ECONOMIC ANALYSIS OF TURKEY PRODUCTION IN KADUNA AND ZARIA TOWNS OF KADUNA STATE, NIGERIA

BY

EMMAH, Simon Abdullahi, B.Agric(ABU,1997)
M.Sc/AGRIC/27358/2001-2002

**A THESIS SUBMITTED TO THE POSTGRADUATE SCHOOL,
AHMADU BELLO UNIVERSITY, ZARIA,
NIGERIA.**

IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF MASTER OF SCIENCE IN AGRICULTURAL ECONOMICS.

**DEPARTMENT OF AGRICULTURAL ECONOMICS
AND RURAL SOCIOLOGY, FACULTY OF AGRICULTURE,
AHMADU BELLO UNIVERSITY, ZARIA.
NIGERIA.**

October, 2006.

DECLARATION

I declare that the work in the thesis entitled 'Economic analysis of turkey production in Kaduna and Zaria towns of Kaduna State' has been performed by me in the Department of Agricultural Economics and Rural Sociology under the supervision of Dr. Ben Ahmed and Professor A. O. Ogungbile.

The information derived from the literature has been duly acknowledged in the text and a list of references provided. No part of this thesis was previously presented for another degree or diploma at any university.

_____ _____

Emmah, Simon Abdullahi DATE

CERTIFICATION

This thesis entitled "ECONOMIC ANALYSIS OF TURKEY PRODUCTION IN KADUNA AND ZARIA TOWNS OF KADUNA STATE, NIGERIA" by Emmah, Simon Abdullahi meets the regulations governing the award of the Degree of Master of Science in Agricultural Economics of Ahmadu Bello University, Zaria and is approved for its contribution to scientific knowledge and literary presentation.

_____ _____
Dr. Ben Ahmed DATE
Chairman, Supervisory Committee

_____ _____
Professor A.O. Ogungbile DATE
Member, Supervisory Committee

_____ _____
Dr. Ben Ahmed DATE
Head of Department

_____ _____
Professor J. U. Umoh DATE
Dean, Postgraduate School

DEDICATION

This thesis is dedicated to ALMIGHTY GOD, whose grace and favour provided the funding for this study, my parents- Mr. Innocent Idakpo and Mrs. Martina Azara Emah who inspired my zeal for education, and my beloved fiancée- Miss Rose Enyojo Ogbe whose love, understanding and friendship sustained me throughout the course of this study.

ACKNOWLEDGEMENT

My profound gratitude goes to God the creator and the provider for His goodness, mercy, favour, protection and especially for seeing me through this programme successfully.

My sincere appreciation goes to my Supervisors Dr. Ben Ahmed and Professor A.O. Ogungbile for their invaluable guidance, supervision, contributions, understanding and advice, thus making this work a reality.

I highly appreciate Professor I.I Dafwang of National Agricultural Extension and Research Liaison Services (NAERLS) for his unselfish invaluable contributions in the provision of some important literature for this study. My heartfelt gratitude also goes to Mr. Uwar Effiong of National Animal Production Research Institute (NAPRI) and Mr. John of Central Bank Nigeria (CBN) Abuja for their moral support and provision of some necessary information and materials for this work.

My immeasurable gratitude to the members of my family especially my parents Mr. Innocent Idakpo Emah and Mrs. Martina Azara Emah who introduced me to the Western Education, my uncle-Mr. Clement Omale for his unflinching support through out my course of studies. Gratitude also goes to my dear younger brothers and sisters for their prayers and moral support.

In a special way, I appreciate my beloved friends, brothers and sisters in persons of Rev. Dr. Nicholas Okpe (Fr.) in Germany, Dr. Andrew Uloko, Pharm. Martins Emeje, Mr. Linus Shaibu, Mallam Husseni Okeme, Mr. Halilu Isah (Halisa), Mallam Ibrahim Salifu (Kindo), Mr. Dominic Adamu, Mr. Benson Ochimana, Miss Blessing Okpe, Mr &

Mrs Stephen Abdullahi, Miss Victoria Adejoh and Mrs. Pauline Asuquo for their unflagging encouragement and support towards the success of this programme.

I sincerely appreciate the concern and encouragement of Professor J.O. Olukosi, Professor T.K. Atala, Mr. Damisa Maiyaki, Dr. Zakari Abdulsalam, Mr. Samuel Duru, Mr. Macurley Magaji and Dr. Shehu Rhaman (my former second supervisor) now of Nasarawa State University.

I appreciate the warmth company of my course mates in persons of Mr. Ugbabe Omadachi, Mr. Babangida Umar, Mallam Oseni Yusuf, Mallam Sani Isiaka, Mr. Akogwu Godwin, Mr. Joseph Osaka, Miss Lilian O. Adah and others. Special thanks to my friend Kizito Emaikwu who was like a sign post to me in the Department.

Thanks to all the staff and students of the Faculty of Agriculture, and the Department of Agricultural Economics and Rural Sociology for their friendliness.

I acknowledge and appreciate anybody who has in one way or the other contributed to the success of this study but have not been mentioned due to space. Once again I appreciate the care, love, prayers and understanding of my fiancée-Miss Rose Enyojo Ogbe.

ABSTRACT

This study was aimed at examining the economic analysis of turkey production in Kaduna and Zaria towns of Kaduna State with the specific objectives of describing the socio-economic characteristics of the turkey farmers, determining the profitability, estimating production function, examining resource use efficiency and identifying the constraints to turkey production. Forty-five turkey farmers were randomly selected from a list of fifty-five turkey farmers identified in the study area. The sampled farmers were selected from twelve parts of Kaduna and Zaria towns where turkey production was predominant. The data were collected from June to December 2005 by the use of oral interview and structured questionnaires. Analysis of the data was done using a combination of descriptive statistics, production function and net farm income analyses. The result showed that all the turkey farmers in Kaduna and Zaria towns were engaged in turkey production on a part-time basis. Double log production function was used to estimate the production function for turkey production. The double log function had an adjusted R square ($\overline{R}^2$) value of 0.79 with all the inputs (labour, feed and capital) each being significant at 1% level of probability. The cost and return analysis indicated that the total cost of production for an average of sixty seven turkeys was at average cost of ₦99, 975. While the average returns was ₦186, 990. The net farm income for both towns was ₦87, 015 and the rate of return on investment per naira was 87 kobo per 100 kobo invested. Thus one Naira invested on an average of sixty seven turkeys within the period of eight months will yields 187% indicating that turkey production was profitable in the study area. Even though turkey production was economically viable in Kaduna and Zaria towns, the problems that were found limiting expansion of the enterprise include poor

marketing services, high cost of feed/feed ingredient, high cost of poults, inadequate credit, fake and high cost of drugs, vaccine and veterinary services, and lack of extension services. It was recommended that producers should target production maturity to high demand periods to cob seasonality in marketing of turkeys and their products. Furthermore, farmers should be trained to formulate their own feeds to minimize cost and adulteration of commercial feeds. More hatcheries should be built by individuals, private and government organisations to minimize the cost of poults and to enhance their qualities.

TABLE OF CONTENTS

	Page
Title page - - - - - - - - - -	i
Declaration - - - - - - - - - -	ii
Certification - - - - - - - - - -	iii
Dedication - - - - - - - - - -	iv
Acknowledgement - - - - - - - - -	v
Abstract - - - - - - - - - -	vii
Table of Contents - - - - - - - - -	ix
List of tables - - - - - - - - - -	xiv
CHAPTER ONE	
1.0 INTRODUCTION - - - - - - - -	1
1.1 Problem statement - - - - - - - -	3
1.2 Objective of the study - - - - - - - -	4
1.3 Justification of the study - - - - - - -	5
CHAPTER TWO	
2.0 LITERATURE REVIEW - - - - - - -	7
2.1 Origin of turkey production - - - - - - -	7
2.2 The business/economics of turkey production - - - - -	8
2.3 Cost and returns in production - - - - - - -	12
2.4 Concepts of resource use efficiencies - - - - - -	15
2.5 Production function analysis - - - - - - -	19

2.5.1 Quadratic production function - - - - - - 19

2.5.2 Cobb-Douglas production function - - - - - 20

CHAPTER THREE

3.0 METHODOLOGY - - - - - - - 22

3.1 The study area - - - - - - - - 22

3.2 Sampling techniques - - - - - - - 24

3.3 Data collection techniques - - - - - - 25

3.4.0 Analytical techniques - - - - - - - 25

3.4.1 Descriptive statistics - - - - - - - 25

3.4.2 Production function analysis - - - - - - 25

3.4.2.1 Specification of the empirical models - - - - 25

3.4.3 Resources use efficiency - - - - - - 27

3.4.4 Net farm income - - - - - - - 29

3.4.5 Elasticity of production - - - - - - 30

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION - - - - - 31

4.1 Socio-economic characteristics of the respondents - - - 31

4.1.1 Sex of respondents - - - - - - - 31

4.1.2 Age of respondents - - - - - - - 32

4.1.3 Marital status - - - - - - - - 33

4.1.4 Level of education - - - - - - - 33

4.1.5 Household size of respondents - - - - - - 34

4.1.6 Major occupation - - - - - - - 35

4.1.7 Membership of a co-operative society - - - - - 35

4.1.8 Years of experience in turkey production - - - - 36

4.1.9 Source of labour - - - - - - - - - 37

4.1.10 Stock population (flock size) - - - - - - 38

4.1.11 Credit Acquisition - - - - - - - - 39

4.2 Management practices of the respondents - - - - 39

4.2.1 Systems of keeping turkeys - - - - - - 40

4.2.2 Housing and equipment used - - - - - - 40

4.2.3 Health and practices of turkeys - - - - - - 40

4.2.4 Feeding and water supply - - - - - - 42

4.2.5 Poult handling - - - - - - - - - 43

4.2.6 Record keeping - - - - - - - - - 43

4.3 Inputs requirements and turkeys output - - - - - 44

4.3.1 Labour - - - - - - - - - 44

4.3.2 Feed - - - - - - - - - 44

4.3.3 Capital (poults, medication and utilities) - - - - 44

4.3.4 Turkey output - - - - - - - - 45

4.4 Production function analysis - - - - - - 46

4.4.1 Multiple regression analysis for turkey production - - - 47

4.4.2 Marginal value productivities and resources use
Efficiency turkey production - - - - - - 47

4.4.3 Marginal physical products and elasticity of production - - 49

4.5 Cost and returns in turkey production - - - - - 50

4.5.1 Costs structure of an average turkey producer - - - - 50

4.5.1.1 Feed cost - - - - - - - - 50

4.5.1.2 Cost of purchasing poults (day-old) - - - - - 51

4.5.1.3 Labour cost - - - - - - - - 51

4.5.1.4 Cost of drugs/veterinary services - - - - - 51

4.5.1.5 Cost of utilities - - - - - - - 52

4.5.1.6 Transportation cost - - - - - - - 52

4.5.1.7 Cost of housing and equipment - - - - - 52

4.5.2 Returns and profitability analysis - - - - - 54

4.5.2.1 Sale of mature turkeys - - - - - - 54

4.5.2.2 Sale of empty bags - - - - - - - 54

4.5.2.3 Sale of manure turkey droppings and other waste products - - 54

4.5.2.4 Returns and net farm income of the turkey producers. - - 54

4.6 Problems of turkey production - - - - - - 56

4.6.1 Poor marketing services - - - - - - - 56

4.6.2 High cost of feeds - - - - - - - 57

4.6.3 High cost of day-old poults - - - - - - 57

4.6.4 Inadequate credit - - - - - - - 58

4.6.5 Fake and high cost of drugs, vaccine and veterinary services - - 58

4.6.6 Lack of extension services - - - - - - 59

CHAPTER FIVE

5.0 Summary, Conclusion and Recommendation - - - - 60

5.1 Summary - - - - - - - - - 60

5.2 Conclusion - - - - - - - - 62

5.3 Recommendations - - - - - - - - 63

5.4 Limitation of the study - - - - - - - - 64

References - - - - - - - - - 65

Appendix - - - - - - - - - 70

LIST OF TABLES

Page

Table 4.1 Distribution of the turkey producers by sex - - - 32

Table 4.2 Distribution of turkey producer by age - - - - 32

Table 4.3 Distribution of turkey producer by marital status - - - 33

Table 4.4 Educational level of respondents - - - - 34

Table 4.5 House size of the respondents - - - - - 34

Table 4.6 Distribution of turkey producers according to major occupation - 35

Table 4.7 Distribution of respondents according to membership of a Cooperative society - - - - - - 36

Table 4.8 Distribution of respondents according to years of experience In turkey production - - - - - - 37

Table 4.9 Distribution of respondents according to source of labour - - 38

Table 4.10 Distribution of respondents according to their stock population - 38

Table 4.11 Vaccination schedule for turkeys - - - - - 42

Table 4.12 Marginal value productivities and resource use efficiency for turkey production - - - - - - - 49

Table 4.13 Estimated marginal physical products and elasticity of Production of inputs used - - - - - - 50

Table 4.14 Costs structure for turkey production based on the average Of 67 turkeys - - - - - - - 53

Table 4.15 Costs, returns and net farm income from turkey production - 55

Table 4.16 Major problems identified militating against turkey production In the study area. - - - - - - - 59

CHAPTER ONE

INTRODUCTION

Poultry production forms an important component of Nigeria's livestock sub-sector. As a provider of employment and income, poultry production constitutes an important form of livelihood for rural and urban dwellers. The bulk of the poultry meat and eggs are produced by small holders who adopt different production strategies in consonance with the little resources available to them while the commercial poultry production for meat and eggs are by urban and peri-urban dwellers (Eduvie, 2002).

