ASSESSMENT OF THE PROFITABILITY OF IMPROVED AGRICULTURE AND ITS RELATIONSHIP TO POVERTY STATUS IN ABUJA, NIGERIA

BY

Beatrice Omopelumi AKINMULEWO
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A DISSERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES, AHMADU BELLO UNIVERSITYZARIA, IN PARTIAL FULFILLMENT OFTHE REQUIREMENTS FOR THE AWARD OF MASTER OF SCIENCE DEGREE IN AGRICULTURAL ECONOMICS

DEPARTMENT OF AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY
FACULTY OF AGRICULTURE
AHMADU BELLO UNIVERSITY
ZARIA, KADUNA STATE
NIGERIA

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DECLARATION

I hereby declare that this dissertation titled **"Assessment of the Profitability of Improved Apiculture and its Relationship to Poverty Status in Abuja, Nigeria"** has been written by me and it is a record of my research work. No part of this work has been presented in any previous application for another degree or diploma in this or any otherInstitution. All borrowed information have been acknowledged in the text and a list of references provided.

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Beatrice Omopelumi AKINMULEWO **Date**
Student

CERTIFICATION

This dissertation titled**"Assessment of the Profitability of Improved Apiculture and its Relationship to Poverty Status in Abuja, Nigeria"** by Beatrice Omopelumi AKINMULEWOmeets theregulation governing the award of the Degree of Master of Science of the Ahmadu BelloUniversity, Zaria and is approved for its contribution to knowledge and literarypresentation.

Prof Z. Abdulsalam **Date**
Chairman, Supervisory Committee

Dr M. A. Damisa **Date**
Member, Supervisory Committee

Prof Z. Abdulsalam Date
Head of Department

Prof K. Baba **Date**
Dean, School of Postgraduate Studies

DEDICATION

This work is dedicated to the Almighty God for His grace and protection upon my life. This work is also dedicated to my late Parents Mr. and Mrs. M. Israel Adesugba whose words of encouragement and push for tenacity always ring in my ears. The work is dedicated to my loving husband, Festus Akinmulewo, and daughter, Sharon OreoluwaAkinmulewo for their support and prayers throughout this programme.

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ABSTRACT

The study was undertaken to assess the profitability of Improved Apiculture and its Relationship to Poverty Status in Abuja, Nigeria". A purposive sampling technique was used to purposively select 140 bee farmers from three area councils namely, Abaji, Bwari and Kwaliin the FCT. The data were analysed using descriptive statistics, Farm budgeting techniques, Foster-Greer Thorbecke (FGT) model, stochastic frontier model and Pearson correlation. Result revealed that all bee farmers in the study area were male and within the age bracket of 30-39 years with a mean age of 37. The average household size was 6. About 62.9% of the bee farmers had a secondary education, indicating that they are largely literates. The average years of farming experience was 4. About 62.9% of the farmers had contact with extension agents, about 35% had more than 40 beehives on their farm land. The calculated net farm income of beekeeping per hive of $0.7m^2$ in the study area was ₦32,514.56, also the returns to naira invested of 2.67 implies that for every ₦ 1 invested in bee farming , a profit of ₦ 1.67 was generated. The poverty gap index shows how far bee farming households are from the poverty line, it was estimated to be 0.39; this implies that the mean aggregate food and non-food consumption shortfall of the poor bee farmers relative to the poverty line across the whole population of bee farmers was 39% and the poor bee farmers are not too far away from the poverty line.The parameters of the stochastic frontier production function were estimated simultaneously with those of the model of inefficiency effects. Results indicated that all the variables were significant (P<0.01) except baiting material. The mean technical and allocative efficiencies were 81% and 64% respectively. Findings further revealed that none of the sampled beekeeping farms reached the frontier threshold.However, the average economic efficiency of the beekeeping farmers was 52%.The mean annual income of the beekeeping farmers from beekeeping (₦30,9671.43) was higher than that of the beekeeping farmers income from on-farm activities (₦162,212.86) and off-farm activities (₦16,285.71) indicating that beekeeping contributing a higher proportion to the total income of the beekeeping farmers. Constraints highlighted were inadequate capital (69.3%), problem of theft (52.1%) amongst others. It was recommended that more extension agents should be trained on modern beekeeping so that they can effectively disseminate beekeeping information to the farmers. Beekeeping farmers should leverage beekeeping association as an avenue to access finance, inputs, technical information and market.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Apiculture (otherwise known as Beekeeping) is the art of rearing, breeding and managing honeybee colonies in artificial hives for economic gains (Ikediobi*et al.*, 1985; Morse, 1989). It refers to the practice and management of the bees in the hives (Ojeleye, 1999; Shu'aib*et al.*, 2009), which leads to the production of valuable materials such as honey, beeswax, propolis, bee pollen, bee venom and royal jelly.

