. With observed levels of outputgiven, the corresponding technically and economically efficient costs of production will be equal to X_{it} Pand X_{ie}, respectively. While the actual operating input combination of the farm is Xi P. The three costmeasures can then be used to compute the technical (TE) and economic efficiency (EE) indices as follows;

$TE = (X_{it}. P) / (X_i.P)$ ---(8)

$EE = (X_{ie}.P) / (X_i.P)$ -- (9)

The combinations of equations (7) and (8) is used to obtain the allocative efficiency (AE) index followingFarell (1957)

$AE = EE / TE = (Xie.P) / (Xi. P)$ -- (10)

The efficient production is represented by an index value of 1.0 while the lower values indicate agreater degree of inefficiency. Using the method by Bravo-Ureta and Pinheiro (1997) which was based onthe work of Jondrow*et al* (1982), efficiency can then be measured using the adjusted output as shown inequation (10)

$Y^* = f(Xi;\beta) - u$ … .. (11)

Where U can be estimated as

E (ui / ε i) = <u>б λ</u>   <u>f* (εiλ/ б) –Σiλ</u>
1 + λ²   1 – f* (εiλ)……………………………………….(12)

Where

f* (.) and f* (.) are normal density and cumulative distribution functions respectively,

$\lambda = б u / б v$

$\varepsilon = Vi - Ui$ and

Y* is the observed output adjusted for statistical noise

When εi, σ and λ estimates, are replaced in equations (11) and (12), it will provide estimates for U and V. Theterm V is a symmetric error, which accounts for random variations in output due to factors beyond thecontrol of the farmer e.g. weather, disease outbreaks, measurements errors, etc. The term U are non negative random variables representing inefficiency in production relative to the stochastic frontier. The randomerror Vi is assumed to be independently and identically distributed as N(o, δv^2) random variablesindependent of the Uis which are assumed to be non negative truncation of the N(o, δu^2) distribution (i.e.half-normal distribution) or have exponential distribution.

2.7 Empirical Studies Utilizing the Stochastic Frontier Approach.

The farm households are both involve in the consumption and production activities, this dual economic characters of the household has implication for economic analysis that can be made on it. According to Elli (2000), the strict definition of economic efficiency requires a competitive market, since neither the individual production unit nor the sector can attain efficiency if some economic agents can influence the prices and return of other economics agents. The concept of efficiency measurement begins with Farrel (1957) who define a sample measure of firm efficiency which could account for multiple inputs. Farrel (1957) proposed that efficiency measurement of a firm consist of two component, technical efficiency (TE) and allocative efficiency (AE) which reflects the ability of a firm to use the inputs in optimal proportion given their respective price.

According to Aigner*et al.* (1977), Battese and Coelli (1977) and Meeusen and VandenBroeck (1977) is motivated by the idea that derivation from the production frontier may be entirely under the control of the farmer. The model allows for technical inefficiency and that random shock outside the control of the farmer can affect output.

The main feature of stochastic frontier model is that the disturbance term is composed of two parts, the symmetric component v_i capture the random of error outside the control of the farmer while the one-side (non negative) component u_i with $u_i \geq 0$ capture the random of human error or technical inefficiency relative to the stochastic frontier. This randomness is under the control of a farmer. Its distribution is assumed to be half normal or exponential. The v_i assumed to be independently and identical distribution random variable, independent of u is and v is assumed to be independently and identically distributed as exponential (Meeusen and Van den Broeck, 1977).

Stochastic frontier approach has found wide acceptable within the agricultural economics literature because of their consistency with theory, versatility and relative ease of estimation. The measurement of efficiency (technical, allocative and economic) has remained an area of important research both in the developing and developed countries, where resources are not sufficient and opportunities for developing and adopting better technologies are dwindling.

Efficiency measures are important because it is a factor for productivity growth. Such studies benefit these economies by determining the extent to which it is possible to raise productivity by improving the neglected sources of growth i.e. efficiency, with the existing resources base and availability of technology.

Olayide and Heady (1982), refers agricultural productivity as the index of the ratio of the value of total farm output to the value of the total inputs used in the farm production, to them increase in agricultural productivity will contribute to the well being of the economy as a whole. According to Adubi (1998), resources efficiency lies in the motive of profit maximization and serves as an ideal framework against which various forms of efficiencies of production can be adequately measured and tested.

$$r = \frac{Marginal\ value\ productivity}{Marginal\ factor\ cost} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (13)$$

The marginal value productivities (mvp_s) for each hectare will be derived and then compared with their respective factor cost at the various production levels. Olukosi and Ogungbile, (1989) observed that marginal value product is the change in total value of product (TVP) as a result of a unit change in the variable input. It is express as follows:

$$MVP = mpp.py \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (14)$$

Where:

mvp = marginal value product

mpp = marginal physical product

py = product price

Tvp= total value product

x= variable input

MFC = Marginal Factor Cost

The marginal factor cost is the addition to the total cost resulting from using an extra unit of input. This is expressed as:

$$MFC = \frac{\Delta TC}{\Delta XI} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (15)$$

Where:

ΔTC=change in total cost

ΔXI= change in variable input

But when input is purchased in the perfectly competitive market, the price of successive unit remains the same. In this case, marginal factor cost is expressed as:

$$MFC=PX_1 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.(16)$$

Where,

$PX_{1=}$is the price paid for the unit of an input.

According to Bamidele*et al*. (2010), efficiencies include technical and allocative efficiencies, he isolate allocative efficiencies into absolute and relative efficiency and affirmed that these can be analysed in the production function framework. Efficiency has the capacity to produce desired results with a minimum expenditure of time, money, energy or material (National Academy of Science USA, 1975).

2.8 Problems of Efficiency Measurement

Farrell's definitions as elegant as they are cannot be measured easily as precise measurement rests on the assumption of an efficient isoquant. Efficiency measures as the average productivity of the say land, labour, capital, water and so forth can only be a meaningful index of technical efficiency if any one of the resources is limiting in the production process (Olayinde and Heady, 1982).

The index of efficiency measured as the weighted average of all inputs compared with the output has index number problems and is consequently not a reliable measure of technical efficiency. In addition the use of cost comparisons in the production process as an index of technical efficiency has restricted application where all farm or plants do not face same factor price (Olayinde and Heady, 1982).

Olayinde and Heady (1982) asserted that the theory of the concept of technical efficiency based on the assumption that all farm firms have an identical production function, that is identical technology, identical fixed factor endowment and therefore, a short run concept of efficiency seem to have a less significant impact in the area of production measures than improvement in technical efficiency.

Maximum efficiency is guaranteed if single products are produced under conditions of decreasing returns (or increasing costs) and if commodities produced in combination are never produced within the range of complementary relationships (Han, 2004).

Measurement of efficiency started with Farrell (1957) who, following Debreu (1951), proposed a division of efficiency, which represents a firm's ability to produce a maximum level of output from a given level of inputs, and allocative efficiency, which is the ability of a firm to use inputs in optimal proportions given their respective prices and available technology. Technical efficiency is the extent to which the maximum possible output is achieved from a given combination of inputs or the ability of a firm to obtain maximal output from a given set of inputs. Allocative efficiency is the ability of a firm to use inputs in optimal proportions, given their respective prices and production technology. The combination of these two measures yields the level of economic efficiency.

There are several approaches to analysing the determinants of technical efficiency from stochastic production frontier function. One is a two-step procedure in which the frontier production function is first estimated to determine technical efficiency indicators while the indicators thus obtained are regressed against a set of explanatory variables that are usually firm specific characteristics. While this approach is very simple to handle, the major drawback is that it violates the assumption of the error term. In the stochastic frontier model, the error term is assumed to be identically independently distributed (Jondrow*et al.*, 1982). In the second step the technical efficiency indicators obtained are assumed to depend on a certain number of factors specific to the firms which implies that the inefficiency effects are not identically distributed. This major drawback led to the development of a more consistent approach that modelled efficiency effects as an explicit function of certain factors specific to the firm, and all the parameters are estimated in one step using maximum likelihood procedure.

2.9 Farm Profitability Analysis

Cost- return analysis is usually form the basis for farm profitability analysis, it involves itemizing the cost and returns of production and use them to arrive at such estimates as the return to one unit of the resources used, the gross margin, as well as the gross and net returns. The farm income is the total output multiply by the price per unit cost. Therefore, farm income is the total revenue generated from the production while net farm income is the difference between the total revenue and total cost. The total cost of production includes both total variable cost and total fixed cost. Total variable cost includes; cost of seed, cost of fertilizer, cost of labour, and cost of agrochemical while total fixed cost include cost of land. The formula for net farm income is stated as follows.

$$NFI = TR - TC \text{ -- } (17)$$

Where

NFI= net farm income (Naira)

TR= total revenue (Naira)

TC= total cost of production (Naira)

TC= TVC+TFC

Total Cost (TC) = Total Variable Cost (TVC) + Total Fixed Cost (TFC)

In some cases, these values are subjected to tests of statistical significance to verify differences between them. Gomez (1975), develop a farm level model to evaluate alternative cropping mixtures and pattern, these include: (i) Profitability, measured as the difference between value of yield and cost of production, and (ii) The net return is defined as the difference between values of yield and as input cost including hired labour. Gomez (1975) said that, cost return analysis is a useful tool in enterprise comparison and in indicating a profitable pattern of aggregate inputs use.

According to Werner (1993), the use of: (i) The gross margin and returns to variable cost where only capital is affected, (ii) Yield/labour ratio where only labour is affected and (iii) Gross margin return to variable costs and monetary return to labour where capital and labour are affected. The Problems associated with cost-return analysis as basis for profitability assessment are: (i) It does not indicate the relative importance of each of the resources in production and (ii) It is location bound and specific in application due to use of money as the common unit of measurement and the prevailing price for estimation.

Olukosi and Erhabor (1988), describe gross margin as a very useful planning tool in situation where fixed cost is a negligible portion of the farming enterprise as in the case of subsistence agriculture. It is easily computed and represents the most relevant economic indicator to draw the attention of the farmer to his farm problems and provide useful solutions.

This method was used by Olagoke (1991) in Anambra state, Osifo and Antonio (1970) in western Nigeria and Nweke and Winch (1980) in Southern – Eastern Nigeria.

The major problems associated with cost-return analysis as basis for profitability assessment are: (i) It does not indicate the relative importance of each of the resources in production and (ii) It is location bound and specific in applicability due to use of money as the common unit of measurement and the prevailing price for estimates.Gomez (1975).Said that in spite of the limitations. Cost-return analysis is a useful tool of enterprise comparison and indicating a profitability pattern of aggregate input use.

CHAPTER THREE

METHODOLOGY

3.1 The Study Area

The study was conducted in six district of Kaduna Metropolis, Kaduna State. It has a land area of about 45, 567 square meters made up of undulating plateau and hills. Kaduna state is one of the thirty-six state in Nigeria, geographically, the state lies close to the center of Northern Nigeria. It is bordered by the Federal Capital Territory to the south, Katsina, Kano, and Sokoto to the North, Plateau State to the east and Niger State to the west. It lies between latitudes 9° and 12° North and longitudes 6° and 9° East.The State shares boundaries with Katsina and Kano State to the north. Plateau to the north east, Nasarawa and Abuja to the south and Niger and Zamfara State to the west (Kaduna State government, 2012). The State occupies an area of approximately 68,000 square kilometersor 7% of Nigeria's land mass. The State has 23 Local Government Areas (NPC,2006).

The State has a total land area of about 4.5 million hectares, with an estimated total arable land of about 2.02 million ha comprising 1.94 million ha upland and 0.08 million ha lowland. The mean annual rainfall shows a marked decrease from South to North(1,524mm to 635mm). Two distinct seasons, rainy and dry witnessed in the state. The relative humidity is constantly below 40 degrees except in few wet months when it goes up to an average of 60 degrees. The duration of dry season is 5-7 months which normally starts from October. Agriculture constitutes the largest occupation of the people with many citizens participating in small scale farming. The state is a major region of animal husbandry. Livestock production is also practiced in the state. Rearing of goats, sheep, cattle and different classes of poultry as well as marketing of their products is practiced in the state. The people of the state live mostly in organized towns and cities . A large variety of non-agricultural occupations also exit.

The total population of the State is 6.11 million (NPC, 2006). With an annual population growth rate of 3.2%, the projected population of the state is about 7,865,409 million people in 2015.