The poultry population in Nigeria is estimated at 104.3 million comprising of 72.4 million chickens, 11.8 million of ducks, 4.7 million of guinea fowls, 15.2 million of pigeons and 0.2 million of turkey (FDLPCS, 1992). The poultry is said to constitute a major animal protein source in this country.

However, according to Nwagu (2002), there is consensus that about 90% of this figure derives from indigenous poultry stocks in Nigeria is in turn composed of chickens (91%), guinea fowl (4%), duck (3%), turkeys and others (2%). Although the indigenous species are characterized by small body size and rather poor production, they have become indigenous to the rural sector with the rural dwellers (about 70% of the Nigerian population), as the primary beneficiaries. Poultry which is next only to ruminants as a source of animal protein in Nigeria accounts for almost 25% of local meat production.

Turkey production is an aspect of the poultry industry which although not popular in Nigeria, is very popular in many parts of the world especially Europe and America where they play an important role in the supply of meat and eggs. The meat is especially

considered by many as a luxury meat. Apart from their role in protein supply, they have an aesthetic value due to their beauty (Ogundipe and Dafwang, 1980). The duo also stated that turkeys are adaptable to wide range of climatic conditions and can be raised successfully almost anywhere in the world if they are well fed and protected against diseases, predators and adverse weather conditions. Turkeys grow faster than broiler chickens and have a slaughter weight that is about double that of the broiler chicken at the age of twelve (12) weeks. Turkeys are more delicate than chicken and since they are raised mainly for meat, the demand is likely to fluctuate with seasonal demand for meat.

Although, turkey production, consumption and trade are much lower than for chicken, they have been affected by many of the same trends that have dominated the broiler industry (Dale, 2000).

According to Gascoyne (1988), turkey production has been one of the fastest growing sectors of the total meat market in North America and Western Europe where 90% of production occurs. From being a whole bird consumed at holiday time, the turkey has now through further processing become a meat available year round in the form of breast products, harm, sausage, salami, etc.

> Internationally, about 4.7 million metric tons (mt) of turkey meat were produced in 1997 of which the U.S.A produced 2.3 million metric tons (FAO, 1999). In Nigeria, the main reason probably for producing turkeys is to sell them to wealthy families at festive periods and to present as gifts to worthy clients by some corporate organization. The sale of turkey parts is a very lucrative business in Lagos and some other parts of the country.

1.1 Problem Statement

While the production of other types of poultry meat has rapidly increased in recent years in Nigeria, very little has been achieved in turkey production. Consumers continue to pay high prices for imported turkeys and even for local turkeys. The reason for apparent inertia in turkey production appears to be lack of appreciation of its potential in contributing to the protein needs of the consuming public or perhaps the lack of understanding of its management and production requirement (Nwagu, 2002).

According to Tanko (2000), with the economic downturn from 1984, characterized by rising inflation and weakened consumer purchasing power, many poultry farms collapsed. In the same vain, structural reform programmes which lowered the exchange rate of the naira and later the import prohibition on maize feed supply and poultry product both expensive and unpredictable.

Indigenous turkey is a neglected “child”. It feeds houses and manages itself and it is also left to the mercy of environmental hazards. Indigenous turkey production, to a large extent is still subsistence. Research activities on indigenous turkeys are still very scanty (Ojewola, *et al*., 2001).

Udokainyang (2001) also stated that turkey production in Nigeria has largely remained at the small holder level due to various reasons ranging from management problems to lack of incentives by government.

Literatures also show that substantial work has been done in Kaduna and Zaria towns of Kaduna State on other aspects of poultry especially the chickens with little or no

attention to turkey as specie. Production information and profitability of the turkey enterprise are currently lacking in the study area.

Despite the importance of turkey to human nutrition and the economy of Nigeria, there is little to show in terms of production and economic aspect of turkey. There is therefore a clear need for studies to be conducted on the Economics of Turkey production in the study area. This situation raises the following questions;

i. What are the socio-economic characteristics of the turkey producers?
ii. What is the input-output relationship in turkey production?
iii. Is turkey production profitable?
iv. What are the constraints that affect turkey production in Kaduna and Zaria towns?

1.2 Objective of the Study

The broad objective of the study is to study the economics of turkey production in Kaduna and Zaria towns of Kaduna State. The specific objectives are to:

1. describe the socio-economic characteristics of turkey farmers, their management practices and how they affect production (output).
2. estimate the production function for turkey production.
3. determine the resource use efficiency in turkey production.
4. determine the cost, returns and the profitability associated with turkey production.
5. identify the major constraints to turkey production in Kaduna and Zaria towns.

1.3 Justification

The supply of edible animal protein is grossly inadequate in Nigeria. As we all know, poultry refers to chickens, ducks, turkeys, guinea fowls, geese, etc., but unfortunately, much emphasis has been laid on chicken production at the expense of other poultry birds which are better in terms of feed conversion, and meat (Fisher and Boorman, 1984). With the continued rise in the cost of production of beef, sheep and chicken, which are the primary sources of animal protein in Nigeria, it has become necessary to explore other efficient and less common but potential sources of animal protein for economic viability.

Government has restricted the importation of turkey products. In addition, turkey production has not been given its rightful attention in Nigeria despite the fact that it is known to grow faster and bigger than other poultry breeds with high rate of return on investment (Mbanasor and Sampson, 2004).

Turkeys have been found to be of considerable economic and social significance in the traditional life of Nigerians, in that they are used as presents during festivals like Christmas, both as a sign of appreciation and expression of goodwill. In spite of all these attributes of the local turkey in the diet of Nigerians, it's production has remained very low compare to other poultry species.

In order to increase turkey production, researchers and policy makers have to develop low cost and effective agricultural technologies which will improve turkey production.

Economic information on production is currently lacking in the study area. Economic study that assists turkey producers to get appropriate information on how to

allocate and utilized resources for their production, will encourage turkey production to meet domestic demand and if possible have surplus for export to earn the country foreign exchange.

CHAPTER TWO

LITERATURE REVIEW

2.1 Origin of Turkey Production

The worldwide acceptance of poultry and a special preference of products from the local birds can mainly be attributed to their unchanged composition, pigmentation, taste and suitability for special dishes (Horst, 1990).

Since the beginning of commercial poultry production in Nigeria in the early sixties, the country has depended on the importation of parent stocks and hatching eggs for its poultry industry. Unfortunately, the parent stock farms that sustain our national poultry industry have to go back for renewal of their stocks through importation on an annual basis. This is because all these farms are multiplication (and not breeding) farms and as such are not able to produce parent stocks on a continuous basis. Such dependence on importation has the negative effects of putting a strain on the country's scarce foreign exchange/reserves, creating an avenue for the introduction of poultry diseases which are foreign to the country and offering a high risk of death of chicks in transit over long distances. Stock developed within the country will make annual importation of parent chicks unnecessary. In addition, they will be more adapted to the environment than imported stock (Abubakar, *et al*., 2002).

Turkey, scientifically known as *Meleagris gallopavo* belongs to the family of birds called Meleagrididae. The young birds are called poults, the male birds are referred to as turkey cocks or toms while the female are called turkey hens (Ogundipe and Dafwang, 1980). Turkey was probably domesticated in the first instance in Mexico, from

the Mexican sub-species *Meleagris gallopavo* and was used as a domestic fowl by Indian communities in what is now the South-Western USA (Smith, 1990).

Turkey rearing is not popular in Nigeria primarily because of the management problems often encountered (Ogundipe and Dafwang, 1980). It is however interesting to note that it is known all over the country and with better management techniques available, there is no doubt that many will be attracted to it.

There is only one turkey breed but many species. The principal varieties that have attained commercial importance in many parts of the world are the Broad Breasted, Large White and the Broad Breasted Bronze. Other breeds are the White Holland, the Beltsville Small White, the Black, the Bourbon Red and the Narrangansell (Ogundipe and Dafwang, 1980). Mature cocks and hens of the Broad Breasted Bronze and the Beltsville Small White weigh 19kg and 11kg; 9kgand 6kg respectively (Williamson and Payne, 1977). The Broad Breasted Bronze, a developed selection from the standard bronze attained popularity for meat production during the 1940's and 1950's (Acker, 1968).

According to Ogundipe and Dafwang (1980), the standard weights for adult toms and adult hens are 16-26 and 9.18kg for the Bronze (large sized breed); 15 and 8.18kg for white Holland (medium sized breed), 10.45kg and 5.91kg for Beltsville small white (small sized breed). Normal mature males of all varieties of turkey have a conspicuous black beard attached to the skin of the upper breast region and occasionally have small beard but beards are reared in females of coloured varieties (Marsden, 1971).

2.2 The Business/Economics of Turkey Production

The turkey business is almost like the broiler business except that the production is more seasonal, growth period is much longer, hens and toms are usually grown

separately and much higher proportion are grown on open-range or open-shelter (Acker, 1971).

Turkey rearing is very popular in many parts of the world especially Europe and America. They can be raised successfully almost anywhere in the world if they are well fed and protected against diseases, predators, and adverse weather conditions (Ogundipe and Dafwang, 1980).

According to Ogundipe and Dafwang (1980), turkeys are more delicate than chickens and since they are raised mainly for meat, the demand is likely to fluctuate with seasonal demands for meat. Turkey growers generally lose more birds during the poult stage than at any other time of the season. High mortality in poult could be as a result of improper management such as inadequate provision of light at night in brooder houses resulting in piling and stampeding due to their poor vision but another cause of mortality is disease. Anyone wishing to raise turkeys commercially must be fully conversant with the practical knowledge of raising turkeys and essential management techniques. Adequate planning, financing, availability of inputs and a dependable market are necessary to make a success of the turkey business. A commercial hatchery is also needed for a dependable and healthy poults production.

The common systems for raising turkeys include fenced range, deep litter and a combination of fenced range and deep litter. Ogundipe and Dafwang (1980) also reported that many turkey rearing in Nigeria often wind up after a trial or two because of the problem associated with its management, especially when males and females are reared together and left to lay eggs and hatch on their own as is often the case with chickens. It is therefore, most preferable to raise the female and male turkeys separately. The male

turkeys can be marketed at an earlier age than their female counterparts. This enables the farmer to exploit the extra growth potentials of the male without wasting nutrients and therefore, money on surplus nutrients going into the female.

Among the conditions influencing the practical function of a specific housing system and thus, production economy are stocking density, climate and labour costs (Walker, *et al.*, 1998). It is therefore, up to the general public to decide which advantages and disadvantages of each system they consider the more important.

Turkeys are produced all year round and the type of stock influences the management breeding turkeys. Brooding management requires ambient temperature of 37 – 38^{o}C during the first week with a space of about 80cm^{2} area. They are reared separately at 16 weeks for breeding and feed on a different higher fibre ration.

Nutritionally, according to Acker (1968), turkeys, because of their one stomach compartment usually need a concentrated ration which must be low in fibre and highly digestible since they have small stomach capacity and are without the large numbers of micro organisms needed for bacterial digestion of fibrous feeds. Research has shown that turkeys can be grown at a maximum rate with early maturity, improved finish, all mash, high energy diets, graduated in the quality and quantity of protein and other nutrients according to age and sex of birds (Marsden, 1971).

Turkeys, like broiler chickens have a high requirement for protein and other nutrients in their diets. The rapid rate with which turkey poults grow demands an even higher level of nutrients in their feed than those of chickens. Since there is now greater tendency towards rearing turkeys under total confinement on all mash feed from day old to slaughter, it demands that they be fed properly balanced diets. Poor diets often result in

high mortality rates amongst poults, poor growth and may cause leg weakness amongst the survivors. The best preventive measures against turkey diseases are feeding balanced rations, routine vaccinations, observing good sanitation, avoiding wet patches and avoiding overcrowding (Ogundipe and Dafwang, 1980).

According to Nwangu (2002), like chickens, turkeys require a starter crumb feed for the first four (4) weeks of life followed by rearers ration until two weeks before slaughter, when they are given finisher ration. If they are not fed on proprietary feeds they will put on weight more slowly.

Ogundipe and Sanni (2002) reported that expenditure on feeds accounts for about 57%, 45% and 68% of the total cost of production in broiler, cockerel and egg production respectively. High costs of conventional feeds resources have encouraged inadequate concentrate feeding and low productivity in the Nigeria livestock and poultry industry.

Oluyemi and Roberts (1982) had reported that even if birds are to be fed adlibitum, the quantity of feed to be given still need to be determined. Compared with other poultry, turkeys have greater efficiencies and up to the 5 weeks of age poults use approximately 2.0 pounds (0.9kg) of feed per pound/kg live-weight increase, while at the age of 12 weeks, they require approximately 2-3 pounds (Marais *et al.*, 1970).

The economic efficiency of investments into the poultry industry depends to a large extent, on environmental conditions such as nutrition and general management. Management in this context means identifying the various alternative production strategies or various cost and return elements that could be employed to obtain the highest possible return (Ogundipe and Sanni, 2002).

2.3 Cost and Returns in Production

A producer values the goods at the amount it costs to produce it – total cost of all the productive resources employed. If the consumer places a higher value on the goods, an exchange will take place and the producer will earn a large return. Harvey (1977) says that the firm making the largest profit is the one whose costs are lowest. It will have an incentive to expand production, and, if necessary, can afford to pay more of factors of production. Returns not only indicate that consumers want more of the goods; they are also the inducement to firms to produce these goods.