According to Oluwole (1999), modern bee keeping that entails housing the bees is not difficult to embark upon because investment is low, it does not require large area of land and water and there is no need for daily care. Beekeeping is an agricultural and forest based decentralized industry and does not displace persons from their villages. Bee keeping is a sustainable form of agriculture that can provide rural people with a source of much needed income and nutrition, therefore they have economic reasons to retain the natural habitat or modify it to boost honey production, and to increase yield of other agricultural products (Babatunde*et al.*,2007).

Poverty, on the other hand, is general scarcity, dearth, or the state of one who lacks a certain amount of material possessions or money.The poverty incidence in Nigeria increased from 65.6% in 1996 to 78.3% of the population in 2004 (FOS, 2004). Furthermore, the distribution of extreme poverty by occupational category indicates that 67.4% of thepoor in Nigeria were in agriculture (FOS, 1999). Its incidence rose from 27.2% in 1980 to 42.7% in 1992 and 69% in 2010 (NBS, 2012).Nigeria Human

Development Index (HDI) value for 2011 was 0.459 in the low human development category, positioning the country at 156 out of 187 countries (UNDP, 2011) and in 2014; it was 0.471 positioning the country at 153 out of 187 countries (UNDP, 2014).

In order to reduce poverty situation in Nigeria, especially in the rural communities, apiculture (beekeeping) which is an aspect of agriculture is a self-reliance enterprise that should be considered; it could help to raise household income and reduce unemployment and other social vices associated with poverty (Ayansola, 2012). Beekeeping for honey production is a profitable agricultural enterprise nowadays in all parts of the world including Nigeria (Onwubuya*et al*., 2013); there is a growing consumption of honey and other bee products because of its high values in maintaining good health and in treatment of various diseases ((Onwubuya*et al*., 2013). But Nigeria usually meets domestic demand for honey mostly by importation from producer countries and local bee hunters (Ja'Afarfuro 2007; Ayansola, 2012).With the current growth in domestic consumption of honey in Nigeria, the future of apicultural enterprise is very bright as the demand for honey and pollinators is bound to increase, it could provide food, nutritional, and livelihood security to the rural work force on an ecologically sustainable basis.

1.2 Problem Statement

Like in many developing countries, poverty in Nigeriais essentially a rural phenomenon as most of theimpoverished people live in the rural areas, where theyderive their livelihood from farming (Etimand Ukoha, 2010).Therefore, beekeeping has been identified as one of the agricultural enterprise that can be practised as a safety net against poverty, providing households with extra income from the sales of honey and other beehive products. The adoption of improved beekeeping technology by bee farmers as an aspect of agricultural enterprise is an option available to meet the culinary and industrial demands for bee honey and its products (Anyaegbunam, et al, 2006).

The importance of beekeeping to the society is enormous. For instance, Ojo (2004) describe the enterprise as a means of empowering youth economically because of its many advantages over other types of agricultural enterprises. The enterprise needs relatively small investment capital and most of the equipment needed for modern beekeeping can besourced locally. In beekeeping, the quality ofland required is less important because hives are placed either on the trees or on the ground. It isalso not competing with other enterprises for resources as the bees use nectar and pollengrains of plants.

The climatic information gathered depicts that the FCT has a vegetation and climatic condition that is favourable to beekeeping activities. The vegetation of the study area is of guinea, woodland and derived savannah, with trees like ParkiabiglobosaButyrospermumparkii, AzadiractaindicaMangiferaindica, Acacia species Delonixregia, and Anacardiumoccidentale. These species of trees provide forage for the honeybees, however despite this fact, these natural resources are not being maximally utilised; since the beefarmers are still living far from the poverty line. Also, bee keeping for wealth creation has practically remained untapped in the study area. Those already involved in beekeeping in the study area are not utilizing all the bee products but are mostly interested only in honey and bee wax extraction.

Modern bee-keeping technology, though not quite popular among the rural community dwellers can be used as a poverty reduction mechanism in Nigeria. The specie of bee, *Apismellifera* commonly known as the honey bee is the most widely-spread and abundant insect on earth. Due to ignorance of the profitability in bee-keeping and fear of being stung by bees, people are scared from venturing into bee-keeping.