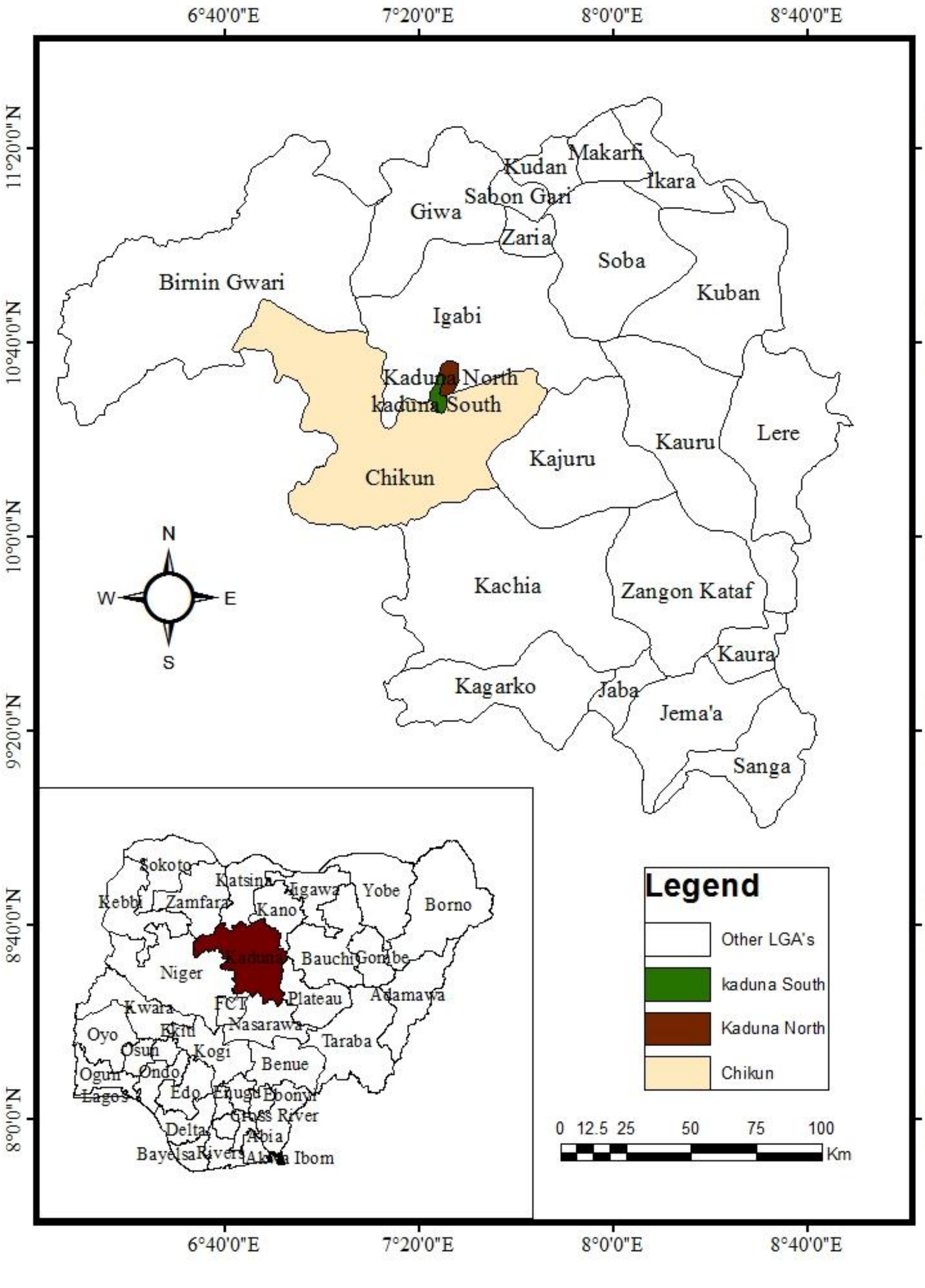

Figure 3.1: Map of Kaduna State Showing the Study Area (Kaduna Metropolis)

3.2 Sampling Technique and Sample size

A combination of purposive and random sampling technique was used to select respondents for this study. Purposive sampling was used for the selection of 6 districts, based on their concentration and intensity of quail production. A simple random sampling was employed in selecting farmers from each of the local zone through lottery method to select the respondents for this study. Fifty % (50%) of the sample frame (244) was used as the sample size. In all, 122 farmers were randomly selected using balloting technique.

Table 3.1: population and sample size of farmers

Districts	***Sample frame**	**Sample size (50%)**
Kakuri	62	31
Nasarawa	54	27
UngwanRimi	42	21
Malali	40	20
Malali high cost	26	13
UngwanSarki	20	10
Total	**244**	**122**

* Source: reconnaissance survey, 2014

3.3 Data collection

Primary data was used for this study. A structured questionnaire was used to collect the data used. The information was collected on (a) farmer's socio-economic characteristics such as age, household size, educational status, amount of credit received, numbers of extension contact, years spent in cooperative membership,and income and access to market, (b)Constraints faced by the farmers. (c) farmer's food consumption and expenditure and (d) The output data include the total value of quail produced including the quantity consumed at home and given out as gifts while the input data include cost per size of the cage (₦), chicks (kg), medication cost (mg/₦), labour wage (man-days), quantity of feeds (kg), and cost of other simple farm tools such as feeders and other simple farm implements.

3.4 Analytical Techniques

The tools of analysis used include: Descriptive statistics, Net farm income and stochastic production function

3.4.1 Descriptive statistics.

Descriptive statistics was used to achieve objective (i) and (iv) of the study. The descriptive tools employed are mean, frequency distribution and %ages to describe the socio-economic characteristics of quail farmers in the study area, i.e. objective (i), and the constraint confronting the quail production, objective (iv).

3.4.2 Net farm income

The Net Farm Income (NFI) was employed to achieve objective two (ii). It was used to estimate the cost and return of quail production. The formula for net farm income is stated as follows.

$$NFI = TR - TC \quad \ldots\ldots (18)$$

Where

NFI= Net farm income

TR= Total revenue (income realized from the sale of birds and eggs)

TC= Total cost of production

$$TC = TVC + TFC \quad \ldots\ldots (19)$$

The fixed inputs (feeding trough, brooding house, cage) are not normally used up in a production cycle. They were depreciated using the straight line method given by

$$D = \frac{(P - S)}{N} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots. (20)$$

Where:

D = depreciation (₦)

P = Purchase value (₦)

S = Salvage value (₦)

N = life span of asset (years)

Return per naira invested (RNI) is obtained by dividing the gross income (GI) over the total cost (TC). Therefore,

$$RNI = \frac{(GI)}{TC} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.. (21)$$

Where,

RNI = Return per naira invested

GI = Gross income

TC = Total cost

Decision Rule

RNI $>$ 1, It implies there is profit in production.

RNI =1, the farmers is at breakeven

RNI$<$ 1,the farmer is at loss

3.4.3 Stochastic production frontier analysis for quail production.

The stochastic production function was used to achieve objective iii. The stochastic production function is written as:

$$Yi=f(xi.\beta)+e_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (22)$$

$$e_i=V_i-U_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (23)$$

where:

Y_i = Output of Quail of the i^{th} farm

X_i = Vector of the inputs used by the i^{th} farm

β = A vector of the parameters to be estimated

e_i = Composed error term

v_i= Random error outside farmer's control

u_i = Technical inefficiency effects

$$\ln Y = \beta o + \beta_1 \ln X_1 i + \beta_2 \ln X_2 i + \beta_3 \ln X_3 i + \beta_4 \ln X_4 i + (Vi-Ui) \ldots\ldots\ldots (24)$$

Where,

ln = The natural logarithm

Y = Output of quail (kg)

βo = Constant term

β_1- β_3 = Regression coefficients

X_1 = Quantity of chicks (kg)

X_2 = Quantity of feed (kg)

X_3 = Total labour used (man days)

X_4 = Drugs (mg)

Vi = Random variability in the production that cannot be influenced by the farmer.

U_i = Deviation from maximum potential output attributable to technically inefficiency.

$$U_i = \delta_0 + \delta_1 1nZ_1 + \delta_2 lnZ_2 + \delta_3 lnZ_3 + \delta_4 lnZ_4 + \delta_5 lnZ_5 + \delta_6 lnZ_6 \text{.................................}(25)$$

Where

U_i = Inefficiency effects

Z_1 = Age of farmer (years)

Z_2 = Household size (number)

Z_3 = Formal education (years)

Z_4 = Amount of credit (amount of credit obtained)

Z_5 = Access to extension services (number of times have contact)

Z_6 = Numbers of years spent on cooperative society (years)

δ_0 = Constant

δ_1-δ_6 = Parameters to be estimated.

$C = F(W_i, Y_i; \alpha)$ expei i = 1,2 ….n ---(26)

Where,

C = Represents the minimum cost associated with quail production

W= Vector of input prices

Y = Quail output

α = Vector of parameters

ei = Composite error term

$\ln C = \beta_0 + \beta_1 \ln X_1 i + \beta_2 \ln X_2 i + \beta_3 \ln X_3 i + \beta_4 \ln X_4 i + (Vi + Ui)$……………(27)

Where,

ln = The natural logarithm

C = Total cost of output (₦)

X_1 = Cost of chicks (₦)

X_2 = Cost of feed (₦)

X_3 = Cost of labour (₦)

X_4 = Cost of drug (₦)

β_0 = Constant term

β_1- β_3 = Regression coefficients

Vi = Random variability in the production that cannot be influenced by the farmer.

U_i = Deviation from maximum potential output attributable to technically inefficiency.

3.5 Variable Definition and Measurement

Nine explanatory variables measured as continuous and discrete variables was hypothesized for determinants of quail production and its profitability.

(i) Age (Z_1): This refers to the number of years of an individual attained from birth. It is a continuous variable and was measured in years. Hofferth (2003) argues that the higher the age of the household head, the more stable the economy of the farm household, because older people have also relatively richer experiences of the social and physical environments as well as greater experience of farming activities. More also, older household heads are expected to have better access to land than younger heads, because younger men either wait for a land distribution, or have to share land with their families. The estimated coefficient of age is expected to have negative sign on the technical inefficiency.

(ii) Household size (Z_2): This means the total number of people in the household which includes the wives, children and dependents that reside within the same house and eat from the pot. This will provide appreciable number of family labour supply to accomplish various farm operations.It will be measured in numbers. The estimated coefficient of household size will be expected to have negative sign on the technical inefficiency.

(iii) Educational status (Z_3): This refers to the acquisition of knowledge through formal schooling. This was measured by the level of formal education. The estimated coefficient of education is expected to have negative sign on the technical inefficiency

(iv) Amount of credit received (Z_4): This refers to amount of credit received from both formal and informal sources of credit. It is needed to acquire or develop quail enterprise; its availability could determine the extent of production capacity and also have prospect in improving the productivity of farmers and contributing to uplifting the livelihoods of disadvantaged rural quail farming communities. It was measured as the actual money/credit borrowed. The estimated coefficient of credit obtained is expected to have negative sign on the technical inefficiency.

(v) Numbers of extension contact (Z_5): This refers to the number of contacts between extension agent and the respondents in the production cycle. It was measured in numbers. The estimated coefficient of extension services is expected to have negative sign on the technical inefficiency.

(vi)Years spent on Cooperative (Z_6): This variable was used to measure the number of years the respondent registered in the cooperative(s). It was measured in years. The estimated coefficient of cooperative membership is expected to have negative sign on the technical inefficiency.

(vii) Quantity of chicks (X_1) : It is included in the model to examine thenumber of chicks the respondent used in productioncycle and it was measured in number. The estimated coefficient of chicks is expected to have positive effect on quail output

(viii)Quantity of feed (X_2): It is included in the model to examine the quantity of feed the respondent used in production will affect output and it was measured in kilogram (kg). The estimated coefficient of feed is expected to have positive effect on quail output

(ix) Labour(X_3): This consist of family and hired labour, it is included in the model to examine how variability in labour used affect output. Following Norman (1972), children age 7-14years are accorded 0.5 of adult male equivalent, female adult of 15-46 years are accorded 0.75 and male adults of 15-64years are accorded 1.00. Labour was measured in man-day. The estimated coefficient of labour is expected to have positive effect on quail output

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Socioeconomic Characteristics of Quail Farmers

4.1.1 Age distribution of quail farmers

The result presented in Table 4.1 shows that about 34% of quail farmers were within the age range of 30-39 years.The mean age of the respondents was 40 years. Consequently, the quail farmers are generally in their economically active years indicating their high degree of prospect to be more receptive to new ideas and innovations. This agrees with the assertion that young people tend to withstand stress, put more time in various agricultural operations and participate in programmes which can result to increased output (Adeola, 2010). Adamu*et al*. (2013) noted that youngfarmers are capable of managing risks associated with new idea or practice than older people who are less active.Ekwenta (2004) asserted that young farmers are more enthusiastic and more inclined to adopting innovation than elderly farmers. He stressed that the elderly people are lukewarm in adopting new practices for the fear of their security or prestige.