The total expenditure in turkey production are generally of two categories – variable and fixed expenditures. The fixed expenditures are the costs that remained relatively constant regardless of the level of production. These costs are not used up in one production cycle. The most common fixed costs in turkey production are the costs of buildings and equipment or their depreciation, interest on loans and loan repayment, depreciation on vehicles and taxes.

The variable or operating expenses are those that will be incurred only if production is carried out and the amount of this cost will depend on the kinds and quantities of inputs used. These costs components are used up in production cycle and thus must be re-incurred for each batch or crop. Operating expenses include cost of birds, feed, drugs, vaccination, litter materials, heating (cost of fuel, electricity and gas), water, salaries or wages for labour, marketing cost, advertisement, etc (Ogundipe and Sanni, 2002).

According to Ogundipe and Sanni (2002), the initial costs of acquiring a poultry house will depend on the scale of operation and the type of materials used. The type and

number of equipment used for poultry production also depend on the scale of production and the production module. The major equipment used in poultry production include: tray-feeders, trough feeder, hanging feeder, chick drinkers, plastic drinkers, adult size drinkers, drinker stands, kerosene stoves, buckets, shovels, bowls, brooms, nests, egg and tray.

Though, there is no available study on turkey production in the study area to reveal its profitability. Akinwunmi *et al* (1979) maintains that among the different kinds of livestock that can be profitably produced in Nigeria, poultry has by far the quickest and highest turnover rate. Profitability of poultry products according to Emmah (1997) on the production and marketing of modern poultry in Chikun Local Government Area of Kaduna State revealed that 62% of the respondents said production of broilers was more profitable than that of eggs, layers and chicks. According to him, the high profitability of broilers could be attributed to the low cost of producing broilers and its short time maturity, and less attention and management requirements compared to layers and chicks.

The foregoing literature reviewed show that, though a lot of benefits are associated with poultry production in Nigeria, and other developing African and non-African countries, literatures on turkey production are very scanty and few, and in most cases, that of the economics of turkey production are not available and inaccessible due to poor data storage and communication.

However, result shown by Moctar (2002) on the Economic Analysis of Commercial Egg Production in Sabon Gari and Giwa Local Government Area of Kaduna State reviewed that commercial egg production was not only economically profitable for the producers but also served as a good means of protein source for the families. She

further stated that the average gross margin per bird and average net farm income per bird obtained for the majority of the poultry farmers who are small scale farmers obtained over N2, 293.10 and N2, 234.94 respectively.

A study by Ogundipe and Sanni (2002), on the economics of poultry production in Nigeria reported that a Naira invested in broiler production will yield N0.28 per crop of 500 birds. Considering the fact that the same capital will be re-invested 5 times in a year, the return to Naira invested per year is N1.40. Thus, one Naira invested into broiler production turning out 5 crops in a year will yield 140% return.

The same study on a batch of 500 birds of cockerels per batch revealed that every Naira invested in the production of cockerels will yield 23 kobo returns. If a farmer turns out 6 batches in a year using the same investment capital, the return to Naira invested per year is N1.38. Thus, one Naira invested into cockerel production with 6 batches in a year will yield 138% return.

Leftwich (1979) maintains that fixed cost depends on the size of the farm's operations and not on the output level at which the farm operates. This is because fixed cost is constant for all possible levels of output and, if it were not so, diminishing returns will not occur during agricultural production.

Olayide and Heady (1982) suggested that for a proper cost estimate, market prices for the all purchased inputs and imputed cost of producer owned capital should be considered in order to determine the actual profit on a particular production.

Downey *et al*.(1981) also states that operating in small-scale farms can be increased by the use of family labour but for proper cost allocation, the opportunity cost of family labour should be determined.

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

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 the estimates.

In spite of the limitation, cost-return analysis is a useful tool in enterprise comparison and in indicating a profitable pattern of aggregate input use. This method was used by Olagoke (1991) in Anambra State.

2.4 Concepts of Resource Use Efficiencies

Many authors define the term resources from different perspective. However, Oni (1982), Olukosi and Erhabor (1988), defined resources as those means available for producing goods and services, which are in turn to satisfy wants.

According to Olayemi (1982), resources go beyond the quantities of material inputs available. They include capable manpower, development oriented organization and institutions, good infrastructural facilities, appropriate and constantly improving technology.

Olayide and Heady (1982) also revealed that resources employed in farming may be either stock or flow. Stock resources are not used up they are stored for a later period. Flow resources on the other hand embody flow services. If not used up when given off they will not be available in a later period. The duo further classified resources into mono-period and poly-period. Mono-period resources are transformed into farm products

in a single and discrete production period, as in resources employed in producing a single crop. Poly-period resources are those whose services are employed over several or an infinite number of periods.

According to Adeniyi (1988), the classical assumption guiding the discussion on resource efficiency lies in the motive of profit maximization. This serves as an ideal framework against which various form of efficiencies of production can be adequately measured and tested.

Following this background, Olukosi and Erhabor (1988), referred to "efficiency" or average productivity as the quantity of output (Y) per unit input (X) used in the production process; i.e the average physical productivity (APP). It was further stressed that efficiency could be measured based on various inputs such as labour, livestock and land.

Symbolically, efficiency is measured as

$$APP = \frac{Y}{X}$$

Where:

APP = Average Physical Productivity

Y = Quantity of output

X = Quantity of input

The National Academy of Science (1975), also defined efficiency as the capacity to produce desired results with a minimum expenditure of time, money, energy or materials.

Bagi (1981), Olayide and Heady (1982) identified and examined two types of efficiency to include technical and allocative efficiencies. Bagi (1981) went further to

isolate allocative efficiency into absolute and relative efficiency and affirmed their ability to be analysed in the function framework.

Farell's (1957) identified three forms of efficiency; technical, price and overall efficiencies. Technical efficiency is a ratio of total output to total input. This ratio is one for perfectly efficient form. Price efficiency is defined by the tangencies of the price to the isoquant. This tangency indicates that a minimum possible amount of each input is being used to produce a unit of output at a given level of price. Overall efficiency is a product of technical and price efficiencies. Farell (1957) recognized the problem involved in this exercise and considered comparing the individual firms' performance with the most efficient performance actually achieved rather than setting up an ideal theoretical function.

Relating efficiency to farm size, Adeniyi (1988) argued that one of the possible means of increasing yield and or reducing production cost is through farm size adjustment, particularly in countries that are rich in agricultural land and where government efforts are focused on the effective distribution of this input among users.

He further showed that the productivity of land was higher on small farms than on large ones. Also, an allocation of resources on the farm aside from land revealed that while labour was efficiently utilized on small farms, the use of its input was found to be efficient on large farms. Contrary to this, however, Sahota (1968), revealed that there were no significant difference in yield due to differences in farm size in most of the crop studied.

Commenting on the concept of efficiency in planning and development, Olayide (1982), affirmed that the concept of efficiency is an important cornerstone of economic

theory. The concept according to him extends to planning in which a major purpose is to enhance efficiency in the allocation of national resources for developments.

In measuring resource use efficiency, according to Upton (1979), technical efficiency can be measured by relating the level of output achieved to the level of input used. A firm is said to be technically efficient if it yields the maximum possible output per unit of variable resources (Olayide and Heady, 1982). Technical efficiency can be measured through the Average Physical Product (APP), the Marginal Physical Product (MPP) and the Elasticity of Production (EP). When computed, these relationships can show cases of increasing, constant or decreasing returns to scale.

Allocative efficiency is measured by determining the ratio of marginal value product to marginal factor cost (Singh, 1975, Olomola, 1988). If the ratio is not significantly different from unity, resources have been efficiently utilized.

However, it is worthy of note that efficiency measurement has some problems associated to it. Olayide and Heady (1982), stated that as elegant as Farell's definitions are, they cannot be measured easily since precise measurement rests on the assumption of an efficient isoquant. Efficiency measures as the average productivity of say labour, capital, land and water can only be a meaningful index if any one of the resource is limiting in the production process. In addition, index of efficiency measured as the weighted average of all inputs compared with output as index number pose problems and is consequently not a reliable measure of technical efficiency. Also, the use of cost comparisms in the production process as an index of technical efficiency has restricted application where all farms or plants do not face same factor price.

The theory of the concept of technical efficiency based on the assumption that all firms have identical fixed factor endowments and therefore, short-run concepts of efficiency seem to have a less significant impact in the area of productivity measures than the improvement in technical efficiency which derives from an improvement in technology which is a long-run concept.

2.5 Production Function Analysis

The purpose of production function is to identify and measure how variable input is used to explain the variability in output. According to Olayide and Heady (1982) production function analysis gives the technical relationship between inputs and output in any production system. It also determines the physical relationship between inputs and outputs resource use efficiency and return to scale.

Different forms of production functions are in use for productivity studies. But the choice of any production function will depend on its desirable characteristics. However, both quadratic and Cobb –Douglas production functions are popularly used by researchers. The criteria that usually guide the selection of lead equation(s) are:

i. The value of the adjusted coefficient of multiple determination (R^{-2})

ii. The appropriateness of the sign of the regression coefficient and the

iii. Level of significance of the t-values

2.5.1 Quadratic Production Function (QPF)

The Quadratic production function allows for a distinctive peak denoting a maximum output for a single limitation combination of factors and the elasticity of production is not constant, but declines with input magnitude. It is easy to estimate and also shows whether there is increase or decrease return to factors in a single curve. The possible limitations of this function are that, it may give a negative total product for very high or very low input and that it becomes complex if more variable inputs are included.

The quadratic function for the three variable inputs is given by:

$Y = a + bx_1 - cx_1^2 + dx_2 - ex_2^2 + fx_3 - gx_3^3 + e$ ……. (1)

Where:

Y = turkey output – live weight (kg)

X_1 = labour (man hour)

X_2 = feed (kg)

X_3 = capital (cost of poults, medication and utilities (₦))

a, b, c, d, e and f = constants determined in the regression

2.5.2 Cobb-Douglas Production Function

The Cobb-Douglas production function is normally estimated in logarithmic form either as semi-log or double log. In the semi-log form, either the input or the output is the log form while the double log form, both the input and output are in the log form.

The Cobb-Douglas function is the most widely used functional form in farm production studies. Its popularity is probably derived from its computational ease and the fact that it gives the economic quantities of interest like the elasticity of production, returns to scale and marginal product directly. It is also an efficient user of degrees of freedom.

The Cobb-Douglas production function can only show one stage of production function (constant, increasing or decreasing marginal return) at a time. The major limitation of Cobb-Douglas model according to Heady and Dillion(1972) are the possibility of over estimating an output quantity which equates marginal revenue with marginal cost at high levels of input use, unless an economic optimum is defined for small magnitude of outputs.

Tanko (2000) using the double log production in his study of efficiency of resource use: the case of poultry production had an adjusted multiple determination (R^2)

of 0.65 for layers at 5% level of probability while the coefficient for feed consumption was negative and significant at 5% level of probability. The result further showed that the inputs (number of birds (x_1) and human labour (x_4) were being over-utilised while the other two resources (feed (x_2) and poultry equipment and facilities (x_3)) were being underutilized. However, the elasticity of production for all the inputs were less than one (and negative for feed consumption and human labour input) indicating a decreasing return to scale in layer production.

Cobb –Douglas functional form is given by equation:

$\text{Log } Y = \log_a + b_1 \log x_1 + b_2 \log x_2 + b_3 \log x_3 + e$ …… (2)

Where:

Y = turkey output – live weight (kg)

X_1 = labour (man hour)

X_2 = feed (kg)

X_3 = capital (cost of poults, medication and utilities (₦))

a = constant

b = elasticity of production

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 The Study Area

The study was conducted in Kaduna and Zaria towns in Kaduna State of Nigeria. The provisional result of 1991 census puts the population of Kaduna State at 3,969,252 people and is the largest in the federation after Lagos and Kano States (FOS, 1994). Using an annual growth rate of 2.5%, the population of the state is estimated at 5.6 million people by year 2005.

The three major towns of Kaduna (the state capital) Zaria and Kafanchan are accessible by trunk A and B roads while all the other designated urban centres are accessible by other state roads (KDSRDA, 1996). The local governments that make up the Kaduna towns include; Chikun, Kaduna South and Kaduna North while Zaria town include; Sabon Gari, Giwa and Zaria local government areas

Although majority of the population of Kaduna state live and depend in the rural areas for agricultural production, about two thirds of the state's population are located in the two major centres of Kaduna and Zaria. As a result of the dominance of the two urban centres, there is a continued drift of young men and women into them. Thus, a lot of social facilities such as housing, schools, health institutions, portable water and electricity are inadequate and under serious pressure. The growth of Zaria urban settlement, though influenced by historical circumstance and political authority it wielded prior to the 19^{th} century is also the result of deliberate establishment of educational institutions (Bello, 2000).

Kaduna state is currently made up of 23 Local Government Areas. The state is located between Latitude 9^{o}N and 12^{o}N and Longitudes 6^{o}E and 9^{o}E. The State experiences a typical continental climate with distinct seasonal regions, oscillating between cool to hot dry and humid wet. However, the seasonality is pronounced with the cool to hot dry season being longer than the rainy season.

Agriculture and forest resources are enormous. Although the soils are poor because of leaching and poor cover management, with good conservation and land management practices, it is capable of supporting calcium – rich annual grass for livestock development. Crops that can be found in Kaduna State include: cotton lint and seed, cereals such as maize, sorghum, millet and rice; cassava, soybean, groundnut, ginger and sugarcane.

Livestock resources in the state are still on a small scale, and are used mainly to raise cash during emergencies or meet demands during religious festival (Bello, 2000). Some of the domesticated livestock in this area include cattle, sheep and rams, pigs, goat, chicken, turkey, guinea fowl, etc.