Some of the studies undertaken had to do with the analysis of the production of bee and honey (Abere*et al*., 2011, Ajao, 2012), others demonstrated the social and health benefits of honey, but there is little or no attention on cost and returns, and overall relationship between poverty status and improved beekeeping. However, despite its significance, there is paucity of information on the level of contribution of beekeeping to household income, and its relationship to household poverty status, considering the fewer number of farmers in the FCT that are involved in this economically viable enterprise despite their poverty status.

There is a knowledge gap in beekeeping related research with respect to the level of contribution of beekeeping to household income, the economic efficiency of the beekeeping farmers as well as the relationship betweenimproved beekeeping activity and the poverty status of the bee farmers. Based on the foregoing, this study intends to answer the following research questions:

(i) What are the socio-economic characteristics of beekeepers in the study area?

(ii) What are the costs and returns from beekeeping in the study area?

(iii) What is the contribution of improved beekeeping to the poverty statusof beekeepers in the study area?

(iv) What is the economic efficiency of the beekeepers in the study area?

(v) What are the problems faced by beekeepers in the study area?

1.3 Objectives of the Study

The broad objective of the study was to assess the profitability of improved apiculture and its relationship to household poverty status in Abuja, Nigeria. The specific objectives were to:

(i) describe the socio-economic characteristics of the beekeepers;

(ii) determine the profitability of beekeeping in the study area;

(iii) assess the contribution of improved beekeeping to poverty status of beekeepers in study area;

(iv) determine the economic efficiency of beekeeping in the study area;

(v) identify the problems faced by beekeepers in the study area.

1.3 Justification of the Study

This study is to create more awareness on the profitability of beekeeping with efficient utilization of resources available to beekeepers, and encourage non-beekeepers to venture into it as means of wealth creation, in order to help boost their income.Ja'afar-Furo*et al*. (2005) in a comparative analysis of beekeeping and crop production in Adamawa State, Nigeria reports that to counter the effects of poverty and to improve the living standard of the rural farmers, beekeeping should be encouraged among the local people as it is a far more profitable and cost effective form of farming.

According to Oluwole (1999),bee-keeping does not require a large piece of land or compete with crops or livestock for land space, it provide farmers with an additional source of income as both local and international markets are readily available. The enterprise needs relatively small investment capital and most of the equipment needed for modern beekeeping can be sourced locally. *Apismellifera*, commonly known as honey bee, is most widespread and abundant insects on earth.

Assessing the profitability of modern beekeeping and its relationship to poverty status in Abuja is important. The study provides valuable information to producers, processors and marketers on how to efficiently carry out their production and marketing activities of honey and other hive products. Also, according to Akachukwu (1993), the importance of honey over sugar has been realized and concerted effort is being geared towards boosting its production. This study also estimated the additional income that was realized from other hive products like the beeswax candle. These could be an investment opportunity for job creation through production of beeswax candle to meet the demand of consumers and could provide wealth to support secondary activities in the community: such as children's education, retail services, and medical care.

Given the available natural resources (flowering plants, crops, water) that can be exploited for a successful modern beekeeping enterprise in the FCT, the demand for honey and other hive products far exceeds the supply. This situation could be attributed to different factors and constraints encountered by existing bee farmers that have not been fully identified and addressed. Thus, the need for this work to help give detailed information and analysis for maximal utilization of unexploited economic potential of the apicultural resources in a sustainable way as well as to upgrade and to promote beekeeping in the study area. It is envisaged therefore, that the results of the study shall contribute in the design of appropriate poverty alleviation policies and programmes of the government for rural beekeepers in the FCT, and add to the few existing literatures on related research topics.

1.5 Hypotheses

i. Improved beekeeping does not have significant relationshipwith poverty status in the study area.

ii. Bee-keeping is not profitable in the study area.

CHAPTER TWO

LITERATURE REVIEW

2.1 Poverty

According to Ogunleye (2010), Poverty, a global phenomenon that is complex and multi-dimensional is not easy to define. Each region of the world has different yardsticks for measuring the level of poverty based on people's ability to have access to basic things of life namely: food, clothing and shelter. However, it is pertinent to note that despite different yardsticks and indices of measuring poverty from region to region all over the world, the fact still remains that the meaning of poverty still tends towards lack and below average and poor standard of living going by the following definitions as posited by scholars. Narsir (2002) defined poverty as a concept that entails socio-economic and political deprivation which may affect individuals' households, or communities and which may result in lack of access to the basic necessities of life.