Table 4.1: Age distribution of quail farmers

Age (years)	Frequency	%age
20-29	31	25.4
30-39	41	33.6
40-49	17	13.9
50-59	20	16.4
60-69	13	10.0
Total	**122**	**100**
Min	**20**	
Max	**69**	
Mean	**40**	
S.E	**1.38**	

4.1.2 Educational level of quail farmers

The result in Table 4.2revealed that about 59% of quail farmers had no formal education, 9% of the respondent had only primary education, and 18% had secondary education while about 14% had tertiary education. However, more than half of quail farmers are not literate. This implies that the educational level of the quail farmer in the study area is low. The level of farmers' education is believed to influence the use of improved technology in agriculture and, hence, farm productivity. The level of education determines the level of opportunities available to improve livelihood strategies, enhance food security, and reduce the level of poverty. It affects the level of exposure to new ideas and managerial capacity in production and the perception of the household members on how to adopt and integrate innovations into the household's survival strategies.Ojuekaiye (2001) posited that education is an important socio-economic factor that influences farmer's decision because of its influence on farmer's awareness, perception, reception and the adoption of innovation that can bring about increase in production or reduced production.Education is a dynamic instrument for enhancing women's participation in agricultural production (Ekong, 2003). There is a positive correlation between level of education and efficiency, effectiveness and ability to think about a problem and managerial capacity (Awoyemi, 2000). Farmer's level of education is expected to influence farmers' adoption of agricultural innovations and decision on various aspects of farming.

Table 4.2: Distribution of quail farmers according to their level of education

Education (years)	**Frequency**	**%age**
No formal education	72	59.0
Primary education	11	9.0
Secondary education	22	18.0
Tertiary education	17	14.0
Total	122	100

4.1.3 Household size of quailfarmers

The result presented in Table 4.3 shows the distribution ofquail farmers by household size. Majority of the farmers 52.2% had household size that ranged from 1-10 persons in their family. The average household size of the quail farmers in the study area was 13 persons in the family (Table 4.3). This implies that the farmers in the study area might have advantage of familylabour availability if many household members participate in quail farms operations. However, the implication of large household size is that it will increase household consumption expenditure which would compete with production for limited financial resources within the household. Ahmed (2011) argued that large household size is associated with increased household consumption expenditure which reduces the money that could be used for production purposes.

Oluwatayo*et al.*, (2008), opined that there is significant and positive relationship between household size and farmers' efficiency in production and household size determine labour supply for the accomplishment of farm operations.

Table 4.3: Distribution of quail farmers according to their household size

Household size (number)	Frequency	%age
1-10	64	52.5
11-20	41	33.6
21-30	6	4.9
31-40	8	6.5
41-50	3	2.5
Total	**122**	**100**
Min	**1**	
Max	**50**	
Mean	**13**	
S.E	**0.95**	

4.1.4 Membership of cooperative society of quail farmers

The result presented in Table 4.4 revealed that about 72% of quail farmers do not belong to any cooperative association and the reasons for this include: being small scale and lack of awareness of any existing associationwhile those who are members of cooperative society constituted about 28% of the farmers.

The results further revealed that majority (73.5%) of the respondent who participated in cooperative association fell between 1-10 years with an average of 9 years. The minimum and maximum years spent by the members was 2 and 30 years respectively. Membership of cooperatives societies has propensity to provision of credit facilities. People come together to pool their resources so as to meet individual needs that could not be resolved by individual limited financial capacity.Ekong (2003) and Ajayi (2002) stated that participants in cooperative societieshave the following advantages, such as micro-credit, input subsidy and also as avenuefor cross breeding ideas and information.

Table 4.4: Distribution of quail farmers according to membership of cooperative and years spent in cooperative association

Cooperative membership (N=122)	**Frequency**	**%age**
Non-members	88	72.1
Members	34	27.9
Members (n=34)		
1-10 years	25	73.5
11-20 years	5	14.7
21-30 years	4	11.8
Total	**122**	**100**
Min	**2**	
Max	**30**	
Mean	**9**	
S.E	**1.33**	

4.1.5 Numbers of extension contact of quail farmers

The distribution of the sampled quail farmers based on numbers of extension visit is presented in Table 4.5. The result revealed that 84% of quail farmers in the study area had no contact to extension service while 16% had contact to extension service. The study revealedthat the majority (84.2%) of the respondents who had extension contact fell between 1-3 times with an average of 2 contact in a production cycle. The implication of this result is that extension contact is low in the area, as most of the quail farmers had never received an extension agent on their farms. Consequently, extension training and information on quail farming were received by only few farmers.

Chery*et al.*(2000) found that the adoption of new technologies is often influenced by the frequency of the farmer's contact with extension agents. The relationship between agricultural extension agent and the farmer could be an important determinant in the adoption and sustenance of improved management practices in quailproduction.

Table 4.5: Distribution of quail farmers according to extension visit

Extension Contact (N=122)	**Frequency**	**%age**
No contact	103	84.4
Contact	19	15.6
Contact (n=19)		
1-3	16	84.2
4-6	3	15.8
Total	122	100
Min	**1**	
Max	**5**	
Mean	**2**	
S.E	**0.288**	

4.1.6 Credit obtain by quail farmers

Adequate funding is required by farmers to finance quail production activities. However, a large number of farmers face serious shortage of funds to finance their production activities, which in turn limits their level of production. They obtained their funds through formal and informal sources as presented in Table 4.6.

The results indicated that majority 93.5% of quail farmers had no access to credit to finance their production activities while about 6.5% had access to credits.However, a large number of farmers had no access tofunds to finance their quail production activities. The result reveals that commercial banks are less patronized for financial support for farming in the study area. This may be due to avoidance high interest rate on collected loan.

The majority (75%) of the farmers who had access to credit fell within ₦1- ₦20,000with an average of ₦23,000. Ekong (2003) asserts that credit is a very strong factor that is needed to acquire or develop any enterprise; its availability could determine the extent of production capacity.According to Tijani*et al*(2006), access to credit provides the farmer with a means of expanding and improving his farm. It also determines the ease with which he adopts new practices and technologies in his enterprise.

Table 4.6: Distribution of quail farmers according to credit obtained.

Credit (N=122)	Frequency	%age
No access to credit	114	93.5
Access to credit	8	6.5
Amount of credit received (n=8)		
1- 20,000	6	75.0
20,001- 40,000	1	12.5
40,001-60,000	1	12.5
Min	**500**	
Max	**50,000**	
Mean	**23,000**	
S.E	**5554.5**	

4.2 Costs and Return Analysis of Quail Production

4.2.1 Cost of quail meat production in the study area.

The viability of an enterprise is indicated by the amount of profit realized per period of time. Profit is the difference between the monetary value of goods produced and the cost of the resources used in their production. The amount of revenue realized and operating cost of a business venture determines how much gain or loss the enterprise can achieve within a certain period. The cost and return estimate for quail's meat production are reflected in Table 4.7.

The quantity of feed used was 55.9 kg with an average market price of ₦100 per kg was used and this constitutes 26.6% of the total cost of production. The average cost of feed for meat production was ₦5, 590.Labour was sourced from both family and hired. The family labour was computed on the basis of opportunity cost in man-days. The wage rate varied according to farm operation performed. An average wage rate of ₦400 per man-day was used. Consequently, the imputed cost of labour used for family labour equals the prevailing wage rate of hired labour. Hence, labour cost accounts for 42.2% of the total cost of production.

The average quantity of chick used was 78 birds with an average market price of ₦20 per bird was used and this constitutes 7.1% of the total cost of production. While the average quantity of drugs used was 0.72 mg and with an average market price of ₦1200 per mg was used and this constitutes 4.1%. The average cost of drug for meat production was₦ 864.00.

4.2.2 Returns to investment in quail meat production

The results presented in Table 4.7 indicated that the total revenue (TR) was ₦41,400 while the total cost (TVC + TFC) was ₦21,049 was incurred on average by quail farmer. The net farm income was therefore ₦20,351. The average rate of returns on investment (return per naira invested) was 1.97, indicating that for every ₦1 invested in quail meat production in the study area, a profit of 97 kobo was made. Thus, it could be concluded that quail meat production in the study area though on a small scale, was economically viable. This finding is similar to that of Bakoji*et al.,* (2013) who in their study economic analysis of quails bird (Cortunixcortunix) production in Bauchi local government area, Bauchi state, Nigeriafound that gross ratio, operating ratio, and return per naira invested was found to be 0.61, 0.60 and 1.62 respectively

Table 4.7 Average costs and return of quails birds production in study area.

Variables	Unit(₦)	Values /100 birds	Cost (₦)	% Cost
Variable cost				
feed (₦)	100	55.9	5590.00	26.6
chick (₦)	20	75.0	1500.00	7.1
labour (₦)	400	22.2	8880.00	42.2
drug (₦)	1200	0.72	864.00	4.1
Total variable cost			16834.00	
Fixed costs				
Depreciation on equipment			2570	12.2
Depreciation on building			1650	7.8
Total fixed cost			4,220	
Total cost			21054	100
Total Revenue			41400	
Net Farm Income (NFI)			20346	
Return per Naira Invested			**1.97**	

4.2.3 Cost of quail (egg) production in the study area.

The viability of an enterprise is indicated by the amount of profit realized per period of time. Profit is the difference between the monetary value of goods produced and the cost of the resources used in their production. The amount of revenue realized and operating cost of a business venture determines how much gain or loss the enterprise can achieve within a certain period. The cost and return estimate for quail's egg production are reflected in Table 4.8.

The quantity of feed used was 63.8 kg with an average market price of ₦100 per kg was used and this constitutes 19.5% of the total cost of production. The average cost of feed for egg production was ₦6, 380.Labour was sourced from both family and hired. The family labour was computed on the basis of opportunity cost in man-days. The wage rate varied according to farm operation performed. An average wage rate of ₦400 per man-day was used. Consequently, the imputed cost of labour used for family labour equals the prevailing wage rate of hired labour. Hence, labour cost accounts for 21.4% of the total cost of production.

The average quantity of chick used was 96 birds with an average market price of ₦150 per bird was used and this constitutes 44.1% of the total cost of production. While the average quantity of drugs used was 0.53 mg and with an average market price of ₦1200 per mg was used and this constitutes 2.0%. The average cost of drug for meat production was₦ 636.0.

4.2.4 Returns to investment in quail (egg) production

The results presented in Table 4.8 indicated that the total revenue (TR) was ₦44,750 while the total cost (TVC + TFC) was ₦32,596 was realized on average by a quail's farmer. The net farm income was therefore ₦12,154. The average rate of returns on investment (return per naira invested) was 1.37, indicating that for every ₦1 invested in quail egg production in the study area, a profit of 37 kobo was made. Thus, it could be concluded that quail egg production in the study area is profitable by returning 37 kobo in every one naira invested. This finding is similar to that of Bakoji*et al.,* (2013) who in their study economic analysis of quails bird (Cortunixcortunix) production in Bauchi local government area, Bauchi state, Nigeriafound that gross ratio, operating ratio, and return per naira invested was found to be 0.61, 0.60 and 1.62 respectively

Table 4.8. Average costs and return of quails egg production in study area.

Variables	Unit(₦)	Values /100 birds	Cost (₦)	% Cost
Variable cost				
feed (₦)	100	63.8	6380.00	19.5
chick (₦)	150	96	14400.00	44.1
labour (₦)	400	17.4	6960.00	21.4
drug (₦)	1200	0.53	636.00	2.0
Total variable cost			28376.00	
Fixed costs				
Depreciation on equipment			2570	7.9
Depreciation on building			1650	5.1
Total fixed cost			4,220	
Total cost			32596	100
Total Revenue			44750	
Net Farm Income (NFI)			12154	
Return per Naira Invested			**1.37**	

4.3.1 Efficiency of Quail Meat Production

4.3.1.1 Estimated technical efficiency of quail meat farmers.

The model specified was estimated by the maximum likelihood (ML) method using FRONTIER 4.1 software developed by Coelli (1995). The ML estimates and inefficiency determinants of the specified frontier are presented in Table 4.9. The study revealed that the generalized log likelihood function was -15.18. The log likelihood function implies that inefficiency exist in the data set. The log likelihood ratio value represents the value that maximizes the joint densities in the estimated model. Thus, the functional form that is, Cobb-Douglas used in this estimation is an adequate representation of the data.The value of gamma (γ) is estimated to be 95% and it was highly significant at ($p<0.01$) level of probability. This is consistent with the theory that true γ-value should be greater than zero. This implies that 95%of random variation in the yield of the farmers was due to the farmers' inefficiency in their respective sites and not as a result of random variability. Since these factors are under the control of the farmer, reducing the influence of the effect of γ will greatly enhance the technical efficiency of the farmers and improve their yield. The value of sigma square (σ^2)was significantly different from zero at 1% level of probability. This indicates a good fit and correctness of the specified distributional assumptions of the composite error terms while the gamma γ indicates the systematic influences that are unexplained by the production function and the dominant sources of random error. This means that the inefficiency effects make significant contribution to the technical inefficiencies of quail meat farmers.