In terms of investment opportunities, Kaduna State has instituted agencies to cater for the interests of local, national and foreign entrepreneurs/industrialists. Mainly, the Ministry of Commerce and Industry arm of the state government is now charged with the responsibility of maintaining a good economic climate. For example, Kaduna and Zaria, have up to seven infrastructural facilities and four industrial estates respectively to provide access roads, water and power. Historically, Kaduna State is known for its liberality and hospitality. It comprises of many tribes intermingling with the predominant tribes.

The state has quite a large number of markets such as Kaduna central market, Sabon Gari market Zaria, Makarfi market, Sundu market, kasuwan magani market and other small and big ones scattered in the rural and urban areas including the Kaduna International Trade Fair. Most of these markets attract participants not only from within the state but also from outside the state, as far as southern and eastern parts of the country and even beyond.

3.2 Sampling Procedure

Thirty eight (69%) and seventeen (31%) turkey farmers were identified in Kaduna and Zaria towns respectively through recognizance survey since there was no available list of turkey producers in the state. Out of the fifty-five farmers identified, seven (13%) had between 1-15 turkeys in Kaduna town and three (5%) had between 1-10 turkeys in Zaria towns. Forty five turkey farmers were randomly selected out of the sample frame because they were among the communities where turkey production activities were noted to be more in the state. The selected sample was based on those who have a minimum of twenty four (24) turkeys in a batch of production. Thirty one (69%) turkey farmers who were selected from Kaduna and its environs (Kaduna Polytechnic Staff Quarters, Mando, Television/Ungwar Yelwa, Barnawa, Sabon Tasha, Kakuri, Ungwar Rimi and Ungwar Sarki) had between 28 and 185 turkeys while fourteen (31%) turkey farmers who were selected from Zaria and its environs (ABU Community -Samaru, Shika, PZ and Wusasa) had between 24 and 100 turkeys.

3.3 Data Collection Techniques

Primary data were collected by the use of oral interview and structured questionnaire administered on the turkey farmers. Questionnaires administered to the forty five respondents were done using face to face interview and oral discussions.

The primary data collected focused on variables such as educational status, sex, age, educational level, major occupation, household size and years of experience of turkey farmers. Others include; membership of cooperative societies, flock size, capital acquisition, source of labour, management system and information concerning price of day-old poults, feed cost, feed source, quantity of feed, medication cost, building and other production equipment costs, labour cost and man-hours input for the production cycle and problems militating against turkey production in the study area. The data collected cover about eight months (32 weeks) of production period.

3.4 Analytical Techniques

The following tools were used to analyse the data collected in the study area.

3.4.1 Descriptive Statistics Analysis

Descriptive statistics was used to satisfy objectives 1 and 5. This involves the use of frequency distributions, percentages, mean, standard deviation and coefficient of variation to analyse and summarise the data collected.

3.4.6 Production Function Analysis

This is used to achieve objective two (2).

3.4.2.1 Specification of the empirical models

The implicit form of the production function was expressed as;

$Y = F(x_1, x_2, x_3, \mu)$ …… (3)

Where,

Y = Turkeys output-live weight(kg)

x_1 = Labour (man hours)

x_2 = Feed (kg)

x_3 = Capital (cost of poults, medication and utilities (₦))

μ = errors term included to capture the effect of other variables not included in the Model.

The functional forms of the model are specified as follows:

The linear functional form of equation (3) is given by;

$$Y = a + b_1x_1 + b_2x_2 + b_3x_3 + e \text{ ……..} (4)$$

This assumes a linear relationship between the inputs and output and also a constant marginal productivity of the resources used.

The semi-log functional form of equation (3) is given by;

$$Y = Log_a + b_1 \log x_1 + b_2 \log x_2 + b_3 \log x_3 + e \text{ ……} (5)$$

This functional form is found useful in aggregate production analysis. It allows for constant, increasing or decreasing marginal productivities and also allows for constant elasticity. The function however, does not have a defined optimum and also does not allow for diminishing total product.

The double log (Cobb –Douglas) functional form of equation (3) is given by;

$$\text{Log } Y = Log_a + b_1\log x_1 + b_2\log x_2 + b_3\log x_3 + e \text{ ……} (6)$$

This functional form allows for ease in estimating elasticity of production, return to scale and marginal productivity directly.

The quadratic functional form of the same function is given by;

$$Y = a + b_1x_1 + b_2x_2 + b_3x_3 - b_4x_1^2 - b_5x_2^2 - b_6x_3^2 + b_7x_1x_2 +$$

$$b_8x_1x_3 + b_9x_2x_3 + b_{10}x_1x_2x_3 + e \text{ ……} (7)$$

The quadratic function allows for diminishing total products and negative marginal production and therefore gives a defined optimum. The limitation of the functional form is that it does not allow for very high or very low inputs. It becomes complex to estimate when many variables are included in the production function.

The square root functional form is given by;

$$Y = a - b_1x_1 - b_2x_2 - b_3x_3 + b_4x_1^{0.5} + b_5x_2^{0.5} + b_6x_1^{0.5} +$$

$$b_7x_1^{0.5}x_2^{0.5} + b_8x_2^{0.5}x_3^{0.5} + b_9x_3^{0.5}x_3^{0.5} + b_{11}x_1^{0.5}x_2^{0.5}x_3^{0.5} + e \quad \ldots\ldots\ldots\ldots (8)$$

Where,

Y, $x_1 \ldots x_3$ = as defined in the implicit form

a = Constant term

e = Error term

b_1-b_{11} = estimated regression coefficients

x_ix_j = interaction terms of variables

The expected signs of the coefficient in equations 6 (i.e double log function) are $b_1>0$, $b_2>0$, $b_3>0$. The remaining can carry any sign.

All the models were tried to estimate production function for turkey production and the one that provided the best fit was selected based on the value of coefficient of multiple determination (R^2), appropriateness of the sign of the regression coefficient of the level of the significance of the t-value.

3.4.3 Resource use Efficiency in Turkey Production

The resource use efficiency was computed from:

$$\text{Efficiency Ratio (r)} = \frac{MVP}{MFC} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (9)$$

Where,

r = Efficiency Ratio

MVP = Marginal value product

MFC = Marginal factor cost of a particular input (x_1)

The resource use efficiency was used to achieve objective three (3).

The value of an input depends on the value of output. In the production function of turkey ($Y = x_1,x_2,x_3$) then the marginal physical product of input x_1 ($MPPx_1$) is the change in output (Y) resulting from a unit change in variable input (x_1) from equation (3).

Therefore, $MPP = \frac{dy}{dx_i} = \frac{b_i \overline{Y}}{\overline{X}_i}$ …… (10)

Where double log form is the lead equation

And the MPP of other input x_2 and x_3 can be determined. The marginal value product (MVP) is the value added to the output due to an additional unit of input. It is derived as the product of elasticity of production (b_i) and the price of output.

$MVPx_1 = MPPx_1 \times Py$ …… (11)

Where,

$\overline{Y}$ and $\overline{X}$ are the mean values of the output and input being considered respectively.

b_i = is the estimated regression coefficient of input x_i

Py = is the unit price of output

X_i = is the various input i.e 1 to n

If r =1, it means that resources are efficiently utilized. i. e MVP = MFC = 1

A unit price of input is equal to marginal value of output added. Profit is maximized here and therefore there is optimum production.

If r >1, it implies that resources are under utilized

Therefore, increase in resources with efficient management leads to increase in output.

If r <1, it implies that resources are over utilized

For efficient utilization of input resources there is need to minimize or reduce the amount of resources used.

3.4.4 Net Farm Income Analysis

The Net Farm Income (NFI) was employed to achieve objective four (4). It was used to estimate the costs, returns and profitability of turkey production in the study area. The equation is expressed as;

NFI = TR – TC …….. (12)

NFI = Net Farm Income

TR = Total Returns/ Receipts of turkey output (₦)

TC = Total cost (TCV + TFC) (₦)

TVC = Total variable cost (₦)

TFC = Total fixed cost (₦)

The total variable cost (TVC) includes items like total cost of labour, feed and day old poults purchased while the total fixed cost (TFC) includes depreciation on houses and equipments used by the turkey farmers. The straight line method which assumed a constant rate of annual depreciation was used to calculate the depreciation. The total return is made up of total output (i.e matured turkeys in kg/liveweight) multiply by the unit price of turkey produced and the sales of empty feed bags and manure (turkey dropping and farm wastes) obtained during the production period. The prices used were open market price of the year 2005.

3.4.5 Elasticity of Production (EP)

Farell (1957) stated that the elasticity of production measures a firm's success in producing maximum output from a given set of inputs. The elasticity of production (EP) and returns to scale (RTS) were estimated using formula:

$$EP_{x_i} = \frac{dy}{dx_i} \cdot \frac{X_i}{Y_i} = 1,2,.....k.....(13)$$

$$= \frac{dy}{dx_i} \cdot \frac{\overline{X}_i}{\overline{Y}} = \frac{MPP_{X_i}}{APP_{X_i}}$$

For Cobb Douglas;

$$EP = \frac{b_i \overline{Y}}{\overline{X}} \cdot \frac{\overline{X}}{\overline{Y}} = b_i$$

$\overline{X}_i$ = Mean of variable input xi

$\overline{Y}$ = Mean of output Y

$$\sum_{i=1}^{k} EP_{xi} = RTS$$

Where,

Ep_{xi} = Elasticity of production of input x_1

$\sum_{i=1}^{k} P_{xi}$ = Return to scale i.e sum of elasticity of production

CHAPTER FOUR

RESULTS AND DISCUSSION

This chapter describes the socio-economic characteristics of the turkey producers, turkey production practices, health practices, problems faced by turkey farmers, input and output level for turkey production, and the analysis of the production function including the determination of resource use efficiency and the net farm income analysis.

4.1 Socio-Economic Characteristics of Turkey Producers

The socio-economic characteristics of turkey producers in the study area were examined with respect to age, sex, level of education, household size, marital status, major occupation, membership of a co-operative society, labour used, stock population (flock size) and years of experience in turkey production.

4.1.1 Sex of Respondents

The result of the study shows that about 44% of the turkey producers sampled in the study area were females while 56% of the producers were males (Table 4.1).The result could be attributed to the fact that the cost of investment in turkey production is higher compared to other poultry species like chickens and duck production, men are more involved since they have easy access to credit and other resources. Attah and Gbede (2000)'s work on swine production in Katsina-Ala local government area of Benue State revealed that women were more involved in crops than in livestock production.

Table 4.1: Distribution of the turkey producers by sex

	Kaduna towns		**Zaria towns**		**Pooled data**	
Sex	Frequency	%	Frequency	%	Frequency	%
Female	15	48.4	5	36.0	20	44.4

Male	16	51.6	9	64.3	25	55.6
Total	31	100.0	14	100.0	45	100.0

Source: Field Survey, 2005

4.1.2 Age of Respondents

The result (Table 4.2) shows that about 16% of the respondents were within the ages of between 21-30 years, 51% were between the ages of 31-40 years while 29% and 4% fell between the ages of 41-50 years and 51-60 years respectively. The average age was 38 years. This implies that the majority of the turkey producers in the study area were in the productive and active age and they are likely to accept and adopt beneficial innovations and technologies faster. According to Ekumakama (2000), the participation of young people in agricultural activities is an advantage to agriculture and rural development in the sense that their developments are mainly driven by young people.

Table 4.2: Distribution of turkey producers by age

	Kaduna towns		**Zaria towns**		**Pooled data**	
Age	Frequency	%	Frequency	%	Frequency	%
21-30	6	19.4	1	7.1	7	15.6
31-40	17	55.0	6	42.9	23	51.1
41-50	8	26.0	5	36.0	13	28.9
51-60	0	0	2	14.0	2	4.4
Total	31	100.0	14	100.0	45	100.0
Mean	37 years		42 years		38 years	

Source: Field Survey, 2005

4.1.3 Marital Status

The marital status of the turkey producers in the study area (Table 4.3) indicates that about 13% of the respondents were single while about 87% of them were married.

Considering the age distribution and the fact that the majority of the turkey farmers were males, the bulk of turkey producers in the study area were married men who took turkey production as means of supplementing family income. This suggests that family labour will be readily available for turkey production since the men who assumed the headship of the households can easily utilize family labour.

Table 4.3 Distribution of turkey producers by marital status

Marital Status	Kaduna towns		Zaria towns		Pooled data	
	Frequency	%	Frequency	%	Frequency	%
Single	5	16.1	1	7.1	6	13.3
Married	26	83.9	13	92.9	39	86.7
Total	31	100.0	14	100.0	45	100.0

Source: Field Survey, 2005

4.1.4 Level of education

Taking into consideration that this study was conducted in urban areas where educational facilities are adequate, the level of education (Table 4.4) was high for the respondents. About 24% of the turkey producers had secondary education, 62% of the producers had non degree higher education. The categories that make up the non degree higher education are graduates of colleges of education, polytechnics and monotechnics, while 13% had university education. This means that about 76% of the turkey farmers in the study area had higher education. It is therefore expected that the turkey producers should be able to run the business efficiently.

Table 4.4 Distribution of turkey producers according to educational level

Educational level	Kaduna towns		Zaria towns		Pooled data	
	Frequency	%	Frequency	%	Frequency	%

Secondary Educ.	9	29.0	2	14.3	11	24.4
Non-degree higher Educ.	19	61.3	9	64.3	28	62.3
University Educ.	3	9.7	3	21.4	6	13.3
Total	31	100.0	14	100.0	45	100.0

Source: Field Survey, 2005

4.1.5 Household size

The household size indicates the number of people in the family and reveals the availability of family labour. Table 4.5 showed that about 36% of the turkey producers had a family size of between 1 and 5 people, 60% had between 6-10 persons while about 4% had a family size of between 11-15 persons. The average family size of the turkey producers was seven persons.