In Nigeria, poverty and unemployment remain the most widespread problems and tackling them continues to be a major policy challenge for every successive government. In the past, the agricultural sector had been relied upon to provide the exit route out of these twin problems. However, increasing population pressure, shrinking per capita land availability and stagnating yield growth have challenge the conventional wisdom that the agricultural sector could provide exit route out of poverty and declining rural income (Babatunde*et al*, 2007).

Beekeeping for honey production has been identified as one of the farming activities that could serve both purposes of providing employment and reducing poverty among rural dwellers in Nigeria.

2.2 Origin of Beekeeping

Africa is the original home of honey bee, *Apismellifera*. Africa and other tropical countries in the Caribbean and pacific therefore have highly appropriate habitat for bees. The common Africa honey bee in Nigeria is *ApisMelliferaadansonni*(Oluwaseun, 2009). Interest in bee keeping started with hunting and robbing of wild colonies in hollow cavities in trees and rocks. (Halil and Nuray, 2007). Until the 19th century, when sugar cane became available, honey was the world most popular sweetener and today, it is still being used as cake, tea, jam and jelly sweeteners. (Babatunde*et al*., 2007).

A bee colony consists of three castes i.e., infertile female (workers), male (drones) and a fertile female (queen) (Johansson, 1980). A colony is a living being composed of different members, each performing different tasks: the queen which is a fertile egg-laying female, and consist of about 10,000 – 20,000 worker bees (infertile female) which fly off to search for food, take care of the brood or maintain the temperature inside the hive. The drones (male bees) are present in the reproductive season to fertilize the queen, but may be absent in times of food scarcity or dearth period (Marieke, 1991).

2.2.1 Apiculture in Nigeria

Bee keeping or apiculture entails the rearing or keeping of bees with the aim of exploiting its products which includes honey,beewax, pollen grain, propolis, and comb.

The climate of the Nigeria is characteristically tropical and humid all the year around (World Bank,2006) which is also obtainable in the study area, this thus supporting the survival of bees. Bee keeping has significant economic importance to both primary and secondary agribusiness. According to Carter (2004), scientific tests carried through agricultural research, have shown that, that the yield of fruit is considerably increased when powerful stock of bee is allowed access to the tree. Honey and pollen grain also has significant nutritive value.

The practice of bee keeping is as old as any other agricultural practice. It has been an alternative source of income to farmers especially in rural communities. Old or traditional bee keeping differs from modern bee keeping in management style; this has ineluctably influence output in terms of quality and quantity per production cycle. Apiculture, being an agribusiness enterprise, requires that the most suitable management practice,(considering other environmental factor) to maximize output be applied. It has been found to be profitable with little investment made into it (Gurung, 2005).

Beekeeping is a useful means of strengthening livelihoods because it uses and creates a range of assets (Bradbear, 2003). Beekeeping fits in well alongside many other livelihood endeavours because it uses the same natural resources as, for example, forestry, and agriculture and conservation activities. It improves the economic condition of the farmers; restrict the migration of rural youth to urban areas and helps in holistic development of rural society. It is a subsidiary, complementary, supplementary and a family business enterprise which is pollution free. Despite her potentials for honey production, due to excellent flora and fauna diversity, Ojeleye (2003), observed that, commercial beekeeping was almost non-existent in Nigeria, until recently. The country had relied on imported honey to meet the growing domestic demand for honey. The local output of honey comes only from the few honey hunters and traditional bee farmers who uses traditional harvesting and processing techniques, which often lead to poor-quality honey that may have little or no market value.

Bee keeping also has some constraints facing it, one of which is the seemingly lack of technical know-how, only little or nothing is known about the level of technical efficiency of the few who practice it (Olarinde*et al*, 2008). This means that the sustainability of bee keeping for honey and the production of other products may not be ascertained. This stems from the fact that the ability to produce maximum output from a given set of inputs (technical efficiency), given the available bee-keeping technology has not been fully understood. More so, honeybees have a lot to offer in terms of agricultural products and ecosystem services. However, bees are exposed to a number of threats such as climate change, reduced biodiversity, and invasive species that reduce their quality of health and longevity (UNEP, 2010).