However, the estimated coefficients of all the parameters of production function (labour, feed, drug and chick) except labour were positive and significant at 5 and 1% level of probability and hence play a major role in quail production in the study area. The average technical efficiency for the farmers was 0.73 implying that, on the average, the respondents are able to obtain 73% of potential output from a given mixture of production inputs. Thus, in a short run, there is minimal scope (27%) of increasing the efficiency, by adopting the technology and techniques used by the best quail farmer.

The estimated coefficient for feed was 0.019 which is positive and statistically significant at 1% level. The estimated 0.019 elasticity of feed implies that increasing feed by 1% will increase quail output by less than 1% which means, all things being equal the output is inelastic to changes in the quantity of feed used. The significance of feed quantity is however, due to the fact that feed determines to a large extent the weight of the output obtained.

Table 4.9: Maximum Likelihood Estimates Results of Frontier Production Function (Technical Efficiency) of Quail Meat Production

Variables	Parameters	Coefficients	Standard error	T-Value
Production Variable				
Constant	β_0	6.659	0.439	15.17***
Labour	β_1	0.030	0.061	0.49
Feed	β_2	0.019	0.005	3.80***
Drug	β_3	0.057	0.024	2.38**
Chicks	β_4	0.243	0.090	2.70***
Inefficiency Variable				
Constant	Z_0	0.332	0.160	2.08
Age	Z_1	-0.003	0.001	-3.00***
Education	Z_2	-0.036	0.040	-0.91
Household size	Z_3	0.006	0.004	1.50
Cooperative association	Z_4	-0.015	0.006	-2.50***
Extension contact	Z_5	-0.005	0.335	0.02
Credit	Z_6	0.78E-06	0.91E-05	-0.85E-01
Sigma-square	**(σ^2)**	0.445	0.017	2.62***
Gamma	**(γ)**	0.947	0.103	9.19***
Log likelihood function	*L/f*	-15.18		
LR test		11.66		
Total Number of Observation		49		
Mean efficiency		0.73		

*** P<0.01 ** P<0.05 and * P<0.1

The production elasticity of output with respect to quantity of drug was 0.057 which is positive and statistically significant at 5% level of probability. This implies that a 1% increase in drug will increase quail output by 5.7%.

The estimated coefficient (0.243) of chick was positive and statistically significant at 1% level of probability. This implies that a unit increase in number of chicks in the production will leads to a unit increase in output, all things being equal the output is inelastic to changes in the number of chick used. The significance of chick is however, due to the fact that chick determines to a large extent the number of output obtained.

The estimated result of the inefficiency model is contained in Table 4.9. Generally, a negative sign on a parameter means that the variable reduces technical inefficiency, while a positive sign increases technical inefficiency. The results show that all the technical inefficiency variable except age and cooperative association were not statistically different from zero.

Age in quail production was negative and significant at 5 % for quail farmers. This shows that increase in age in quail production would reduce technical inefficiency. Farmers' age could be associated with skill accumulation which could enhance productivity and resource allocations thereby reduce technical inefficiency.

Membership of cooperative was negative and significant at 1% level of significant for quail farmers. The negative coefficient for membership imply that membership of association reduces technical inefficiency in quail production. Membership of association could affords the farmers the opportunity of sharing information on modern farming practices by interacting with other farmers. Okike (2000) noted that the reduction of inefficiency effects through farmers belonging to cooperatives is linked to cooperatives being a source of good quality inputs, information and organized marketing of products. This implied that quail farmers can market their produce through cooperative societies for higher profit and income.

4.3.1.2 Estimated Stochastic Frontier Cost Functions

The Maximum Likelihood (ML) estimates of the stochastic frontier cost parameters for quail meat production are presented in Table 4.10. For the cost function, the sigma (σ^2= 0.14) and the gamma (γ=0.99) are quite high and highly significant at 1% level of probability. The high and significant value of the sigma square (σ^2) indicate the goodness of fit and correctness of the specified assumption of the composite error terms distribution (Idiong, 2005). The gamma (γ = 0.99) shows that 99% of the variability in the output of quail farmers that are unexplained by the function is due to allocativeinefficiency.

The results of stochastic frontier cost function for quail in KadunaMetropolis are shown in Table 4.10. All the estimated coefficients of the parameters of the cost function are positive and statistically significant at 1% level of probability.

The coefficient of the cost of labour, feed, drugs and chick were positive and statistically significant at 1% level of probability. This implies that all the input variables were important in quail production. The implication of these finding is that if there is an increase in any of the variable input the total cost of production will increase. This shows that the cost of production is influenced by the cost of variable input incurred in the production cycle. The result of this research agrees with the findings of Siddiqueand Mandal (1996) where they reported labourcost, feed and veterinary services &medicine costs had significant impact on quail meat production. The most of the selected variables, especially feed cost had significantly positive impact on breeding quail farms returns.

Table 4.10: Results of Maximum Likelihood Estimates of Frontier Cost Function for Quail meat production

Variables	Parameters	Coefficients	Std. error	T-Value
Production Function				
Constant	β_0	0.879	0.138	6.37***
Labour	β_1	0.305	0.026	11.73***
Feed	β_2	0.515	0.322	1.60
Drug	β_3	0.012	0.003	4.00***
Chick	β_4	0.201	0.021	9.57***
Diagnostic Statistic				
Sigma-square	**(σ^2)**	0.136	0.029	4.69***
Gamma	**(γ)**	0.998	0.041	24.34***
Log likelihood function	*L/f*	50.791		
LR test		19.185		
Total number of observation		49		
Mean efficiency		0.61		

*** P<0.01 ** P<0.05 and * P<0.1.

4.3.1.3 Distribution of quail farmers according to technical, allocative and **economic efficiencies** *of quail (meat) farmers in the study area.*

i. Distribution of quail farmers according to technical efficiency estimates

The frequency distribution of the technical efficiency estimates for quail farmers in the study area as obtained from the stochastic frontier model is presented in Table 4.11. It was observed from the study that 33% of the farmers had technical efficiency (TE) of 0.81 and above while 67% of the farmers operated at less than 0.8 technical efficiency levels. The farmer with the best and least practice had technical efficiencies of 0.73 and 0.44 respectively. This implies that on the average, output fell by 33% from the maximum possible level attainable due to inefficiency.

The study also suggest that for the average farmer in the study area to achieve technical efficiency of his most efficient counterpart, he could realize about 28 % cost savings while on the other hand, the least technically efficient farmers will have about 58 % cost savings to become the most efficient farmer. This finding is similar to that of Bakoji*et al.,* (2013).

ii. Distribution of quail farmers according to allocative efficiency estimates

The Maximum Likelihood (ML) estimates of the stochastic frontier cost function for quail (meat) are presented in Table 4.10. The sigma (σ^2= 0.14) and the gamma (γ=0.99) are quite high and highly significant at 1% level of probability. The high and significant value of the sigma square (σ^2) indicate the goodness of fit and correctness of the specified assumption of the composite error terms distribution (Idiong, 2005). The gamma (γ = 0.99) shows that 99% of the variability in the output of quail (meat) farmers that are unexplained by the function is due to allocativeinefficiency.

The allocative efficiency estimates presented in Table 4.11, indicate that it ranged from 0.20 to 1.00; the mean allocative efficiency was 0.61. The result indicates that average quail (meat) farmer in the state would enjoy cost saving of about 41 % if he or she attains the level of the most efficient farmer among the respondents. The most allocative inefficient farmer will have an efficiency gain of 90.5 % in quail (meat) production if he or she is to attain the efficiency level of most allocatively efficient farmer in the state. This finding also is similar to that of Bakoji*et al.,* (2013)

iii. Distribution of quail (meat) farmers according to economic efficiency estimates

The frequency distribution of the economic efficiency estimates for quail farmers in the study area as obtained from the stochastic frontier model is presented in Table 4.11. It was observed from the study that no quail farmer had economic efficiency (EE) of 0.81 and above while 100% of the farmers operate at less than 0.8 efficiency level. The mean economic efficiency of the 122 sampled farmers in the study area was 0.45. The farmer with the best and least practice had economic efficiencies of 0.79 and 0.06 respectively. This implies that on the average, output fall by 55% from the maximum possible level due to inefficiency.

The study also suggest that for the average farmer in the study area to achieve economic efficiency of his most efficient counterpart, he could realize about 69.6 % cost savings while on the other hand, the least economic efficient farmers will have about 119 % cost savings to become the most efficient farmer. However, the average economic efficiency of the quail (meat) farmers was 45 %. This indicates that quail (meat) farms were economically inefficient.

Table 4.11: Frequency Distribution of Technical, Allocative and Economic Estimates from the Stochastic Frontier Model for Quail (meat) production

Technical Efficiency			**AllocativeEfficiency**		**Economic Efficiency**	
Class	**Frequency**	**%**	**Frequency**	**%**	**Frequency**	**%**
<0.2	0	0	0	0	3	6.1
0.21-0.40	0	0	2	4.1	17	34.7
0.41-0.60	9	18.4	11	22.4	19	38.8
0.61-0.80	24	48.9	20	40.8	10	20.4
0.81-1.00	16	32.7	13	26.5	0	0
Total	**49**	**100**	**49**	**100**	**49**	**100**
Mean	0.73		0.61		0.45	
Minimum	0.44		0.10		0.06	
Maximum	0.97		0.95		0.79	

4.3.2 Efficiency of quail egg production

4.3.2.1 Estimated technical efficiency of quail egg farmers

The model specified was estimated by the maximum likelihood (ML) method using FRONTIER 4.1 software developed by Coelli (1995). The ML estimates and inefficiency determinants of the specified frontier are presented in Table 4.12. The study revealed that the generalized log likelihood function was 69.45. The log likelihood function implies that inefficiency exist in the data set. The log likelihood ratio value represents the value that maximizes the joint densities in the estimated model. Thus, the functional form that is, Cobb-Douglas used in this estimation is an adequate representation of the data.The value of gamma (γ) is estimated to be 99% and it was highly significant at ($p<0.01$) level of probability. This is consistent with the theory that true γ-value should be greater than zero. This implies that 99%of random variation in the yield of the farmers was due to the farmers' inefficiency in their respective sites and not as a result of random variability. Since these factors are under the control of the farmer, reducing the influence of the effect of γ will greatly enhance the technical efficiency of the farmers and improve their yield. The value of sigma squared (**σ^2**)was significantly different from zero at 1% level of probability. This indicates a good fit and correctness of the specified distributional assumptions of the composite error terms while the gamma γ indicates the systematic influences that are unexplained by the production function and the dominant sources of random error. This means that the inefficiency effects make significant contribution to the technical inefficiencies of quail meat farmers.

However, the estimated coefficients of feed and chick were positive and significant at 1% level of probability while labour and drug were negative and statistically not different from zero and hence play a major role in quail production in the study area.

The average technical efficiency for the farmers was 0.85 implying that, on the average, the respondents are able to obtain 85% of potential output from a given mixture of production inputs. Thus, in a short run, there is minimal scope (15%) of increasing the efficiency, by adopting the technology and techniques used by the best quail farmer.

The estimated coefficient for feed was 0.027 which is positive and statistically significant at 10% level. The estimated (0.027) elasticity of feed implies that increasing feed by 1% will increase quail egg output by less than 1% which means, all things being equal the output is inelastic to changes in the quantity of feed used. The significance of feed quantity is however, due to the fact that feed determines to a large extent the egg output obtained.

Table 4.12: Maximum Likelihood Estimates Results of Frontier Production Function (Technical Efficiency) of Quail Egg Production

Variables	**Parameters**	**Coefficients**	**Standard error**	**T-Value**
Production Variable				
Constant	β_0	5.541	0.367	15.07***
Labour	β_1	-0.067	0.019	-3.40***
Feed	β_2	0.027	0.013	1.92*
Drug	β_3	-0.025	0.091	-0.2
Chicks	β_4	0.077	0.017	4.43***
Inefficiency Variable				
Constant	Z_0	0.236	0.153	1.54
Age	Z_1	-0.032	0.036	-0.89
Education	Z_2	-0.056	0.029	-1.88*
Household size	Z_3	0.854E-03	0.137E-01	0.62E-01
Cooperative association	Z_4	-0.065	0.021	-6.24***
Extension contact	Z_5	-0.024	0.033	-0.72
Credit	Z_6	0.56E-08	0.18E-05	-0.31E-02
Sigma-square	**(σ^2)**	0.025	0.009	2.61***
Gamma	**(γ)**	0.99	0.242	4.13***
Log likelihood function	*L/f*	69.45		
LR test		9.056		
Total Number of Observation		73		
Mean efficiency		0.85		

*** P<0.01 ** P<0.05 and * P<0.1

The estimated coefficient (0.077) of chick was positive and statistically significant at 1% level of probability. This implies that a unit increase in number of chicks in the production will leads to a unit increase in egg output, all things being equal the egg output is inelastic to changes in the number of chick used. The significance of chick is however, due to the fact that chick determines to a large extent the number of egg output obtained.