Table 4.5 Household size of turkey producers

	Kaduna towns		**Zaria towns**		**Pooled data**	
Household size	Frequency	%	Frequency	%	Frequency	%
1-5	12	38.7	4	28.6	16	35.6
6-10	17	54.8	10	71.4	27	60.0
11-15	2	6.5	0	0	2	4.4
Total	31	100.0	14	100.0	45	100.0
Mean	7 persons		7 persons		7 persons	

Source: Field Survey, 2005

4.1.6 Major Occupation

Table 4.6 shows that majority (58%) of the turkey producers in Kaduna and Zaria towns are primarily civil servants. About 16% and 27% of the producers have poultry keeping and trading as their major occupations. The result implies that none of the turkey producers was keeping turkey solely and so the business of turkey production in the study area was a secondary occupation to support household income. This agrees with Peters *et al* (1994) which reported that majority of the turkey farmers have other jobs.

Another reason for not keeping turkey as a major occupation could be due to high risk at poult's stage and inadequate management skills. Mbanasor (2000) supported this claim in his study of the future of livestock in Nigeria by revealing that Nigeria's livestock industry has problems such as high cost of inputs, risks and lack of market information.

Table 4.6 Distribution of turkey producers according to major occupation

	Kaduna towns		**Zaria towns**		**Pooled data**	
Major occupation	Frequency	%	Frequency	%	Frequency	%
Poultry keeping	6	19.4	1	7.2	7	15.5
Civil service	14	45.1	12	85.7	26	57.8
Trading	11	35.5	1	7.1	12	26.7
Total	31	100.0	14	100.0	45	100.0

Source: Field Survey, 2005

4.1.7 Membership of a Co-operative Society

Table 4.7 shows that 19% of the turkey producers in Kaduna towns are members of Poultry Association of Nigeria (PAN) while in Zaria towns, 14% are members of Poultry Association of Nigeria (PAN). The overall result shows that in the two towns, 18% of the turkey producers are members of a co-operative society. The study further

revealed that the bulk of the respondents (82%) who were not members of the co-operative society gave reasons of their non-membership to include being small scale and unawareness of such association (Poultry Association of Nigeria). The effect of this result is that most of the turkey producers in the study area do not enjoy the assumed benefits accrued to members of a co-operative of producers' societies through pooling of resources together for a better expansion, efficiency and effective management of resources and for profit maximization.

According to Mbanasor (2000), for better development of the livestock industry in Nigeria, the individualistic approach and lack of interaction which hampers the development and optimal utilization of livestock and meat resources should be removed while a cooperative approach adopted to enhance performance.

Table 4.7 Distribution of turkey producers according to membership of a co-operative society

Membership of Poultry Association of Nigeria	Kaduna towns		Zaria towns		Pooled data	
	Frequency	%	Frequency	%	Frequency	%
Member	6	19.4	2	14.3	8	17.8
Non-member	25	80.6	12	85.7	37	82.2
Total	31	100.0	14	100.0	45	100.0

Source: Field Survey, 2005

4.1.8 Years of Experience in Turkey Production

The average number of years of turkey keeping experience in Kaduna and Zaria towns was four (4) years. Years of experience in agricultural production and especially in turkey production helps in determining the accuracy in decision making and in allocation of scarce resources wisely. The result in table 4.8 revealed that 87% of the respondents had 1-5 years of experience in turkey production, 9% had 6-10 years experience while

5% had 11-15 years of experience in turkey production. The four (4) years average experience in the study area is moderately enough for a good production performance since turkey production was considered to be at its rudimentary stage in the study area and in Nigeria in general. Mbanasor and Sampson (2004) outrightly revealed that there was obvious lack of information on specific requirements for turkey production which may be attributed to low level of research on it in Nigeria.

Table 4.8 Distribution of turkey producers according to years of experience

Years of experience	Kaduna towns		Zaria towns		Pooled data	
	Frequency	%	Frequency	%	Frequency	%
1-5	27	87.1	12	85.7	39	86.7
6-10	2	6.5	2	14.3	4	8.9
11-15	2	6.4	0	0	2	4.4
Total	31	100.0	14	100.0	45	100.0
Mean	4 years		4 years		4 years	

Source: Field Survey, 2005

4.1.9 Source of Labour

Major human resource in any agricultural production is labour. Table 4.9 shows that about 62% of the turkey producers in the two towns used family labour only while 38% used the combination of both family and hired labour. None of the turkey producers used hired labour alone. The reason for not using hired labour alone was due to their small size of production and that it is rather regarded as a family business in which personal involvement is part the goal.

Table 4.9 Distribution of turkey producers according to source of labour

Source of labour	Kaduna towns		Zaria towns		Pooled data	
	Frequency	%	Frequency	%	Frequency	%
Family	5	48.4	13	92.9	28	62.2
Both	16	51.6	1	7.1	17	37.8
Total	31	100.0	14	100.0	45	100.0

Source: Field Survey, 2005

4.1.10 Stock population (flock size)

The stock population helps to determine the scale of operation as it relates to benefits and problems. The study revealed that 87% of the respondents had a stock population of 10-100 turkeys while 13% had a stock population of 101-200 turkeys. The mean flock size was 67 turkeys, while the minimum and maximum flock size of the producers were 24 and 185 turkeys respectively. It can therefore be deduced that turkey production in Kaduna and Zaria towns is still on a small scale of operation. This implies that majority of the turkey producers may not enjoy the benefits to economies of scale. However, according to Oluyemi and Roberts (2000), it is practicable in Nigeria to produce turkeys profitably on a small scale provided the enterprise is efficiently managed.

Table 4.10 Distribution of turkey farmers according to stock population

Stock population	Kaduna towns		Zaria towns		Pooled data	
	Frequency	%	Frequency	%	Frequency	%
10-100	25	80.7	14	100	39	86.7
101-200	6	19.3	0	0	6	13.3
Total	31	100.0	14	100.0	45	100.0

Source: Field Survey, 2005

4.1.11 Credit Acquisition

The amount and quality of credit available to a producer at a particular period of time usually counts in the scale and mode of operation. The analysis of the data from the study showed that 71% of the turkey producers in the study undertook and run their business through personal savings only, 9% of the producers had their funds from personal savings and loan from banks while 20% of the respondents got their funds through personal savings and friends/relatives. The study further revealed that majority of the turkey producers had to source their funds through personal savings to avoid the bottlenecks and bureaucratic procedures associated with loans from banks. Those who got loans from banks and borrowed from friends/relatives also complained of high interest rate being charged by banks and inadequate amount of money available to them from their lenders. Short repayment period was also indicated as a problem from money borrowed from friends/relatives. In essence, the small scale operation by the turkey producers in the study area could be due to the meagre amount realized from their salary since majority of them were civil servants. This finding therefore supports the study on small holder local turkey production in Ogun State, Nigeria by Peters *et al* (1993 and 1994) which indicated that rearers of turkey lacked fund for expansion and are unwilling to take loan for fear of incurring debts and the bottlenecks involved in loan procurement.

4.2 Management Practices of Turkey Production by the Turkey Producers

Here, the major management practices undertaken by the respondents are discussed. They include systems of keeping turkeys, housing and equipment used, health care, feeding and water supply, poults handling and record keeping.

4.2.1 Systems of Keeping Turkeys

The result showed that 69% of the turkey producers in the study area reared their turkeys under the deep litter or intensive system while 31% of the respondent used the semi-intensive (combination of confinement and range) system to raise their turkey. Those who used deep litter system, however, said it was capital intensive but agreed that it was advantageous in terms of land maximization considering their urban locations. Other advantages according to them include better control and protection of turkeys against losses due to thieves and other predators. Those respondents (31%) who practiced semi-intensive system did so to minimize cost of feed and housing materials.

4.2.2 Housing and Equipment used

The study showed that 82% of the turkey producers owned the turkey houses themselves while 18% hired houses for their production. It was also found that 56% of the respondents used mud blocks to raise their turkey houses while 44% used cement floor for theirs. About 91% and 9% of the turkey producers used zinc and asbestos respectively in roofing their turkey houses. Those who used mud and zinc material did so to reduce cost. However, cement was used for the floor and plastering of walls. The study also revealed that the average stocking capacity of the turkey houses in the study area was 95 turkeys.

4.2.3 Health Care Practices of Turkeys

The health care practices undertaken by the turkey producers in the study area were sanitation, routine vaccination, avoidance of over-crowing and curative measures.

In terms of sanitation, the respondents cleaned and disinfected their turkey houses a week before the arrival of their poults. Cracks and leaks were mended, and the floors

were covered with clean absorbent litter materials – sawdust and wood shavings (depending on the type available to the producers). They also carried out a routine and daily cleaning by removing turkey droppings and change of wet litter materials. The use of bags and cartons was as well used around the open-sided portions of the house to provide adequate fresh air thereby preventing suffocation.

The study revealed that 90% of the respondents religiously vaccinated their flocks as scheduled on table 4.11 as many of the producers believed that turkeys were more delicate to handle at the early age (poults) and since it was costly to purchase the poults, they could not take the risk of loosing them to diseases. Though there was no major cases of disease outbreak some of the respondents especially 10% of those who did not observe the vaccination witnessed few mortalities due to a slight presence of some diseases like fowl pox, Newcastle and coccidiosis. Some of the drugs and vitamins used during the production period included sulfaquainoxaline, amproliumor, penicillin, streptomycin, keproceryneotreat and vitalyte. Some of the producers also consulted specialists and veterinary clinics for treatment of diseases and parasites.

The mortality rate recorded by the producers was 14%. The respondents further stated that most of the mortality was recorded at the early age of the turkeys (1-14 days). Some attributed the mortality to include stress during transportation, carry over disease from hatchery, starving of poults due to poor visibility and poor management.

Table 4.11: Vaccination schedule for turkeys

Disease	Type of vaccine	Route	Age of turkeys
Newcastle	Newcastle vaccine Lasota	Intraoccular or in drinking water	1st week
Erysipelas	Erysipelas bactrin	Intraocular or in drinking water	8 weeks
Fowl typhoid	Fowl typhoid vaccine	In drinking water	8 weeks
Coccidiosis	Sulfaquainoxaline	In feed or water	8 weeks
Fowl pox	Fowl pox	Intra-muscular or via the living web	12 weeks (can be repeated)
Newcastle	Komarov	In drinking water	12 weeks (can be repeated

Source: Field Survey, 2005

4.2.4 Feeding and Water Supply

The turkey producers in the study area confirmed that turkeys like broiler chickens have high requirement for protein and other materials in their diets. The result has it that 60% of the respondents sourced their feeds from the market only while 7% and 33% of them depended on home only and both home and market for their feeds respectively. Broiler feed was majorly available to them while a few producers (22%) who had about (7%) of hen turkeys in their flocks fed them with layers mash at the time of laying. Three types of feeds were used by the turkey producers –starter mash (0-8 weeks, grower mash (8-18 weeks) and finisher or layer mash (18-32 weeks). Those who practice semi-intensive system allowed their turkey to pick crumbs and house wastes

within the range. Though some of the respondents often practice feed restriction to minimize cost and wastage by turkeys, a few of them had spoilt feeders overflowing with feed on their farms. Those who sourced their feeds from home did so to reduce cost and to minimize adulteration by commercial feeds. The turkey producers in Kaduna and Zaria towns used well and tap water for their turkeys.

4.2.5 Poult Handling

Poults are the young turkeys (1-7 weeks). The turkey producers stated that the poults are very fragile and delicate to handle and should be treated with care. Sixty one percent of the turkey farmers sourced their poults from the market while 20% and 11% of the remaining got theirs from their co-producers and hatchery respectively. The mode of transportation used by the respondents in the area of study to convey their poults were private cab, truck, taxi, motor cycle and wheel barrow depending on the distance.

The study also showed that poults have poor vision and may take several days before vision is complete and this makes it difficult for them to eat and drink at first which led to early death of their poults due to starvation. Brooding boxes and cartons were used at brooding with lantern, stoves and electric bulbs as sources of light and heat.

4.2.6 Record Keeping

The study revealed that majority (almost 100%) of the respondents were literate but many (65%) of them did not keep comprehensive records of their activities on the farm. Some had records on papers which were not entered in the main record books, while others depended on their experiences and memories for information on production and management practices. The records and information gotten from the turkey producers included those of input supplies/prices, management practices, output, sales and

production practices. It was obvious that those (35%) who kept detailed records were more concise and accurate in giving information about their businesses than those who did not.

4.3 Inputs Requirements and Turkey Output

The inputs used for the turkey production in the study area were labour, feed and capital (poults, medication and utilities) while the output was the turkey produced (in kg/live-weight). Table 4.12 shows the input-output level of turkey production in the study area.

4.3.1 Labour

The sources of labour in the study area were mainly family and hired labour. An average of 425.4 man hours of labour was used in the production process over a period of 8 months (32 weeks). There was no exclusive use of hired labour by the turkey farmers, rather hired labour was used to supplement the family labour. The estimated labour charged per man hour was ₦30.00.

4.3.2 Feed

An average of 804kg of feed was used to rear an average of 67 matured turkeys for the period of 8 months. In addition to the commercial feed concentrates which were used by the turkey farmers, some of them supplemented their turkey's feed with self-formulated feed and house wastes. The concentrates used were mainly broiler and layer's mash.