2.2.2. Composition of Honey

Honey contains a complex mixture of carbohydrates, mainly glucose and fructose; other sugars are present as traces, depending on floral origin. It also contains small quantities of organic acids, lactones, amino acids, minerals, vitamins, enzymes, phenolic compounds, volatile compounds, pollen, wax and pigments. The contents of these components in honey are the most important quality criteria of honey and indicate some important deterministic quality properties of the honey (Sahinler and Gul, 2004). Chemical composition of honey mainly depends on the vegetation sources from which it derives, though external factors like climate, harvesting conditions and storage can also influence it. Careless handling of honey can reduce its quality. Amongst the factors that most influence the quality of honey are high temperature, length of storage and moisture content greater than 21%. They lead to fermentation, high levels of Hydroxymethylfurfural (HMF), loss of enzymatic activity, changes in flavor, darkening and microbial growth (Moguel*et al*., 2005). On the average, honey is composed of: moisture (17.2%), fructose (38.19%), glucose (31.28%), sucrose (1.31%), disaccharides calculated as maltose (7.31%), higher sugars (1.5%), free acid as gluconic (0.43%), lactone as gluconolactone (0.14%), total acid as gluconic (0.57%), ash (0.16%) and nitrogen (0.041%) (Jeffrey and Echazarreta, 1996).

Honey is reported to contain little or no fat, but free fatty acids like palmitic (16:0), oleic (18:1) and linolenic (18:3) have been detected in white clover honey (Tan *et al.*, 1988; Singh and Kuar Bath, 1997). The protein content of honey has been reported to vary between 1.0 to 4.0 g/kg with proline, lysine, phenylalanine, aspartic and glutamic acid most readily detected (Bosi and Battalglini, 1978). A number of B-group vitamins are also reported present in honey but their concentrations are generally low (National Honey Board, 2003). Moisture content is one of the most commonly monitored parameters of honey quality; according to Smith, 1960, if there is more than 17.4% of water in honey, the weight will be less, and this enhances its quality. Also, if the water content is above 17.4%, there is a danger of the honey fermenting (Fadare, 2001).

2.2.3 Production of Beewax

Beeswax is produced by worker bees using carbohydrates to build honeycomb cells for nesting and storage of honey and pollen (Krell, 1996). Beeswax is produced from old hive combs, which should be removed regularly to encourage more comb production and avoid infection from dirt build-up (Bogdanov, 2009). Raw beeswax can easily be collected by placing combs on a sun melter, a special piece of equipment designed to hold frames and collect melted wax; these can be constructed or purchased. The type of hive being used makes a big difference: moveable frame hives are designed to maximize honey production: The ratio of honey and beeswax production using fixed comb or movable-comb hives is about 10:1" (Bradbear, 2009). Beeswax, as a natural by-product of beekeeping, which can easily be harvested from discarded combs, presents an excellent opportunity for added revenue from beekeeping. However, depending on the choice of hive, there can be considerable trade-offs with honey production, but the higher value of beeswax may, in some cases, offset these trade-offs. Humans have kept bees for the production and harvest of honey since 4,000 B.C (Halil and Nuray, 2007).

2.3 Review of Empirical Studies on Beekeeping

Beekeeping has been an important part of agriculture in the Midwest since about 1840 (killion, 1985). He stressed that early settlers and farmers kept bees in primitive hives or cut down bee trees to get honey for home use and for sale. Levi (2001) opined that beekeeping and honey production would not only boost the revenue of the beekeeping families but also, in turn significantly advance the local economies in communities. Until the refining of sugar cane developed in the 19th century, honey was the only sweetening agent widely available; it was prized not only as food, but also for its uses in folk medicine (Hentry, 2001). With close to 70 percent of the rural population in Nigeria living in poverty, income generating opportunities such as beekeeping are critical for poor rural families. As a profitable activity requiring little capital outlay, minimal labor and a small amount of land, beekeeping can be an important self-employment opportunity for the generation of supplemental income for poor and subsistence farmers, particularly women (Hentry, 2001).