The estimated result of the inefficiency model is contained in Table 4.12. Generally, a negative sign on a parameter means that the variable reduces technical inefficiency, while a positive sign increases technical inefficiency. The results show that all the technical inefficiency variable except age and cooperative association were not statistically different from zero.

Years of education showed a negative relation with technical inefficiency and are significant at 10% level for quail farmers. The negative coefficient of education reveals that a high level of education results in a reduction in technical inefficiency of quail farmers. Anon (2006) noted that education is one of the socio–economic variables that greatly affect farmers' decision to accept and adopt modern farm technologies. Also, Kalirajan and Shand (1999) observed that education sharpens managerial input and leads to a better assessment of the importance and complexities of good decisions in farming. It also implied that education widens the scope of farmer's horizon towards adoption of new technological innovation, thereby moving him away from traditional practices to adopt technological concepts.

Membership of cooperative was negative and significant at 1% level of significant for quail farmers. The negative coefficient for membership imply that membership of association reduces technical inefficiency in quail production. Membership of association could affords the farmers the opportunity of sharing information on modern farming practices by interacting with other farmers. Okike (2000) noted that the reduction of inefficiency effects through farmers belonging to cooperatives is linked to cooperatives being a source of good quality inputs, information and organized marketing of products. This implied that quail farmers can market their produce through cooperative societies for higher profit and income.

4.3.2.2 Estimated Stochastic Frontier Cost Functions

The Maximum Likelihood (ML) estimates of the stochastic frontier cost parameters for quail egg production are presented in Table 4.13. For the cost function, the sigma (σ^2= 0.14) and the gamma (γ=0.99) are quite high and highly significant at 1% level of probability. The high and significant value of the sigma square (σ^2) indicate the goodness of fit and correctness of the specified assumption of the composite error terms distribution (Idiong, 2005). The gamma (γ = 0.99) shows that 99% of the variability in the output of quail farmers that are unexplained by the function is due to allocativeinefficiency.

The results of stochastic frontier cost function for quailegg production in KadunaMetropolis are shown in Table 4.13. All the estimated coefficients of the parameters of the cost function are positive and statistically significant at 1% level of probability.

The coefficient of the cost of labour, feed, drugs and chick were positive and statistically significant at 1% level of probability. This implies that all the input variables were important in quail egg production. The implication of these finding is that a unit increase in any of the variable input will increase the total cost of production. This shows that the cost of production is influenced by the cost of variable input incurred in the production cycle. The result of this research agrees with the findings of Siddiqueand Mandal (1996) where they reported labourcost, feed and veterinary services &medicine costs had significant impact on quail meat production. The most of the selected variables, especially feed cost had significantly positive impact on breeding quail farms returns.

Table 4.13: Results of Maximum Likelihood Estimates of Frontier Cost Function for Quail egg production

Variables	Parameters	Coefficients	Std. error	T-Value
Production Function				
Constant	β_0	11.076	0.137	8.06***
Labour	β_1	0.236	0.009	2.60***
Feed	β_2	0.224	0.010	2.36**
Drug	β_3	0.013	0.041	0.33
Chick	β_4	0.528	0.018	2.83***
Diagnostic Statistic				
Sigma-square	(σ^2)	0.136	0.029	4.69***
Gamma	(γ)	0.998	0.041	23.92***
Log likelihood function	*L/f*	108.003		
LR test		46.92		
Total number of observation		73		
Mean efficiency		0.64		

*** P<0.01 ** P<0.05 and * P<0.1

4.3.2.3 Distribution of quail farmers according to technical, allocative and economic efficiencies of quail (egg) farmers in the study area.

i. Distribution of quail egg farmers according to technical efficiency estimates

The frequency distribution of the technical efficiency estimates for quail farmers in the study area as obtained from the stochastic frontier model is presented in Table 4.14. It was observed from the study that 74% of the farmers had technical efficiency (TE) of 0.81 and above while 26% of the farmers operated at less than 0.8 technical efficiency levels. The farmer with the best and least practice had technical efficiencies of 0.96 and 0.66 respectively. This implies that on the average, output fell by 26% from the maximum possible level attainable due to inefficiency.

The study also suggest that for the average farmer in the study area to achieve technical efficiency of his most efficient counterpart, he could realize about 15.6% cost savings while on the other hand, the least technically efficient farmers will have about 35.4% cost savings to become the most efficient farmer. This finding is similar to that of Bakoji*et al.,* (2013).

ii. Distribution of quail farmers according to allocative efficiency estimates

The allocative efficiency estimates presented in Table 4.14, indicate that it ranged from 0.20 to 1.00; the mean allocative efficiency was 0.64. The result indicates that average quail (egg) farmer in the state would enjoy cost saving of about 56% if he or she attains the level of the most efficient farmer among the respondents. The most allocatively inefficient farmer will have an efficiency gain of 123% in quail (egg) production if he or she is to attain the efficiency level of most allocatively efficient farmer in the state. This finding also is similar to that of Bakoji*et al.,* (2013)

iii. Distribution of quail (egg) farmers according to economic efficiency estimates

The frequency distribution of the economic efficiency estimates for quail farmers in the study area as obtained from the stochastic frontier model is presented in Table 4.14. It was observed from the study that only 1.4% of quail farmer had economic efficiency (EE) of 0.81 and above while 98.6% of the farmers operate at less than 0.8 efficiency level. The mean economic efficiency of the 122 sampled farmers in the study area was 0.55. The farmer with the best and least practice had economic efficiencies of 0.85 and 0.16 respectively. This implies that on the average, output fall by 45% from the maximum possible level due to inefficiency.

The study also suggest that for the average farmer in the study area to achieve economic efficiency of his most efficient counterpart, he could realize about 52.9% cost savings while on the other hand, the least technically efficient farmers will have about 98.8% cost savings to become the most efficient farmer. However, the average economic efficiency of the quail (egg) farmers was 55%. This indicates that quail (egg) farms were economically inefficient.

Table 4.14: Frequency Distribution of Technical, Allocative and Economic Estimates from the Stochastic Frontier Model for Quail (egg) production

Technical Efficiency			**AllocativeEfficiency**		**Economic Efficiency**	
Class	**Frequency**	**%**	**Frequency**	**%**	**Frequency**	**%**
<0.2	0	0	0	0	1	1.4
0.21-0.40	0	0	3	4.1	8	11.0
0.41-0.60	0	0	15	20.6	39	53.4
0.61-0.80	19	26.0	42	57.5	24	32.9
0.81-1.00	54	74.0	13	17.8	1	1.4
Total	**73**	**100**	73	**100**	**73**	**100**
Mean	0.85		0.64		0.55	
Minimum	0.66		0.21		0.16	
Maximum	0.96		0.64		0.85	

4.4 Constraints of quail farming in the study area

The problems militating against Quail meat and egg production is presented in Table 4.15. Constraints to Quail egg and meat production were sought out which includes, high cost of feeds, high capital requirement, pest and diseases and poor market. Among the said constraints high cost of feed was identified to be the major problem with about 86.2% of quail farmers attesting to this fact. This finding agreed with work of

Emeyonu and Okafor (2003) that poultry farmers in Nigeria are face by some problem such as high cost of production inputs.

Inadequate access to extension services (83.8%) rank second as the most serious constraint affecting quail farmers in the study area. This could be generally attributed to low extension agent- farmers ratio. In Nigeria today, the ratio of extension to famers is about 1: 25,000 (Paul Mari Bdliya, 2009). Thisis very unacceptable if we are to attain the food security for the populace.

Fund was also cited as very severe constraints to quail production (82.5%) in the study area. This may account for the reason most respondents are small- scale farmers. Also, the stringent conditions and bureaucratic bottleneck of credit institutions shy farmers away from obtaining loans to finance their farm operations. Credit is a very strong factor that is needed to acquire or develop any enterprise; its availability could determine the extent of production capacity. It agrees with findings of Nasiru, (2010) who noted that access to micro-credit could have prospect in improving the productivity of farmers and contributing to uplifting the livelihoods of disadvantaged rural farming communities. It also agree with Idachaba (1989); Olayemi (1996) and Omonona and Agoi (2007) who reportedthat poor accessibility to credit facilities, storage and marketing facilities, production inputs are important factors causing food insecurity in Nigeria.

About 5% of the farmers revealed that pest and disease was major constraint of quail producers and was responsible for quail production mortality while about 29% of the respondents attesting to this fact that poor pricing/fluctuation of quail egg were the least constraint faced by farmers in the study area.

4.15: Constraints of Quail Production

Constraint	*Frequency	%age	Rank
high cost of feed	83	68.03	1th
inadequate extension service	71	58.20	2nd
Shortage of capital	54	44.26	3rd
Pest and diseases	38	31.15	4th
Poor prices	35	28.69	5th

*Multiple responses

4.5 Test of hypothesis

The null hypothesis (H_o) which stated that there is no significant difference between costs and revenue in quail meat production (test of hypothesis i) in the study area was tested using the result of a t-test presented in Table 4.16. From the result in the table 4.16, an average cost was 21049 and average return was 41400. Calculated t-value was 4.31 and exceeds the critical value (t-critical two tail) of 1.96. The calculated t-value was 4.31 and exceeds the critical value (t-critical two tail) of 1.96, therefore $H_o$is rejected at 5% level of significance. The result of the analysis indicates that quail meat production is profitable in the study area.

Table 4.16: The result of t-test showing significant differences between costs and return in quail meat production.

Variable	Average cost	Average return
Mean	21049	41400
Standard deviation	43386.39	48865.34
Observations	49	49
Pearson Correlation	0.76	
Hypothesized Mean Difference	0	
Df	48	
t Stat	-4.31	
P(T<=t) one-tail	0.00	
t Critical one-tail	1.66	
P(T<=t) two-tail	0.00	
t Critical two-tail	1.96*	

*P<0.05

The null hypothesis (H_o) which stated that there is no significant difference between costs and revenue in quail egg production (test of hypothesis ii) in the study area was tested using the result of a t-test presented in Table 4.17. From the result in the table 4.17, an average cost was 421371.12 and average return was 44750. Calculated t-value was 4.31 and exceeds the critical value (t-critical two tail) of 1.96. The calculated t-value was 2.91 and exceeds the critical value (t-critical two tail) of 1.96, therefore $H_o$is rejected at 5% level of significance. The result of the analysis indicates that quail meat production is profitable in the study area.

Table 4.17: The result of t-test showing significant differences between costs and return in quail egg production.

Variable	Average cost	Average return
Mean	32596	44750
Standard deviation	421371.12	4953265.34
Observations	73	73
Pearson Correlation	0.69	
Hypothesized Mean Difference	0	
Df	72	
t Stat	-2.91	
P(T<=t) one-tail	0.00	
t Critical one-tail	1.56	
P(T<=t) two-tail	0.00	
t Critical two-tail	1.96*	

*P<0.05

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

This study focused on economic efficiency of Quail production among small holder farmers in Kaduna metropolis, KadunaState. Six districts were randomly selected from Kaduna metropolis and 122 farmers were selected in these areas. The purpose of the study was to examine the economic efficiency of quail meat and egg production among small holder farmers in Kaduna metropolis, Kaduna state. The objectives of the study were to: describe the socio-economic characteristics of quail farmers in the study area, determine the costs and returns associated with quail production, determine the technical, allocative, and economic efficiencies in quail meat and egg production and describe the constraints facing farmers in quail production in the study area.

The primary data were collected from 122 respondents using a structured questionnaire. The statistical tools used to analyse the data were descriptive statistics, net farm income and stochasticfrontier production function.

The result of the analysis shows that (34%) of the respondents fell within the age range of 30-39years, the majority of the farmers (59%) did not have formal education. the household size ranged from1-10 persons with 53%. 72% were not members of a cooperative society. About 84% did not have access to extension service while about 94% of the farmers did not have access to credit.

The average costs incurred and revenue obtained for quail meat and egg production were estimated to determine the profitability of quail production in the study area. The total revenue was ₦41,400 and ₦44,750 for meat and egg respectively while the total cost was ₦21,049 and ₦32,596. The net farm income was therefore ₦20,351 and ₦12,154. The average rate of return on investment (return per naira invested) is 1.97 and 1.37 for quail meat and egg respectively, indicating that for every ₦1 invested in quail meat and egg production in study area; a profit of 97 and 37 kobo was made. Thus, it could be concluded that quail meat production had higher profit to egg producers in the study area.

The estimated mean technical efficiency for quail meat producers was 0.73 and quail egg producers was 0.85. The mean allocative efficiency of quail meat producers is 0.61 and the average allocative efficiency for quail egg producers is 0.64. While the mean economic efficiency of quail meat producers is 0.45 and the average economic efficiency for quail egg producers was is 0.55.