4.3.3 Capital (poults, medication and utilities)

The capital resource is made up of cost of poults, medication and utilities in the course of production. The number of poults (day-old turkey) purchased to be reared to

maturity formed one of the major variable inputs in turkey production. They are delicate and tender in nature than other species of poultry. About 71% (32) turkey farmers in the study area sourced their poults from the market, 9 (20%) got theirs from their hatcheries/breeders. This result indicated that there were not enough hatcheries or breeders in the study area where turkey farmers can adequately rely on for their poults and this could have adverse effect on the quality, quantity and cost of poults from markets. About three thousand and forty three (3,043) poults were purchased during the production period under consideration.

The medication which form part of the capital resources included the cost of drugs, vaccine and veterinary services administered in the course of production. Some of the drugs and vaccine used included amproliumor, penicillin, fowl typhoid vaccine and sulfaquainoxaline while the capital utilities were cost on water, electricity and stationeries used for the smooth running of the turkey production.

4.3.4 Turkey Output

The turkey output is the total number of matured turkeys produced (in kg/live weight) over the period of 8 months in the study area. Appendix I show that a total of 2617 turkeys were produced while the minimum and maximum outputs for the production were 254 and 1690 kg respectively and the coefficient of variation of output, labour and capital were 53%, 40%, 61% and 41% respectively. Therefore, an average of 672kg of live-weight turkey was produced during the production period and the average weight per kg of a matured turkey produced was 10.03kg. However, Ogundipe and Dafwang (1980) stated that all heavy breed turkeys may attain first year breeding or "standard" weight (16.36) at 36 weeks while all small type turkey may attain breeding or

"standard" weight (10.45kg) at 34 weeks. These according to them can be expected only when the birds are fed well balanced diets and kept free from diseases, parasites and other stress factors that can lower feed intakes and lower growth rates.

4.4 Production Function Analysis

> An empirical production function enables us to make judgment about the efficiency of the prevalent factors of production, hence, the Marginal Value product (MVP) of each input estimated from the function could be compared with its marginal factor cost (MFC). The estimation of elasticity of production and return to scale are also possible from the production function analysis. All these help in economic decision making.

The Cobb-Douglas production function explained in chapter two was chosen as the lead equation among the various functional forms – quadratic semi-log, square root and linear equation tried because it best estimates the production process in terms of coefficient of multiple determination (R^2) values, sign of coefficients and their levels of significance.

The regression coefficient in table 4.13 shows that all the variable inputs (labour, feed and capital) were all statistically significant at 1% level of probability. The regression coefficients in this case represent the elasticity of production with respect to the resources that were used in the turkey production.

The coefficient of multiple determinations (R^2) was 0.80 which is the percentage of the variation of the dependent variable explained by the independent variables which was found to be 80% while the adjusted R square ($\overline{R}^2$) values was found to be 79%. The F-value 54.92 was significant at 1% level of probability. The double log equation was also chosen to estimate the elasticity of production, return to scale and marginal product. Appendix 1 gives the results of the various functional forms.

4.4.1 Multiple Regression Analysis for Turkey Production

The models as specified in equations 6 is:

$$\text{Log } Y = -3.862 + 0.507 \log x_1 + 0.221 \log x_2 + 0.574 x_3 + e \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (14)$$
$$(0.963)^* \quad (0.092)^* \quad (0.072)^* \quad (0.102)^*$$

$\bar{R}^2 = 0.79$

$\sum bi = 1.30$

F –value = 54.92 significant at 1% level of probability

* = Significant at 1% level of probability

4.4.2 Marginal Value Productivities (MVPs) and Resource Use Efficiency for Turkey production

The marginal value product (MVP) and resources used efficiency for turkey production (table 4.13) is calculated from the double log regression coefficients using the appropriate formula in equation 11 while the market price of one unit of the input concerned is the marginal factor cost (MFC).

The economic efficiency of resources used based on the ratios of marginal value product (MVP) to marginal factor cost (MFC) in table 4.14 indicated that feed and capital were over utilized (r = 0.50 and r = 0.08) respectively while labour was under utilized (r= 74.70).

Over utilization of feed could be due to wastage of feed by the turkey producers as a result of over filling of feeders and the use of spoilt feeders. Another reason for such over utilization could be traced to the fact that the farmers kept the turkeys for a longer period (average of eight months) before disposing them thereby feeding the turkeys beyond the economic weight gain. The feeds therefore need to be used efficiently by

using good feeders and by disposing matured turkeys as soon as they attain their economic weights

The over utilization of capital resources could result from the large sum of money expended on the poults by the farmers due to high cost of poults. The farmers could as well have mismanaged the funds available to them from their primary occupations as many of them (65%) did not keep records of their businesses to know when to purchase more inputs or not. The farmers are therefore advised to spend less on the capital resources and minimize cost for efficient utilization by sourcing day-old poults from reliable hatcheries and breeders who have low prices.

Labour was under utilized by the turkey farmers. The study however revealed that the average household size was seven persons but the needed family labour may decide to go for higher paid jobs making labour unavailable for turkey production. The flock size on the other hand was small which must have discouraged other members from participating in the production. The result therefore, shows that the turkey farmers could earn more returns by increasing the flock size and thereby increasing the efficiency of their labour since their marginal contributions to the turkey output were more than their opportunity cost.

Table 4.12: Marginal value productivities (MVPs) and Resource use efficiency for turkey production inputs from the double log function

Variable	Unit	$\overline{X}$	MPP	Bi	MFC (₦)	MVP (₦)	R = MVP/MFC
Labour	Man hr	425	0.80	0.507	30	2240	74.7
Feed	25Kg	803	0.19	0.221	1043	532	0.5
Capital	Naira	25777	0.01	0.574	350	28	0.08

Source: Field Survey, 2005

$\overline{Y} = 672$

$$MPP = \frac{b_i \overline{Y}}{\overline{X}}$$

Where:

b_i = estimated regression coefficient of input

$\overline{X}_i$ = Mean of input (x_i)

$\overline{Y}$ = Mean of output

4.4.3 Marginal Physical Products (MPPs) and Elasticity of Production (EP)

The sum of elasticity ($\sum Pxi$) indicates the nature of returns to scale associated with a particular production system. Table 4.15 revealed that the estimated sum of elasticity of inputs was 1.30. This implies that if all inputs included in the model are increased by one percent, output will increase by one hundred and thirty percent. This is an increasing return to scale. Therefore, a unit change in any of the inputs (labour, feed and capital) while holding others constant results in a higher percentage increase in the quantity of output. Therefore turkey production in the study area is in stage 1. At this stage the producers are advised to use more of the resources thereby expanding production until stage 2.

The estimated marginal physical product (MPP) for labour was 0.80. This was the highest of the three resources used which implies that a unit increase in labour would increase the output more than any other input. The MPP for feed and capital were 0.19 and 0.01 respectively.

Table 4.13: Estimated marginal physical products (MPP) and elasticity of production of inputs used in turkey production

Input	MPP	Elasticity of production
Labour	0.80	0.507
Feed	0.19	0.221
Capital	0.01	0.574
∑Pxi		1.30

Source: Field Survey, 2005

4.5 Cost and Returns in Turkey Production

4.5.1 Costs Structure of an Average Turkey Producer in the Study Area

Table 4.16 gives the total expenditure which is made up of the total variable costs (cost of labour, feed, poults, drugs/veterinary services, utilities and transportation) and the total fixed costs (depreciation on housing and equipment). The values of houses and equipment were estimated with the use of the straight line method of depreciation.

4.5.1.1 Feed Cost

Table 4.16 shows that the variable cost accounts for about 99% of the total cost of production for an average of 67 turkeys. Fifty three per cent of the cost was expended on feed. The average price of a 25kg bag of feed was ₦1043 (₦41.72/kg). The total average

cost amounted to ₦53, 005. Feed ranked as the first (53%) most expensive and important factor cost of production by the respondents. This result agrees with Mbanasor and Sampson (2004) who revealed that feed had the highest single item of cost in the production of turkey. Ogundipe and Dafwang (1980) also reported that turkeys like broiler chickens have a high requirement for protein and other nutrients in their diets. This under scores the importance of feed availability and affordability if turkey production is to be given a boost.

4.5.1.2 Cost of Purchasing Poults (day-old)

The cost of purchasing the poults which formed the flocksize ranked second to feed in the cost of production in the study area. Table 4.13 indicated that the cost of purchasing poults was 28% of the total cost. The average price for a day-old poult was found to be ₦333.00 and the total cost of poult was ₦27,752. The result agrees with Shetter and Jadha (1999) who reported that the cost of chicks accounted for 26% and next to feed in small scale broiler production cost in Bidar. The turkey farmers however asserted that cost of the poults could be reduced if there were enough and available hatcheries and/or breeders in the study area.

4.5.1.3 Labour Cost

This formed third (14%) most important factor cost in turkey production in the study area. Labour charge was ₦30.00 per man hour in the study area. The total labour cost was ₦13, 541.

4.5.1.4 Cost of Drugs/Veterinary Services

This is the total expenses incurred on drugs, vaccines and other veterinary services from the beginning of production to the time the turkeys are sold. Medication

cost formed about (3%) of the total cost of production in the study area. Though there was no disease outbreak, routine vaccination was done by the turkey farmers. The average total cost of medication on the turkeys was ₦3, 287.

4.5.1.5 Cost of Utilities

These were cost expended on stationeries, water and electricity. Some of the turkey farmers used either tap or well water while others used the combination of the two. A Jeri can of a 20 litres of water cost ₦ 10 in the study area. Expenses were also made on papers, notebooks and biros for record purposes by those (35%) who kept records of their activities. Two percent of the total cost was expended on utilities by the turkey farmers. Majority of the respondents could not give accurate cost of the bill on electricity as their main house bills from the turkey houses were not separated. However, it was gathered that some people paid ₦ 4 per unit point per month on electricity bill. Total average cost of N1, 720 was on utilities.

4.5.1.6 Transportation Cost

The cost of transportation was incurred at every stage during the production process. The mode of transporting the input resources in the study area included bicycle, wheel barrow, trucks, motorbike, taxis, private vehicles and even by head portage which depended on the financial strength of the individual farmers. The average cost on transportation was N303.

4.5.1.7 Cost of Housing and Equipment

Housing and equipment are the fixed inputs in turkey production. Housing of the birds constituted 0.22% of the total cost of production while that of equipment was 0.15%. The average cost of the total fixed cost in the study area was ₦364. According to

Shettar and Jadhar (1999) fixed cost constituted 5.81% while variable cost accounted for 94.19% among the different cost concepts considered in the broiler farming in Bidar.

The equipment mostly used by the turkey producers in the study area include; feeders (both plastic and steel), drinkers (plastic), stoves, bulb and stand, brooding boxes, cartons, lanterns, wheel barrows and shovel. Others are needle/stringe, rakes, weighing scale, bunch of broom and packers. The prices of the different equipment used according to the producers depended on the type and time of purchase. The market prices for year 2004/2005 were used.

Table 4.14: Cost structure for turkey production in the study area based on the average of 67 turkeys

Cost items	Kaduna		Zaria		Pooled data	
	Cost (₦)	% cost	Cost (₦)	% cost	Cost (₦)	% cost
a)Variable Input						
Labour	14,496	12.5	11,427	17.6	13,541	13.6
Feed	64,415	55.7	27,741	42.8	53,006	53.1
Poults	30,934	26.8	20,706	31.9	27,752	27.8
Drug/vet. Service	3,396	2.9	3,049	4.7	3,288	3.3
Utilities	1,820	1.6	1,500	2.3	1720	1.7
Transportation	195	0.2	114	0.2	303	0.2
Total variable cost	115,256	99.7	64,537	99.5	99,611	99.6
b)Fixed input						
Housing	238	0.2	165	0.3	215	0.2
Equipment	155	0.1	136	0.2	149	0.2
Total fixed cost	393	0.3	301	0.5	364	0.4
c)Total cost (a+b)	115,649	100	64,838	100	99,975	100

Source: Estimated from field survey, 2005

Note: Straight line method of depreciation was used to compute the fixed inputs (housing and equipment)
Assumed ₦ 1,000 and ₦ 500 salvage values for building and equipment respectively. The expected years for the houses and equipments were also assumed to be 10 and 5 years respectively.

4.5.2 Returns and Profitability Analysis

The total return obtained was made up of returns from the sales of matured turkeys, sales of empty bags and sales of manure.

4.5.2.1 Sales of Matured Turkeys

A sale of matured turkeys in the study area was done by weighing with the use of scale. Prices at festive periods like Christmas, Sallah and Easter periods were usually higher than the ordinary times. The average selling price of a matured turkey in the area was ₦ 2,800.00. The total returns from the turkeys (Table 4.16) was ₦ 186,991. Sales were mainly done at the farm gates by the producers

4.5.2.2 Sale of Empty Bags

The empty used bags were obtained from feeds bought. About 719.5 bags of a 25kg feeds were used by the turkey farmers during the production period. Though some of the bags were used for other domestic purposes and some were given out to friends/neighbours while the remaining was sold. The average income obtained was ₦160.