Finally, among the major constraints identified on quail production in the study area were high cost of feed (68%), inadequate extension services (58%), inadequate capital (44%), pest and disease (31%) and poor pricing (29%).

5.2 Conclusion

Based on the findings of this study, it could be concluded that quail meat and egg production in the study area is profitable by returning 97and 37 kobo to every ₦1.00 spent for meat and egg production respectively.The farm specific technical efficiency distribution concluded that none of the farmers achieved the maximum efficiency level.

Thus, within the context of efficient agricultural production, output can still be increased by 27% and 15% for quail meat and egg production respectively using available inputs and technology. These results call for policies aimed at encouraging new entrants especially the youths who are agile and stronger to involve into quail production and the experienced ones to remain in quail farming.

5.3 Contribution of the Study to Knowledge

1. The study revealed that quail production in the study area is profitable with a netfarm income of ₦20,351 and ₦12,154 for quail meat and egg production respectively.

2. The study revealed high cost of feed s and inadequate of extension service and inadequate capital were major constraints affecting quail production in the study area.

3 It was revealed that quail farms were economically inefficient in the study area having an economic efficiency of 45% and 55% for quail meat and egg production respectively.

5.4 Recommendations

i. Pest and disease is one of the constraint to quail production. This constraint constitutes serious impediments to quail production and need to be addressed adequately before quail production can be improved in the study area. It is recommended that the Department of Livestock production should ensure that their staffs are well trained on quail farming so that they can be in a position to offer technical advice to quail farmers

ii. Majority of the farmers financed their production through personal savings and relatives which are mostly not adequate for appreciable production. Agricultural loan facilities should be made accessible to quail producers to ensure timely and adequate utilization of agricultural inputs for improvement in farm production efficiency and Unemployed youths should be encouraged by giving soft loan to enable them participate in the quail farming, since they are energetic and strong.

iii. Majority of the farmers do not participate in any cooperative association, it is therefore recommended that farmers should be encouraged to join cooperatives to pool their resources together in order to purchase necessary farm inputs by taking the advantage of economies of scale.

iv. Any measure adopted that will reduce the cost of production will invariably increase their profit margin, therefore farmers should be taught and encourage to formulate and produce their feed by themselves to reduce the cost of production and also make the feed readily available for the farmers.

v. The Directorate of Livestock Production should provide more information on the nutritive and medicinal value of quail eggs in order to promote local consumption of quail eggs in the community so as to have an attitude change from the traditional belief that quails should be consumed by children .

vi. The study has shown that majority (72.1%) of the quail farmers did not belong to any association/cooperative. In the light of this, it is recommended that quail farmers in the study area should be encouraged to join farmers association especially quail farmers association so as to enable them pool their resources in order to have access to quail inputs and knowledge on improved quail farming practices. This is very important as membership of cooperatives aids the adoption of improved quail technologies towards enhancing efficiency of quail farmers.

vii. In order to further enhance the profitability of quail farming in the study area, efforts should be made to bring down the cost of feeds which accounted for a larger proportion of the total variable cost of quail production in the study area. This can be done, by exploring alternative sources of feeds and this could be achieved through well-funded researches on quail nutrition.

viii. Given the level of profit that accrues to quail farmers in the study area and the existing production potential in view of the demand-supply gap for protein, unemployed youths should be encouraged to take up quail farming as a means of livelihood. This will invariably reduce the incidence of social vices by youths in the study area.

ix. Given the level of technical efficiency of quail egg and meat of 71 and 61% respectively, there is scope of increasing the efficiency. It is recommended that extension agent should teach the farmers the best practice to adopt and the right technology and techniques to use to achieve optimum efficiency.

REFERENCES

Abatcha, M. G.,Emennaa, P. E., Musa, U., Ahmed, M. S.,Njam, L. R.,Karsin, P. D., Jamilu, H. and Ajibola, H. O.(2009). Hatching Success and Embryonic Mortality in Japanese Quail (Coturnixcoturnix japonica) Farm in North Central Nigeria. Proceeding of 14th Annual Conference Animal Science Association of Nigeria. (ASAN), 14th– 17th September, LAUTECH, Ogbomoso.556 – 558.

Abedullah, K. B and Ahmad, B. (2006). Technical Efficiency and Its Determinants In Potato Production.Evidence from Punjab, Pakistan.*The Lahore Journal of Economics*,11(2): 1-22

Abedullah, S. K and Mushtaq, K. (2007). Analysis of Technical Efficiency of Rice Production in Punjab (Pakistan): Implications for Future Investment Strategies, *Pakistan Economic and Social Review*. 45(2):231-244

Abu, O. A. and Soetan, K. O. (2009).Swot Analysis on the Application of Biotechnology in Livestock Improvement in Nigeria. Proceeding of 14th Annual Conference of Animal Science Association of Nigeria (ASAN), Sept. 14th– 17th LAUTECHOgbomoso, Nigeria. pp. 215 – 217.

Adamu, M. T., Biwe, E. R., and Suleh, Y. G. (2013). Socio-economic Characteristics of Farmers under National Fadama Development Project in Billiri Local Government Area of Gombe State, Nigeria. *Projournal of Agricultural Science Research*.1(2): 7-21.

Adebayo, O. O. andAdeola, R. G. (2005). Socio-economic Factors Affecting Poultry Farmers in Ejigbo Local Government Area of Osun State.*Journal of Human Ecology*, 18(1): 39 – 41

Adeleke, O. A., Matanmi, H. and Ogunniyi, L.T. (2008). Application of the Normalized Profit Functions in the Estimation of the Profit Efficiency Among Smallholder Farmers in Atiba Local Government Area of Oyo state, Nigeria. *Journal of Economic Theory* 2(3):71-76.

Adeola, S.S. (2010).Economic of Insecticide Usage among Cowpea Farmers in Kaduna State Nigeria. Unpublished M.Sc. Thesis, Department of Agricultural Economics and Rural Sociology, Ahmadu Bello University, Zaria.

Adeyeye, E. I. (2012). Nutritional Value of Lipids Composition of Free Range Chicken Eggs. *Agriculture and Biology Journal of North America*, 2: 374- 384.

Adubi, A.A. 1998. Conceptualizing the economic behaviour of Nigeria smallscale

Ahmad, M., Rafiq, M and Ali, A. (1999). An Analysis of Technical Efficiency of Rice Farmers in Pakistan Punjab.*Bangladesh Journal of Agricultural Economics,* 22(2):79-86

Ahmed, F. (2011). Practices of Poverty Measurement and Poverty profile of Bangladesh. ERD Working Paper Series No. 54. Asian Development Bank. Manila. 2:1- 6

Aigner, D.J. and Chu, S.F. (1968) Estimating the Industry Production Function. *American Economic Review,*58:826-83

Ajayi, A. R. (2002). Changes in Behaviour and Social Status as Perceived by Participating Farmers in Agricultural Development Projects in Ondo and Enugu States, Nigeria.*Agro-Science Journal of Tropical Agriculture, food, Environment and Extension*,3(1): 47-54.

Akpan, I. A.and Nsa, E. E.(2009). Growth Performance of Growing Japanese Quail (Coturnixcoturnix japonica) Fed Diets Containing Different Crude Protein Levels.Proceeding of 14th Annual Conference of Animal Science.Association of Nigeria.(ASAN). 14th– 17th Sept. LAUTECH, Ogbomoso, Nigeria, pp 553 – 555.

Alvarez A., Arias C. (2004) Technical Efficiency and Farm Size: a Conditional Analysis, Agricultural Economics 30, pp. 241–250.

Amaza,P., Tahirou, A., Patrick, .K., and Amare, T. (2009). Changes in Household Food Security and Poverty Status in PROSAB Area of Southern Borno State, Nigeria.Promoting Sustainable Agriculture in Borno State (PROSAB).International Institute of Tropical Agriculture, Ibadan, Nigeria.:1-40.

Ani. A. O. and Adiegwu, L. I. (2005). The Feeding Value of Velvet Beans (Mucuna pruriens) to WeanerRabbits. Proceeding of 30th Annual Conference of Nigeria.Soc. for Anim. Prod.(NSAP), 20th– 24th March,University of Nigeria, Nsukka, Nigeria. pp. 186 – 189.

Ani A. O.; Okeke G. C.andEmeh, M. B. (2009). Response of Growing Japanese Quail (Coturnixcoturnix japonica) Chicks to Diets Containing Different Energy and Protein Levels.Proc. 34th Ann. Conf. Nig. Soc. for Anim. Prod. 15th– 18th March, Uyo, pp. 328 – 331

Annon, L.(1991). Little Known Animals with Promising Economic Future (micro-livestock), Boardof Science and Technology for International Development, National Academy Press, Washington D.C. pp 147 – 155.

Arthur, J. A. (2013). A Study of the Consumer Market for Duck and Quail Egg Products: The Case of Chinese Canadians in Vancouver, British Columbia. British Columbia University: Vancouver.

Awoyemi, T.T. (2000). A Gender Analysis of Economic Efficiency of Cassava based Farm holding. Unpublished Ph.D. Dissertation, Department of Agricultural Extension Services, University of Ibadan, Oyo State.

Azadeh N., Abdolazim, A., Mohammad, C., and Masoud, B. (2009). The Socio-economic Characteristics of Wheat Farmers Regarding Adoption of Sustainable Soil Management (SSM). Journal of Human Ecology, 27(3): 201-205

Babangida, S.andUbosi, C. O.(2005). Effects of Varying Dietary Protein Levels in the Performance of Laying Japanese Quail (Coturnixcoturnix japonica) in a Semi-Arid Environment.*Nig. Journal of Animal Production*, 33 (1): 45 – 52.

Bakhsh, K. (2007). An analysis of Technical Efficiency and Profitability of Growing Potato, Carrot, Radish and Bitter Gourd: A case Study of Pakistani Punjab. An Unpublished PhD Dissertation Submitted to the Department of Environmental and Resource Economics. University of Agriculture, Faisalabad, Pakistan
.

Bakoji, I., Aliyu, M.K., Haruna, U., Jibril, S.A., Sani, R.M.and Danwanka, H. (2013). Economic Analysis of Quails Bird (Cortunixcortunix) Production in BauchiLocal Government Area, BauchiState, Nigeria.*Research Journal of Agriculture and Environmental Management*. 2(12): 420-425

Basappa G, Deshmanya JB, Patil BL (2007). Post-Harvest Losses of Maize Crop in Karnataka-An Economic Analysis.*Karnataka.Journal of Agricultural Science*.20(1):69-71.

Belbase, K. and Grabowski, R. (1985).Technical Efficiency in Nepalese Agriculture. *Journal of Development Agriculture*. 19(5): 15-25.

Bravo-Ureta and Evenson R. E. (1994) Efficiency in Agricultural Production: The case of PeasantFarmers in Eastern Paraguay. *Agricultural Economics* 10 (1): 27 – 37.

Bravo-Ureta B.E and Pinheiro A.R (1997).“Technical, Economics, and Allocative Efficiency in Peasantfarming.Evidence from the Dominican Republic. “The Development Economics” .35 (1): 48-07,

Central Bank of Nigeria ``(CBN), (2011).Annual Report.CBN, Abuja, Nigeria.

Chang Reissig E.; Martella, M. B.; Navarro, J. and Robles, C. A. (2001).Aspectos Sanitarios de LacriadelChoique (pterecnenemiapannata) en Granjas de la Patagonia Argentina. RevistaDemedicinaVeterianaria, 82: 324 – 326.

Chelmonska, B., Jerysz, A., Lukaszewicz, E., Kowalczyk, A. and Malecki, I. (2008). Semen Collection from Japanese Quail (Coturnix japonica) using a Teaser Female. *Turkish Journal of Vetinary Animal Science*; 32(1): 19-24.

Chery, R. D. and Michael, L. M. (2000). How Does Gender Affect the Adoption of Agricultural Innovation? The Case Study of Improved Maize Technology inGhana:Women Agricultural and Rural Development. Findings of Food and Agriculture Organisation Study inAfrica, In: Adepoju, S.O., Umar, G. and

Agun, J. O. An Appraisal of Participation of Women inKano Agricultural and Rural Development Authority (KNARODA) Extension Delivery Programmes.*Journal of AgriculturalExtension*, 10: 207- 217.Crethill Publishers, Ibadan.

Chibe, L. I. (2009). Poultry Nutrition and Feeding.Animal Nutrition Handbook, 316-331.