4.5.2.3 Sale of Manure (turkey droppings and other waste products)

Some of the turkey farmers used the manure from their farms in their gardens while others gave them freely to neighbours in need. About 73 bags of 100kg bags of manure were collected. The return on manure was ₦164

4.5.2.4 Returns and Net Farm Income of the Turkey Producers

The total returns from the sales of turkeys, empty bags and manure amounted to ₦186, 990. The net farm income (NFI) in table 4.16 shows that Kaduna and Zaria towns have net farm incomes of ₦90, 611 and ₦79, 487 respectively while the total net farm income for both towns was ₦87, 015. It was also found that the mean income of the

turkey producers for the average production period of eight (8) months was at ₦10, 877 per farmer and return per bird was ₦162. The rate of return to investment was 187%. For every ₦ 1.00 spent on turkey production, the average farmer was able to make 87 kobo as profit. From this result, it can be said that the business of turkey production in the study area though on a small scale, was economically viable.

Table 4.15: Costs, Returns and Net Farm Income from turkey production based on an average of 67 turkeys

Item	Kaduna	Zaria	Pooled data
RETURNS	(₦)	(₦)	(₦)
Sales of turkeys	205,936	144,000	186,667
Sales of empty bags	167	145	160
Sales of manure	157	180	164
Total Returns (TR)	206,260	144,325	186,991
COSTS			
Variable cost			
Labour	14,496	11,427	13,541
Feed	64,415	27,741	53,006
Poults	30,934	20,706	27,752
Drugs/Vet. Services	3,396	3,049	3,288
Utilities	1,820	1,500	1,720
Transportation	195	114	303
Total variables cost (TVC)	115,256	64,537	99,611
FIXED COST			
Housing	238	165	215
Equipment	155	136	149
Total fixed cost (TFC)	393	301	364
Total cost (TC)	115,649	64,838	99,975
Net Farm income (NFI)	90,260	79,487	87,016
Mean income	11,326	9,936	10,877
Mean income/bird	169	148	162

Source: Field Survey, 2005

4.6 Problems of Turkey Production

The major problems of turkey production in the study area shown in table 4.17 were; marketing of turkeys and their products, high cost of feed/feed ingredients and high cost of day-old poults. Others include; inadequate credit, fake and high cost of drugs and vaccine/veterinary services, and inadequate extension services.

4.6.1 Poor Marketing Services

According to the respondents in the study area, the problem of marketing of turkeys and their products result from alternating periods of boom and bust characterized at festive and non-festive periods respectively. Poor marketing services ranked first (31%) among the major problems militating against turkey production in the study area (Table 4.19). The study further revealed that turkey sale was better at festive periods like Christmas and Sallah in Kaduna and Zaria towns since the majority of people in these areas are Christians and Muslims who use turkey at these festive periods. Again, sales were mainly done at the farm gates without an organized market for turkeys like chickens. In consonance with this finding, Peters *et al* (1994) in a study conducted on small holder local turkey production in Ogun State Nigeria, stated that sale of turkeys were more during Christmas and festive period than other periods of the year.

In a similar study, Dale (2000) reported that while turkey production and consumption have both become year round activities, consumption still has a seasonal component, although it is less pronounced than in the past, but the seasonal component for turkey per capita consumption was still significant at the end of the period. He further stated that turkey trade has not been modelled extensively in the context of international markets and trade.

4.6.2 High Cost of Feeds

Amongst the variable inputs used by the turkey producers, feed/feed ingredients were identified to be the greatest limiting factors in turkey production in terms of cost and availability. According to the farmers, broilers and layers feeds were mostly fed to their turkeys since specific turkey feed were seldom seen and were costly. This was rated second (29%) among the problems. Many of the farmers resorted to supplemental feeding of the turkeys on a daily basis to reduce cost and minimize adulteration of commercial feeds. The few producers who formulated feeds for their turkeys, complained of scarcity of ingredients like maize, groundnut cake, soyabean, rice bran and other premix especially at the peak period of the year since the ingredients were mostly consumed by humans. In agreement with this study, Ojo *et al* (2000) stated that the high and persistent increases in the prices of poultry feeds have constituted a big hindrance to expansion in the Nigerian poultry since the early 1980 and consequent upon the high cost of feeds, the prices of poultry products have continued to rise. The high cost of feed also could be due to competition between man and his livestock for grains and conventional sources of plant proteins.

4.6.3 High Cost of Day-old Poults

Closely ranked to the high cost of feed was the high cost of day-old poults. Nine (20%) respondents declared that high cost of day old poults hampers the rearing of turkeys in Kaduna and Zaria towns as most of them were being brought in from the western part of the country particularly from Oyo and Ogun states while some were imported. Some producers in Zaria towns believed that although some are being bred in Shika in collaboration with NAPRI, it could not meet the demand and therefore the prices

were very high. The average price of a day-old poult in Kaduna and Zaria towns was at ₦333.00. According to Ibe (1990), and Oluyemi and Oyenuga (1971), the potential of local turkeys cannot be overlooked considering the huge foreign exchange implication of the importation of improved exotic stock and also genotype-environment interaction which leads to considerable loss of fitness of the exotic stock. The scarcity of local strain of turkey could be due partly to the fact that chickens are so familiar and grow so well that there seems to be no reason to consider any other poultry. It was also because modern turkeys have been bred for intensive production that the resulting birds are inappropriate for free range/semi intensive production.

4.6.4 Inadequate Credit

Many producers could not afford to invest much since they were mostly (58%) civil servants and turkey production was capital intensive when compared to broiler chicken production. Only 13% of the turkey producers had a stock population of 101-200 turkeys. Majority of the respondents (71%) said they did not have enough money to engage in large turkey production since their source of funds were through personal savings and from relatives because they could not contend with the bottlenecks and procedures associated with loans from commercial banks. They also complained that the funds available to them from friends/relatives were not usually adequate to run there businesses.

4.6.5 Fake and High Cost of Drugs, Vaccine and Veterinary Services

About seven percent of the producers complained that some of the drugs/vaccine purchased from the open markets was not effective when ministered and so they were

believed to be fake and expensive. Some of the drugs/vaccines such as amproliumor, penicillin and sulfaquainoxaline were sold between ₦350 to ₦600 per sachet.

4.6.6 Lack of Extension Services

Four percent of the respondents complained of unavailability of vital information on some requirements for turkey production due to non-visitation of the extension officers. According to the farmers, information on feed and management of turkeys were lacking. This finding agreed with the result of Ojewola *et al* (2001) which observed that in Nigeria, farmers often feed turkeys with broiler chicken diets because there is dearth of information on the nutrient requirements of turkey under the tropical environment.

Table 4.16: Major problems identified militating against turkey production in the study area

Problems	Frequency	Percentage
Poor marketing services	14	31.1
High cost of feed/feed ingredient	13	28.9
High cost of day-old poults	9	20
Inadequate credit	5	11.1
Fake and high cost of drugs, vaccine and veterinary services	3	6.7
lack of extension services	2	4.4
Total	45	100

Source: Field survey 2005

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Summary

This study was conducted in Kaduna and Zaria towns of Kaduna state to examine the economics of turkey production in the study area. The data for this study were collected mainly from primary sources using structured questionnaire. Forty five (45) turkey producers were randomly selected from fifty five (55) turkey producers identified in the area.

The places that made up Kaduna towns were; Kaduna Polytechnic staff quarters, Mando, Television/Ungwar Yelwa, Barnawa, Ungwar Rimi and Ungwar Sarki, while Zaria towns include; Ahmadu Bello University (ABU) community –Samaru, Shika, Wusasa and PZ areas.

The result of the study shows that 44% of the turkey producers were female while 56% were males with 87% of the respondents being married. The mean age of producers was 38 years signifying that the farmers were in their productive ages.

Further analyses also showed that all (100%) of the respondents were literate with about 76% having education above the secondary school level. The turkey producers had a mean experience of four (4) years in turkey production. The mean household size of producers was seven (7) persons. In terms of occupation, 58% of the turkey producers were civil servants, 27% were traders while 16% were poultry keepers. This means that the producers do not operate turkey production as their major business. It was also shown that 88% of the producers do not belong to Co-operative Society. Those who belonged to associations were members of the Poultry Association of Nigeria (PAN). About 82% of the producers owned the turkey houses themselves while 18% hired houses for their production.

The study further showed that 71% of the producers used personal savings as their only source of funds. Twenty percent got theirs through both personal savings and friends/relatives while 9% got their funds through personal savings and bank loans. Personal savings was the major source of funds according to the respondents because of bottlenecks and bureaucratic procedures associated with bank loans and also, because pressure for payment from friends/relatives. The average flock size in the study area was 67 turkeys while the minimum and maximum flock sizes were 24 and 185 turkeys respectively.

The study shows that 69% of the producers reared their turkeys under deep litter intensive system while 31% used semi-intensive system. The health care practiced by the turkey producers include proper sanitation, routine vaccination, avoidance of over crowding and curative measures. As for feed and water supply, about 60% of the producers sourced their feeds from the market, 7% depended on feeds formulation and home wastes, while 33% sourced their feeds from both home and market.

Sixty five percent of the turkey farmers did not keep comprehensive records of their activities on the farms. Some had records on papers and others depended on memories. It was observed that 63% of the producers used solely family labour while 38% depended on both hired and family labour.

The double log functional form was used in the estimation of the elasticity of production, return to scale and marginal productivity. The R^2 value was 80% and the adjusted $\overline{R}^2$ value was 79%. The regression equation shows that the variables (labour, feed and capital) were all statistically significant at 1% level of probability. The result signifies an increasing return to scale. To minimize the over utilization of the feeds, the

farmers should use good feeders to avoid wastage thereby reducing amounts spent on feeds. And the turkeys should not be kept more than necessary i.e six months for meat production. The farmers should be prudent in spending on capital resources by sourcing for good quality and cost effective resources especially day-old poults, which seems to incur high cost.

The estimation of the efficiency of resource utilization shows that feed and capital were over utilized. This implies that increase in output in the production process, all things being equal will result from a unit increase of the input.

The analysis of cost, returns and Net farm income for an average of 67 turkeys produced in the study area showed a total cost of ₦99, 610 and a total return of ₦186, 990. The Net farm income from the production was ₦87, 015. The rate of return to investment was 187%.

5.2 Conclusion

The labour resource was underutilized while feed and capital resources were over utilized. To further maximize profit, the over utilized feed and capital have to be reduced while labour which was underutilized increased.

Some of the major problems faced by the turkey producers in the study area include; poor marketing services, high cost of feeds/feed ingredients and high cost of poults. Others were inadequate credit, fake and high cost of drugs/vaccines and veterinary services and lack of extension services.

5.3 Recommendations

Based on the findings of this study and in order to ensure sustainable turkey production in the study area, the followings recommendations are advocated:

1. There is need for turkey farmers to target production to high demand periods (e.g festive periods like Christmas, Easter and Sallah) where they can easily sell and make more profit since marketing of turkeys and their products form one of the major problems of turkey production in the study area.
2. Storage and packaging facilities should be encouraged by private and public organisations to help retail sales of turkey parts and hence, make turkey meat affordable.
3. As a way of minimizing cost and adulteration of feed, the producers should be encouraged and trained to formulate their feeds. Also, there is the need to find alternatives to the high cost protein supplements in turkey diets, such alternatives should have comparable nutritive value which is not only cheaper than the conventional protein sources but, which are not consumed by man.
4. Turkey producers should be visited periodically by the extension officers. There is the need to further strengthen turkey research activities at all levels in the country for lack of essential information on breeding and production of turkeys.
5. There is need for encouraging the youths and the unemployed to embark on small scale turkey production especially as it has the potential of improving their income.

5.4 Limitations of the Study

1 Due to financial and time constraints, the study did not cover the whole state and so the sample of (45) turkey farmers may not be adequate to make generalization about the entire state.

2 The study did not specify the breed (s) of turkeys kept by the producers to know which was predominant in the study area.

REFERENCES

Abubakar, B.Y; O.O. Oni; I.A. Adeyinka; B.I. Nwagu; S.O. Ogundipe; and A.A. Sekoni(2002). Poultry Layer Grand Parent Stock Development at National Animal Production Research Institute (NAPRI) Shika. In: Gefu, J.O; I.A. Adeyinka and A.A. Sekoni. (eds), *Poultry Production in Nigeria,* pp. *52-53.* Training Workshop held at the National Animal Production Research Institute (NAPRI), Shika, Zaria, Nigeria. 1-6 September.

Acker, Durane (1968). *Animal Science and Industry* Englewood Cliffs. Prentice Hall. South Dakota State University, p 487.

Acker, Durane (1971). *Animal Science and Industry* 2nd edition. Englewood Cliffs. Prentice Hall. South Dakota State University, p. 604.

Adeniyi, J.P. (1988). Farm Size and Resource Use Efficiency in Small Scale Agricultural Production. The Case Study of Rice Farms in Kwara State of Nigeria. *The Nigerian Agricultural Journal* 23(2): 43 – 49.

Akinwunmi, J.A., A.J. Adegeye; A.E Ikpi; and S.O Olayide (1979). Economic Analysis of Nigeria Poultry Industry. A study commissioned by Federal Livestock Department, Lagos.

Atta, S.and S.J. Gbede (2000). A study of swine production in Katsina-Ala Local Government Area of Benue State. In: Ukachukwu S.N; J.A. Ibeawuchi; S.N. Ibe; A.G. Ezekwe; and S.F. Abasiekong (eds), *Animal Production in the New Millennium*: *Challenges and Options,* pp *384-385*. Book of proceedings of 25th Annual Conference, Umudike, 19-23, March.

Bagi, F.S. (1981). Economics of Irrigation in Crop Production in Haryana. *Indian Journal of Agricultural Economics* 34(3): 15 – 26.

Bello A. L. (2000). Kaduna State. In: Mamman, A.B; J.O. Oyebanji; S.W. Peters. (eds), *Nigeria, A People United, A Future Assured*. Survey of States vol. 2 Millennium edition, pp. 101-105.