Coelli, T. J., Prasada, R. and Battese, G. (1998).*An Introduction of Efficiency and Productivity Analysis*. Kluwer Academic Press, Boston. 9:225-235

Coelli, V.J (1996) Guide to Frontier Version 4.1: A Computer Program for Crops in Africa. In: Akoroda, M. O. and Ngeve, J. M. (eds.). Proceedings of the 4th TriennialSymposium of the International Society for Tropical Root Crops (ISTRC). 8: 7 – 16

Cox, W. A., Kimball, R.T. and Braun, E. L. (2007). Phylogenetic Position of the New World Quail (Odontophoridae): Eight Nuclear Loci and Three Mitochondrial Regions Contradict Morphology and the Sibley AhlquistTapestry. The Auk, 124(1):71-84,

DAFF. 2013. Structure and Dynamics of the Quail. Commonwealth of Australia.
Downey, W. D. and Trocke, .J. K. 1981. Agribusiness Management. New York: McGraw-Hill.

Dercon, S. and P. Krishnan, (1998). “Changes in Poverty in Rural Ethiopia 1989–1995: Measurement Robustness Test and Decomposition”.Centre for the Study of African Economics Working Paper Series.

Dozier, W.A., Bramwell, K., Hatkin, J., and Claudia, D. (2010).Bobwhite Quail Production and Management Guide. University of Georgia : GeorgiaEvangelical Quarterly , 195- 208.

Dugje, I. Y., Omoigui, L. O., Ekeleme, F., Kamara, A. Y., &Ajeigbe, H., (2009). Farmers Guide to Cowpea Production in West Africa. IITA Ibadan, Nigeria.

Ekong E. E. (2003) Rural Sociology: *An Introduction and Analysis of Rural Nigeria,* Uyo: Dove Educational Publication.

Ekwenta, C.M. (2004). Factors Affecting the Adoption of Recommended Soyabean Food Production Among Farm Household in Makarfi Local Government Area of Kaduna State, Unpublished Ph.D Thesis. Department of Agricultural Economics and Rural Sociology, Ahmadu Bello University-Zaria.

Ellis, F. (2000).*Rural livelihood and diversity in developing countries*.New York, Oxford university press, Pp 3 – 4.

Emokaro, C.and Ekunwe, P. (2009).Efficiency of Resource-Use and Elasticity of Production among Catfish Farmers in Kaduna, Nigeria.*Journal of Applied Sciences Research,*5(7):776-779.

Esobhawan, A. O. (2007). Efficiency analysis of artisanal fishery production in Edo State.UnpublishedPh.D Thesis, Department of Agricultural Economics and Extension, AmbroseAlli University, Ekpoma.

Esobhawan A. O.; Ojo S. O.andIkhelao, E. E. (2008). Profitability, Input Elasticity and Returns to Scale in Agriculture Production in Lagos State. Proc. 14th Ann. Conf. of Agric. in Nig.WetlandsFUTA, Akure 21st May. Pp 219 – 222.

Food and Agriculture Organisation, MARD and ACI. (2007). Gender Analysis in Poultry Production: The Future of Poultry

Food and Agriculture Organisation. (2002). Rural Women: Crucial Partners in the Fight Against Hunger and Poverty: Side Event Report. Food and Agriculture Organisation : Rome.

Food and Agriculture Organisation. (2010). The State of Food Insecurity in the World: Addressing Food Insecurity in Protracted Crisis. Food and Agriculture Organisation : Rome.

Food and Agriculture Organisation. (2012). Women Manages Livestock Diversity: Food and Agriculture Organisation Animal Production and Health. Invisible Guardians , 174.

Food and Agriculture Organisation. (2006a). Livestock Report Food and Agriculture Organisation : Rome .

Food and Agriculture Organisation. (2007). Poultry Feeding in Tropical and Subtropical Countries. Food and Agriculture Organisation : Rome .

Food and Agriculture Organisation. (2009). Food and Agriculture Organization Nutrition Profile: Nigeria. Food and Agriculture Organisation : Rome.

Food and Agriculture Organisation. (2010). Agribusiness Hand Book: Poultry Meat and Eggs. Food and Agriculture Organisation : Rome.

Food and Agriculture Organisation. (2011). The Role of Women In Agriculture. ESA Working Paper No 11 - 02. Food and Agriculture Organisation: Rome. Framing in Vietnam After the Highly Pathogenic Avian Influenza. Food and Agriculture Organisation : Hanoi, Vietnam.

Farell, M.J. (1957): The measurement of production efficiency. *Journal of theRoyal Statistical society service A(general)*25: 3-81.

Femi, A. (2011). The Newsafrica.com/2011/11/07/the sun

Fielding, D.(1991). Rabbits.The Tropical Agriculture.Macmillan Education Ltd London pp. 106.Garwood, A. A.and Diehl, R. C. J. (1987). Body Volume and Density of Live CortunixQuail and Associated Genetic Relationship. Poult.Sci. 66 (8) 1269.

Food and Agriculture Organization (2011).The State of Food and Agriculture. Food and Agriculture Organisation Publication. Rome. 2011 :1-160.

Gomez, O.(1975). *Economic of agricultural production and resource use*. Prentice Engle Wood, New York, 428p.

Gonzalez A.; Satterlee D. G.; Moharer F. and Cadd, D. G.(1999). Factors Affecting Ostrich Egg Hatchability. Poultry Science, 78: 1256 – 1262.

Hall, G. 2012. Brown Quail and its Management. 2012-05_Brown-Quail-and-its Management.pdf.

Haruna E.S.; Musa U.; Lommon L. H.; Tat P. M.; Shamaki P. D.; Okewole, P. and Molokwu, J. U.(1997a). Introduction to Quail Production in Nigeria.*Veterinary Journal*, 18: 104 – 107.

Haruna E. S.; Musa U; Lombin L. H.; Tat P. B.; Shamaki, D.; Okewole, P. and Molokwu, J. U. (1997). Introduction of Quail Production in Nigeria.*Nigerian Veterinary Journal*. 18: 104 – 107.

Heft, N. S., Puppharessa, D., Otte, J., Roland, H. D., Sudsawasd, S., and Zilberman, D. (2008). Supply Chain Auditing for Poultry Production in Thailand. Rural DevelopmentResearch Consortium: Bangkok Thailand.

Hemid, A. F. A., Abd El-Gawad, A. H., El-Wardany, I., El-Daly, E. F., and Abd El-Azeem, N. A. 2010. Alleviating Effects of some Environmental Stress Factors on productive performance in Japanese quail 2.Laying performance.*World Journal of Agricultural Sciences* 6 (5): 517-524.

Hussain, A., Saboor, A., Khan, M. A., Mohsin, A.Q., Hassan, F. and Anwar, Z.M. (2012). Technical Efficiency of Wheat Production in Punjab (Pakistan): A Cropping Zone Wise Analysis. *Pakistan Journal of Social Science* 10(2): 130-138

Idiong, I.C. (2005) Evaluation of Technical, Allocative and Economic Efficiencies in Rice Production Systems in Cross River State, Nigeria. An unpublished PhD Thesis, University ofCalabar, Nigeria.

Igado, O. O., and Aina, O. O. 2010. Some Aspects of the Neurometrics and Oculometrics of the Japanese Quail (coturnixcoturnix japonica) in Nigeria. *Journal of Morphological Science*, 27(3-4): 133-135.

Ikheloa, E.E., Inedia, G. (2005). Analysis of surviva l rates of chick in poultry farm in

Edo state.Proceeding of 39th Annual Conference of ASN Benin Edo State, Nigeria.

ILO, (2007), Chapter 4. Employment by sector "In Key indicators of the labor market (KILM)",

Izuchukwu, O. (2011). Analysis of the Contribution of Agricultural Sector on the Nigerian Economic Development.*World Review of Business Research*, 1(1): 191 – 200.

Jondrow, J. C., Lovell, A.K., Materoy, I.S and Schmidt, P. (1982)."On the Estimation of TechnicalInefficiency in the Stochastic Frontier Production Function Model".*Journal of Econometrics,* 19: 233 – 238

Kaduna State Government (2012).Kaduna State Information Manual.the Kaduna State Government, Federal Republic of Nigeria. http://www.kadunastate.gov.ng

Kalarijan and shand (1999). Application of the normalized profit functions in the estimation of the profit efficiency among smallholder farmers in Atiba Local Government Area of Oyo state, Nigeria. *Journal of Economic Theory* 2(3):71-76.

Kingori, A. M. (2011). Review of factors that Influence Egg Fertility and Hatchability in Poultry. *International Journal of Poultry Science,* 483- 492.

Lamorde, A. G. (1997). Research priorities for sustainable women empowerment and development. A paper presented at the National Conference on Research as Backbone for Sustainable Development held in Abuja, 11th – 15th August, 1997.

Mahabub, H. and Jaim, W. M. H. (2011). Empowering Women to Become Farmer Entrepreneur Case Study of a NGO Supported Program in Bangladesh. Paper presented at the IFAD Conference on New Directions for Smallholder Agriculture 24-25 January, 2011 :1-30.

McNaughton, J. L., and Haymes, R. L. (1978).Nutritional Requirements of Game Birds. Mississippi State University: Starkville.

Meeusen W, van Den Broeck J. (1977) Efficiency Estimation from Cobb-Douglas Production Functions with Composed Error.International Economic Review. 18(2):435-444.

Mizutani, M. 2003. The Japanese Quail. www.angrin.tlri.gov.tw/apec2003/chapter /pdf.

Mohammed, B. T. (2011). Socio-economic Analysis of Melon Production in Ifelodun Local Government Area, Kwara State, Nigeria.*Journal of Development and Agricultural Economics*.3(8) :362-367

MOLD.(2012). A Guide to Quail Farming. Ministry Of Livestock Development: Nairobi.

Mujibur R, Naushad K, Inayatullah J (2007). Post-harvest losses in tomato crop:A Case of Peshawar Valley.Sarhad Journal of Agriculture.23(4):1279-1284.

Naibi S. A.; Zahraddeen, D.; Kalla, D. J. U. and Nathaniel, C**.** (2009).Effects of storage length andpositioning on hatchability of Japanese quail eggs ((*Coturnixcoturnix japonica*) in a subtropical environment.*Proc. 34th Ann. Conf. Nig. Soc. for Anim. Prod*.15th – 18th March, Uyo.Pp. 457 – 460.

Narala, A. and Zala, Y. C. (2010). Technical Efficiency of Rice Farms Under Irrigated Conditions In Central Gujarat. *Agricultural Economics Research Review*. 23:375-381

Nasiru M. O. (2010). Microcredit and Agricultural Productivity in Ogun state, Nigeria . *World Journal of Agricultural Sciences. 6(3): 290-296*

NPC (2006).National Population Commission. Population Census of the Federal Republic of Nigeria.Census Report. National Population Commission, Abuja.

NVRI, 1994.Farmer training on quail production and health management. National Veterinary Research Institute Vom, Nigeria. Pg.44.

Obiona, F. C. (1992). A Guide to Poultry Production in the Tropics.AcenaPublishers : Enugu.

Ogundari, K. and Ojo, S.O. (2007). An Examination of Technical, Economic And Allocative Efficiency of Small Farms: The Case Study of Cassava Farmers InOsun State of Nigeria. *Bulgarian Journal of Agricultural Science.*13:185-195

Ogundari, K., Ojo, S.O. and Ajibefun, I.A. (2006). Economies of Scale and Cost Efficiency in Small Scale Maize Production: Empirical Evidence from Nigeria. *Journal of Social Science.* 13(2): 131-136

Ojuekaiye, E. O. (2001). Economic Analysis Of Cassava Production in Three Local Government Area f Kogi State Unpublished M.Sc Thesis, Department of Agricultural Economics and Rural Sociology, Ahmadu Bello University, Zaria, Nigeria.

Okike, I. (2000). Crop-Livestock Interaction and Economic Efficiency of Farmers in the Savanna Zone of Nigeria. Unpublished Thesis, Department of Agricultural Economics, University of Ibadan, Nigeria.

Okoruwa, V. O. and Ogundele, O. O. (2006).Technical efficiency differentials in rice production technologist in Nigeria. African Economic Research Consortium, Research paper No.154.

Oladiebo, J.O and Fajuyigbe, A.A. (2007). Technical efficiency of women upland rice farmers in Osun state, Nigeria. *Journal of human ecology* 22(2):93-100.

Oladeebo, J.O. 2003 “The Effect of Socio-Economic Characteristics of Farmers on Land Degradation in the Derived Guinea Savanna Ecological Zone of Nigeria” *International Journal of Environmental Issues*, 1 (1):237-243.

Oladele, O.I 2004.Effect of World Bank Loan Withdrawal on the Performance of Agricultural Extension in Nigeria. Nordic *Journal of African Studies*, 13(2):141-145

Olaleye, R. S, Ibrahim, M. and Ojo, M. A. (2009).Probit Analysis of Women’s Access to Agricultural Inputs in Bosso Local Government Area, Niger State, *Nigeria Journal of Agricultural Extension.*13 (2):1-9.