Dale Coyler (2000). Econometric Analysis of U.S. Turkey Exports. Paper presented at the Annual Meeting of the North eastern Agricultural and Resource Economics Association, New Green Wich, West Virginia University, Morgantown, pp. 1-6.

Downey, D.W. and Trock, J.K. (1981). *Agribusiness Management*. McGraw-Hill, Tokyo, Japan, pp. 85-89.

Eduvie, L.O. (2002). Poultry Production as an important Component of Nigeria's Livestock Sub sector. In: Gefu, J.O; I.A Adeyinka and , A.A. Sekoni (eds) *Poultry Production in Nigeria,* pg. 6. Training Workshop held at the National Animal Production Research Institute (NAPRI), Shika, Zaria, 1-6 September.

Ekumankama, O.O. (2000). Participation of rural women in livestock marketing in Ikwuano area, Nigeria. In: Ukachukwu, S.N; J.A Ibeawuchi; S.N. Ibe; A.G. Ezekwe and S.F. Abesiekong. (eds), *Animal Production in the New Millennium: Challenges and Options, pp. 375-376.* Book of Proceedings of 25th Annual NSAP Conference Umudike, 19-23, March.

Emmah, S.A. (1997). Production and Marketing of Modern Poultry around Sabon Tasha, Narayi and Kujama Areas of Chikun Local Government Area of Kaduna State. Unpublished undergraduate project. Faculty of Agriculture, ABU, Zaria.

Farell, M.J. (1957). The Measurement of Production Efficiency. *Journal of Royal Statistical Society Series* A (General), part 111 vol. 120. pp. 253-281.

Federal Department of Livestock and Pest Control Services (FDLPCS) (1992). Nigerian National Livestock Survey. Federal Ministry of Agriculture Lagos, Nigeria.

Federal Office of Statistics (FOS) (1994). *Digest of Statistics*. Demographic Report of Nigerian States presented by the Federal Office of Statistics, Lagos.

Fisher and Boorman (1984). Nutrient Requirement of Poultry and Nutritional Research. In: Ojewola, G.S; A.H. Akinmitimi and C.S Nwachukwu (2001). (eds), *Economics of Methionie Supplementation in Growing Indigenous Turkey Poults Ration.* pp *218-219*. Paper presentation at proceedings of 6th annual conference of Animal Science Association of Nigeria. University of Maiduguri Convocation. 17-19 September.

Food and Agricultural Organisation (1999). In: Dale Coyler (2002). *Econometric Analysis of U.S. Turkey Exports*. pp *1-2*. West Virginia University, Morgantown.

Gascoyne, J. (1988). The World Turkey Industry, Structures and Production. *World Poultry Science Journal*. 44: 112.

Harvey, C. (1977). *Macro Economics for Africa*. Heinemanni: London.

Heady, E.O. and Dillon, J.L. (1972). *Agricultural Production Function*. 1st edition. IOWA State University Press Ames. IOWA, USA. pp 43-55.

Horst, P. (1990). Problems and Perspectives of Small Scale Poultry Development. *Entwicklung Landicher raum* 4/90 Germany. 44:129

Ibe, S.N. (1990). Utilising Local Poultry Genetic Resources in Nigeria. In: Petersm S.O; Ikeobi, C.O.N. and Bankole, O.O. (eds), *Small Holder Local Turkey Production in Ogun State,* Nigeria. p 2

Kaduna State Rural Development Authority (KDSRA) (1996). In: Mamman A.B; J.O. Oyebanji and S.W. Peters. *Nigeria, A People United, A Future Assured*, pp. *50-52*. Survey of States vol. 2. Millennium edition, Abuja.

Leftwich, R.H. (1979). *The Price System and Resource Allocation* (17th edition). The Odyer Press, USA, pp. 94 – 120.

Marais, C.L; J.J. Jourbert and D.P. Roux (1970). *Turkeys*, Bulletin No 390 published by the Department of Agricultural Technical Services, South Africa.

Marsden, S.J. (1971). Turkey Production. *Agricultural Handbook*, No. 393 United States Department of Agriculture, Washington D.C, pp. 26.

Mbanasor, J.A. (2000). The Future of Livestock Industry in Nigeria. In: Ukachukwu, S.N; J.A. Ibeauchi; S.N. Ibe; A.G. Ezekwe and S.F. Abasiekong. (eds), *Animal Production in the New Millennium: Challenges and Options*, pg. *397*. Book of Proceedings of 25th Annual Conference Umudike, 19-23 March.

Mbanasor, J.A. and Sampson, A.(2004). Socio-economic Determinants of Turkey Production among Nigerian Soldiers. *International Journal of Poultry Science*, Nigeria. 3(8); 497-502.

Moctar Diallo (2002). Economic Analysis of Commercial Egg Production in Sabon Gari and Giwa Local Government Area of Kaduna State. Unpublished undergraduate project. Faculty of Agriculture, ABU, Zaria.

National Academy of Science (1975). Agricultural Production Efficiency. *National Council of Science Publication*, Washington D.C, USA, pp. 21 – 23.

Nwagu, B.I. (2002). Production and Management of Indigenous Poultry Species. In: Gefu, J.O; I.A. Adeyinka and A.A. Sekoni. (eds), *Poultry Production in Nigeria*, pp. *10-19.* Training Workshop held at National Animal Production Research Institute (NAPRI), Shika, Zaria. 1-6 September.

Ogundipe, S.O. and Dafwang, I.I. (1980). Turkey Production in Nigeria. *National Agricultural Extension Research and Liaison Service* (*NAERLS) Bulletin* No. 22. pp 2-22.

Ogundipe, S.O. and Sanni, S.A. (2002). Economics of Poultry Production in Nigeria. In: Gefu, J.O; I.A. Adeyinka and A.A. Sekoni. (eds), *Poultry Production in Nigeria.* Training Workshop held at National Animal Production Research Institute (NAPRI), Shika, Zaria. 1-6 September, 2002. pp. 27-44.

Ojewola, G.S; .A.H. Akinmutimi and C.S. Nwachukwu (2001). The Economics of Methionine Supplementation in Growing Indigenous Turkey Poults Ration, pp. 218-219. Paper presented at the Proceeding of 6th Annual Conference of Animal Science Association of Nigeria on 'Meetingthe Challenges of Animal Production in the New Millennium', held at University of Maiduguri Convocation. 17-19 September.

Ojo, S.O. and J.A. Afolabi (2000). Economic Analysis of Replacing the Fish Meal Component in Broiler Starter Mash with *Gliricidia sepium*. Paper presented at the 25th Annual NSAP Conference, Umudike.

Olagoke, M.A. (1991). Efficiency of Resource use in Rice Production Systems in Anambra State, Nigeria. *Issues in African Rural Development, Winrock International edition*, Arhington, USA, pp. 319-342.

Oluyemi, J.A. and V.A Ayenuga (1971). A Preliminary Evaluation of the Nigerian Indigenous Fowls as Table Birds. In: Peters, S.O; C.O.N. Ikeobi and O.O. Bankole. (eds), *Small Holder Local Turkey Production in Ogun State,* Nigeria. 1993 and 1994. p.2

Olayemi, J.K. (1982). Assessment of Technical and Economic Efficiencies in Farming. Paper presented at the fourth National Training Workshop for Agricultural Planners, Ibadan, Oyo State, pp. 1 – 10.

Olayemi, J.A. and F.A. Roberts (1982). *Poultry Production in Warm Wet Climates*. University Press, Ibadan p.

Olayemi, J.K; O. Titilayo and A.H. Igben (1986). *Food Balance Sheet for Nigeria.* A Research Report of the Nigerian Institute for Social and Economic Research (NISER), Ibadan, Nigeria.

Olayemi, J.A. and F.A. Roberts (2000). *Poultry Production in Warm Wet Climates*. Spectrum Book Ltd, Ibadan, pp. 45-50.

Olayide, S.O. and B.O. Heady (1982). *Introduction to Agricultural Production Economics*. I.U.P Ibadan, pp. 41 – 44.

Olomola, A.S. (1988). Agricultural Credit and Production Efficiency. In monograph series No.4, Nigerian Institute of Social and Economic Research, Ibadan, Nigeria.

Olukosi, J.O. and P.O. Erhabor (1988). Financing Agriculture in Nigeria Performance and Challenges of the Nigeria Financial System. Paper presentation at the Implant Training Course in Agricultural Credit Management (NACB) Kaduna held in Kongo Conference Hotel, Zaria, 5th – 30th September. pp 25-30.

Oni, S.A. (1982). Resource Appraisal for Agricultural Planning.. Paper presented at the fourth National Training Workshop for Agricultural Planners, Ibadan, Oyo State, Nigeria.

Peters, S.O; C.O.N. Ikeobi and O.O. Bankole (1993 and 1994). Smallholder Local Turkey Production in Ogun State, Nigeria. Paper Presentation at the College of Animal and Livestock Production, University of Agriculture, Abeokuta, Nigeria, pp.1-11.

Sahota, G.S. (1968). Efficiency of Resource Allocation in Indian Agriculture. *Indian Journal of Agricultural Economics* vol. 2.

Shettar, V.B. and N.V. Jadhar (1999). Economic Evaluation of Small Scale Broiler Farming. Department of Animal Genetics and Breeding, Veterinary College, Bidar. *India n Veterinary Journal*. 76: 663 – 665.

Singh, J.P. (1975). Resource Use, Farm Size and Returns to Scale in Baclay and Agriculture. *Indian Journal of Agricultural Economics* 2: pp. 32 – 46.

Smith, A.J. (1990). *The Tropical Agriculturist Poultry*. 1st Edition, The Macmillan Press Limited, London, pp. 195-218.

Tanko, L. (2000). Efficiency of Resource Use: The Case of Poultry Production in Kebbi State. In: Ukachukwu, S.N; J.A. Ibeawuchi; S.N. Ibe; A.G. Ezekwe and S.F Abasiekong. (eds), *Animal Production in the New Millennium: Challenges and Options*, pp. *392-393*. Book of Proceedings of 25th Annual Conference, Umudike, 19-23 March.

Udokainyang, A.O. (2001). Growth performance carcass characteristics and economic of local poults fed varying dietary energy levels. Project Reports, University of Agriculture, Umudike.

Upton, Martin (1979). *Agricultural Production and Resource Use*. Oxford University Press, London.

Walker, A.W; S.A. Tucker and H.A. Elson (1998). An Economic Analysis of a Modified Enriched Cage-egg Production System. *British Poultry Science*. 39: pp 14-15.

Williamson, G. and W.J.A. Payne (1977). *An Introduction to Animal Husbandry in the Tropics*. 3rd edition. Tropical Agricultural Series, Longmans.

Appendix II: Inputs and output levels of turkey production in the study area

	Kaduna town				Zaria town				Pooled data		
Parameter	Output	Inputs			Output	Inputs			Output	Inputs	
		Labour	Feed	Capital		Labour	Feed	Capital		Labour	Feed
	(Kg)	Man hr	(Kg)	(₦)	(Kg)	Man hr	(Kg)	(₦)	(Kg)	Man hr	(Kg)
Minimum	262	130	250	9324	254	129	304	11988	254	129	250
Maximum	1690	177	2500	61605	1095	144	1300	33300	1690	169	2500
Mean	726	820	838	27427	553	568	728	22126	672	820	803
Standard deviation	386	447	560	11918	239	378	266	6336	354	425	487
Coefficient of variation	53%	40%	67%	43%	43%	38%	36%	29%	53%	40%	61%

Source: Field Survey, 2005

Appendix III: Multiple regressions for different production functional forms

	LINEAR FUNCTION			DOUBLE LOG FUNCTION			QUADRATIC	
FUNCTION	SQUARE ROOT FUNCTION							
	Regression Coefficient	Standard Error	t-value	Regression Coefficient	Standard Error	t-value	Regression Coefficient	Standard Error
	t-value	Coefficient	Error	t-value				

Constant	-276.5	71.434	-3.871	-3.862	0.963	-4.009	867.897	371.395	2.337
470.192	919.9	0.574							
Labour (X_1)	1.048	0.169	6.212*	0.507	0.093	5.470*	-2.163	0.988	-2.189^{NS}
1.670	2.366	0.706***							
Feed (X_2)	0.147	0.048	3.040*	0.221	0.072	3.057*	-.348	0.627	-.555***
-.906	0.416	-2.179**							
Capital (X_3)	0.015	0.003	5.760*	0.574	0.102	5.607*	-.037	0.013	-2.783**
0.029	0.027	1.047***							
X_1X_2								2.039- 03	
1.342-03	1.520	-3.372-04	3.37-04	-0.91					
$X_1 X_3$								6.786-05	
3.245-05	2.091	2.508-05	2.148-05	1.17					
X_2X_3								3.943-05	
1.295-05	3.044	8.602-06	4.017-06	1.14					
XX_1								1.555-03	
1.145-03	1.358								
XX_2								-1.218-04	
.172-03	-1.358								
XX_3								2.709-07	
1.585-07	1.709								
SQX_1									
-48.260	66.283	-.728							
SQX_2									
62.024	26.610	2.331							
SQX_3									
-10.210	7.596	-1.344							
R^2	0.83			0.80				0.91	0.89
R^2 Adjusted	0.82			0.79				0.89	0.86
F-value	66.77			54.92				36.14	31.36

Source: Field Survey 2005

* = Significant at 1% level of probability

** = Significant at 5% level of probability

*** = Significant at 10% level of probability

NS = Not significant