Olayemi, J. K. (1996) A Survey of Approaches to Poverty Alleviation. Paper Presented at the NCEMA National Workshop on Integration of Poverty Alleviation Strategies into Plans and Programmes in Nigeria NCEMA Ibadan.

Olubamiwa O.; Haruna E. S.; Musa U. ; Akinwole T. O.; Combin L. H.andLonge, G. O.(1999). Effects of Different Energy Levels of Cocoa Based Diets on the Productive Performance of Japanese Quail. *Nigeria Journalof Animal Production*, 26: 88 – 92.

Olukosi J.O., Eehabor P.O. (1988). Introduction to Farm Management Economics Principles and Application AgitapPublishers Ltd, Zaria, Nigeria.

OlukosiJ.O.andA.O.Ogungbile, (1989), *Introduction to Agricultural Production Economics: Principles and Application.*Agitab publishers, ZariaPp 112.

Oluwatayo, A.B. Sekumade O., &Adesoji, S.A. (2008). Resource Use Efficiency of Maize Farmers in Rural Nigeria: Evidence from Ekiti State, Nigeria. *World Journal of Agricultural Science*, 4(1):91-99.

Oluwatomi, O. (2011) www.tribune.com.ng/index.php/wealth

Oluwatomi, O. 2011.Raising Quails: A Beginners Introduction. Tribune.com

Oluyemi, J. A. and Roberts, F. A. (2000).*Poultry production in the warm climate*.MacmillanPublisher Ltd. London

Omonona, B.T. and Agoi, G.A. (2007). An Analysis of Food Security Situation AmongNigerian Urban Households. *Journal of central European Agriculture*, 8 (3): 397-401.

Onyewuchi, U. U., Offor, I. R. and Okoli, C. F. (2013).Profitability of Quail Bird and Egg Production in Imo State.*Nigerian Journal of Agriculture, Food and Environment*. 9(1):40-44

Ortlieb.G. 2013. Raising Coturnix Quail. www.howtoraisequail.com/coturnix quail. Randall, M. and Bolla, G. 2008. Raising Japanese Quail. State of New South Wales Department of Primary Industies. Prime Fact 602 2nd Edition.

Rahman, S. A. and Umar H.S. (2009). Measurement of Technical Efficiency and its Determinants in Crop Production in Lafia Local Government Area of Nasarawa State, Nigeria.*Journal of Tropical Agriculture, Food, Environment and Extension.* 8(2):90-96

Randall, M., and Gerry, B. (2008). Raising Japanese Quails. Prime Facts, 602:1- 5.

Rankling, F. W., Artin, A., Lison G. M., Artin, D. and Nnabelle, M. A. (1998).Quail: An egg and meat production system. www.echocommunity.org/../quailegg.pdf

Robbins, G. E. S. (1981). Quails, their Breeding and Management. Publisher – World PheasantAssociation (WPA), 9:10.

Rodriquez, T. J., Sarda, P. F., and Puigcerver, M. (2012). Post – Breeding Movements and Migration Pattern of Western Population Quails: From Knowledge to Hunting Management. Animal Biodiversty and Conservation, 333- 342.

Sabo, E. (2006). Participatory Assessment of the Impact of Women in Agriculture Programme of BornoState, Nigeria.*Journal of Tropical Agriculture*. 44 (1-2): 52-56.

Sahin, N., Akdemir, F., Orhan, C., Kucuk, O., Hayirli, A. and Sahin, K. (2008). Lycopene-enriched Quail Egg as Functional Food for Humans. *Food Research International*, 41: 295-300.

Seid H, Hassen B, Yitbarek WH (2013). Postharvest Loss Assessment of Commercial Horticultural Crops in South Wollo,Ethiopia"Challenges and Opportunities".Food Science Quality Management.17:34-39

Serres, H**.** (1992). *Manual of Pig Production in the Tropics*. CAB International.

Siddique S. A. and Mandal M. A. S. (1996). Economics of Japanese Quail Farming in Dhaka Metropolitan City.Bangladesh J. Agric. Econs. XIX, 1& 2 (1996): 71-84

Singh, N.P., Kumar, R. and Singh, R.P. (2006) Diversification of Indian Agriculture: Composition, Determinants and Trade Implications. *Agricultural Economics Research Review*, 19: 23-36.

Singh, L. M. (2005). Japanese Quail Demonstration-cum-Production. Manipur Science and Tehnology Council: Manipur.

Shanaway, M. M. 1994. Quail production systems: A review. Food and Agriculture Organisation.

Shim Kim Fah. 2005. Nutrition and Management of Japanese Quail in the Tropics. www.quail place.com.

Shwartz, R. W. and Allen, W. K(1981).The effect of aging on the protein requirement of naturefemale Japanese quail for egg production.*Japanese poultry Science*. 60 (2) 342 – 348.

Smith, A. J.(2001). Poultry. 2nd Ed. Macmillan Publishers Ltd London pp 1 – 11.

Tambe, R.E. (1995) The economics of cocoyam production by small holder farmers inManyaDivision, South west province of Cameroun, M.Sc. Project ReportDepartment of Agricultural Economics, University of Nigeria, Nsukka.

Thomas, D. (1990). Intra-Household Resource Allocation an Inferential Approach. *Journal of Human Resources 25 (4): 635-64.*

Taylor, G.T and Shonkwiler, J.S. (1986). Alternative Stochastic Specification of the Frontier Production Function in the Analysis Of Agricultural Credit Programs And Technical Efficiency. *Journal Of Development Economics. 21:149-160*

Tijani, A.A., Oshitimehin, K.O. (2007). Economic Pesticide Use among Farmers in Edo State, Nigeria. *Research Journal of Agricultural Biological Sciences*, 3 (3), 129-132

Tunsaringkarn, T., Tungjaroenchai, W. and Siriwong, W. (2013). Nutrient Benefits of Quail(Coturnixcoturnix japonica) Eggs. *International Journal of Scientific and Research Publications*, 3(5): May 2013.

Wilkinson, J. (1999). Physical Healing Atonement and the Body in the Old Testament.

Winrock, N. (1992). Assessment of Animal Agriculture in sub-Saharan Africa.*Winrock International, Morrilton, Arkansas,* USA pp. 125

Xu, X and Jeffrey (1995) "Rural Efficiency and Technical Progress in Modern Economic Evidence fromRice Production in China". Staff Paper 95 – 102. Dept. of Rural Economy, Faculty of Agriculture,Forestry and Home Economics, University of Edmonton Canada.

Ya'aisheModu, Alice J. Putai and A. M. Petu-Ibikunle (2009).An Economic Analysis of Cowpea Production among Women Farmers in Askira/Uba Local Government Area Borno State Nigeria.*African Journal of General Agriculture*. 6(1):1-11

APPENDIX I: Farmers' Research Questionnaire, for Quail egg producers

ECONOMIC ANALYSIS OF QUAIL PRODUCTION AMONG SMALL HOLDER FARMERS IN TWO LOCAL GORVERNMENT AREAS OF KADUNA STATE, NIGERIA

Dear Respondent**,**

This questionnaire will be used by a student of Department of Agricultural Economics and Rural Sociology, Faculty of Agriculture, Ahmadu Bello University, Zaria. Please, respond or tick where necessary. All information will be treated with utmost confidentiality and will strictly be used for the purpose of research only. Thanks for your cooperation.

SECTION A: BACKGROUND INFORMATION OF THE FARMER

Questionnaire No……………………..….. Name of Respondent……………………………

Village…………………………………… L.G.A…………………… Date……../……../2014.

SECTION B:SOCIO-ECONOMIC CHARACTERISTICS OF THE FARMER

1. Sex: Male ( ) Female ( )
2. Age of respondent (years): ……………………………………………………
3. Marital status: (a)Single ( ) (b) Married ( ) (c) Widow ( ) (d) Widower ( ) (e) Divorce ( )
4. Household size: ………………………………………………………………
5. Level of education……………….……………………………………………..
   (a) No formal education: ( )
   (b) Adult-education: ………………………. Years
   (c) Primary education: ……..……………….Years
   (d) Secondary education: …….……………..Years
   (e) Post-secondary education : …………………………years

6. Family Size (All the number of the people depending on you for living)……………

   (a) No of Adult Male ( ) (b) No of Adult female ( ) (c) Children >15yrs ( ) (d) Children <15yrs ( )

7. How long have you been in quail farming? (Years of experience)…………………

8. Do you belong to any co-operative/Association? Yes ( ) No ( )

9. If yes, (Years of participation) -------------------------

10. What benefit did you derive as a member?

11. What is your major source of capital for quail farming?

A .Personal savings ( ) b. credit (borrow) ( ) c. Friends and family ( )

d. Money Lenders (Borrow) (   )

12. If you borrow, what were the sources of the credit?

a. commercial bank(   ) b. Bank of Agriculture ( ) c. Cooperative Society (   )   d. Money Lenders (   )   e. Friends and Family (   ) f. Others (specify)…………………………………………………………

13. How much did you borrow to finance last production? (Fill for the source you indicated in Q .12)

SOURCE OF LOAN	AMOUNT(₦)	INTERST RATE (%)
Commercial Bank		
Bank of Agriculture		
Cooperative Societies		
Money Lenders		
Friends And Family		
Others (Specify)		

14. Have you been visited by an extension agent? Yes (   ) No (   )

15. If Yes, How many times in last one year?

16. What activities did the agent teach you? ....

17. Of what benefit were the techniques learnt to you to the success of your farm? ....

18. Have you been trained on quail farming? Yes (   ) No (   )

19. If Yes, which organization conducted the training?

20. Was the training beneficial to you?

a. Not beneficial (   ) b. somehow beneficial ( ) c. beneficial (   )   d. very beneficial (   )

21. Weekly labour supply by type, time and cost.

Operations	N0 of birds	Hire Labour			Family Labour		
		No of people	No of Hours	Cost (₦)	No of people	No of Hours	Cost (₦)
Feeding (feed & watering)							
Egg collection							
Litter change							

22. Weekly feed supply. Fill the table below as appropriate as possible

Types of feed	Quantity (25kg bag/week)	Price/25kg bag	Total feed cost/week
Commercial feed			
Chick mash (0-5weeks)			
Layers (6-12weeks)			
On-farm mixed feed			
Chick mash (0-5weeks)			
Layers (6-12weeks)			
Total			

23. Indicates the consumables used on your farm

Parameters	**Quantity**	**Total cost**
Type of vaccine		
i.		
ii.		
Drugs used		
I		
Ii		
Others		
Debeaking		
Fuel (litres)		
Water		
Electricity		
Disinfectant		
Litter materials		

24. Indicates the equipment you used for egg/meat production on your farm

Equipment	Quantity	Year of purchase	Cost/unit
Feeders			
Chick			
Adult			
Drinkers			
Chick			
Adult			
Brooders			
Lighting			
Heat source			
Scale			
Wheel barrow			
Laying nests			
Battery cages			
Egg crates			
Polythene			
Others			

25. Do you own the poultry house? Yes ( ) No ( )

26. If owned, when was it built? ....

27. How much did it cost you to build? …………………………

28. How much do you think is its present value? …………………………….

29. Apart from the building, does the land belong to you? Yes ( ) No ( )

30. If yes, how much did you buy it? ....

31. In which year did you buy it? …………………………

32. How much do you think is its present value? …………………………….

33. If you do not own a poultry house, did you rent the one you are using now?Yes (   ) No (   )

34. How much per year? …………………………….

35. How much do you spend on transportation? …………………………….

Production information on Day-old chicks and pullet

36. How many day-old chicks did you purchase? …………………………….

37. What was the price? …………………………….

38. How many reach point of lay? …………………………….

39. If you purchase point of lay, how much did you buy? **…………………**

40. What was the price for pullet? …………………………….

41. How many did you purchase? …………………………….

42. How many did you lost during the production period? …………………………….

43. Information on egg production

Parameters	Quantity/week	Price/unit	Receipts
Egg sales in crate			
Cracks			
Gift/house use			
Sales of feed bags (empty)			
Sales of manure			
Spent layers			

44. (i) Information on quail output

Plot No	No. of birds produced(Kg)	Total Qty sold	Price/Unit
1			
2			
3			

45. Where do you sell your produce?

a. Farm gate (   ) b. Rural market ( ) c. Urban market (   )

46. When do you sell your produce?

a. immediately after maturity (   ) b. Few months after maturity ( ) c. Off season (   )

CONSTRAINTS

47. What are your constraints as farmer?

(i) ………………………………………………….

(ii)…………………………………………………..

(iii) ………………………………………………….

(iv)………………………………………………….

30. Suggest ways in which the above constraints can be reduced for farmers in Kaduna State

(i) ……………………………………………………………

(ii)…………………………………………………………….

(iii)……………………………………………………………

(iv)……………………………………………………………

(v)……………………………………………………………

Thank you.