In the studycarried out byOnwbuya, (2004) bee farming can help alleviate poverty in rural areas as beekeeping can be taken as a hobby, a social booster and can be practiced by those who are not conventional farmers. Bee farming is relatively cheap to manage, as the major production is undertaken by the bees, while man does the harvesting. It is the only agricultural practice that does not need large expanse of land, water, feed and fertilizer to thrive. According to Atanda (2007), lack of access to credit and where credits are made available the semi-rich take advantage; lack of access to factors of production to boost agricultural productivity (land and capital), lack of access to economic resources (monetary and non-monetary income) are the constraints faced by farmers. All of these cause a reduction in the expected output from the farmer's hives. Ebojei *et al.* (2008) in a study of Assessment of the Contributions of Bee- Keeping Extension Society to the Income of Bee-Farmers in Kaduna State, Nigeria reported the constraints to beekeeping in the study area to be pest attack, lack of finance, poor storage, deforestation, inadequate beekeeping equipment and theft. The population of bees and wild insect pollinators is on the decline because of reduction in hibernating and nesting places due to intensive agriculture, deforestation, cleaning of wastelands and indiscriminate use of pesticides (Singh *et al.*, 2006).

Beekeeping offers opportunities for empowering and developing the rural populace by making them self-reliant and depend less on the government through 'train the trainer' approach in which the teacher teaches the students and pupils in a formal set up as found in schools or informally by organizing enlightenment campaign and workshops which will encourage grass root participation in beekeeping. Whatever be the approach the trained teacher and his trained pupils students, adopt their parents and peers are part and -parcel of the rural populace. They can be economically empowered through the various benefits derivable from beekeeping (Oluwole, 1999; Winnie the Pooh 2008).

Beekeeping in Ethiopia plays an important role in income generation for beekeepers. Gidey and Kibrom (2010) conducted a household survey to assess the potential of beekeeping for rural development and identify the major constraints of beekeepers. In their study, they noted that Ethiopia produces about 28,500 tons of honey and 5000 tons of beeswax annually, and that despite all the constraints and challenges faced by the beekeepers, there are enormous opportunities and potentials to boost the production and quality of honey products in the village of study. And that, enhancing bee forage plantation through introducing Multi-Purpose Trees (MPT) such as fruit crops is recommended.

Olarinde*et al*., (2008) empirically estimated the technical efficiency of bee-keeping farms and also identified the socio-economic factors that determine the level of estimated technical efficiency of the sampled respondents. Results indicated that the mean technical efficiency of the sampled respondents is not too far from the respective efficiency values for each of the bee-keeping farms, because of the availability of the direct inputs. Results also showed that bee-keepers who keep bees as primary occupation are more technically efficient than those who keep bees as a secondary occupation. The implication of the results is that increased and sustainable honey production would better be achieved through young producers who can devote their full time to honey production.

The ability to produce maximum output from a given set of inputs (technical efficiency) given the available bee-keeping technology is termed resource use efficiency. Efficiency level of farmers, according to Awotide and Adejobi (2006) has direct bearing on the cost of production which consequently translates to more profit to the farmers. According to Babatunde*et al*., (2007), the scope for resources use efficiency will require that the number of hives and expenses on fixed assets be reduced and use of labour be increased. However, when labour input is increased beyond certain limit, fixed assets and hives would have to be added also to ensure optimal resource combination in honey production.

An important assumption underlying efficiency concept is that firms operate on the outer bound of production function that is, on their efficiency frontier, implying that when firms fail to operate on the outer bound of their production function, they are said to be technically inefficient. For such firms, an improvement in technical efficiency could be achieved in three ways, through (a) improved production techniques, which implies a change in factor proportions through factor substitution under a given technology, thus representing a change along the given production function; (b) an improvement in production technology, which represents a change in the production function itself such that the same amount of resources produce more output, or alternately, the same amount of output is derived from smaller quantities of resources than before, and (c) a simultaneous improvement in both production techniques and technology (Amaza, *et al*., 2001).

2.4 Apiculture as a Tool to Enhance Rural Economy

Bradbear, (1990) among others identified the following as benefits of beekeeping venture which can also help raise household Income:

i. Production of honey, bee wax, propolis and bee venom which are useful and valuable commodities. The products are cash-crops that are readily marketable and have long shelf-life.

ii. The pollination service rendered by the honeybee from beekeeping results in increased crops production and abundant harvest.

iii. Beekeeping does not require expensive equipment, as simple hives and others can be made from local materials by local artesian. This stimulates business for local trades.

iv. No serious food is required by bees other than pollen and nectar in flowers which are available all year round

v. Basic beekeeping techniques are easy to learn by both sexes and all age groups

vi. Bees do not require daily attention

vii. Beekeeping do not take up valuable land or space as hives are placed on trees, waste land or on flat roof tops.

viii. The formation of beekeeper's association or co-operative related ventures can encourage contact between people and provide means of obtaining loans to establish bee farms.

2.5 Modern Apiculture

2.5.1 The use of modern bee hives

Modern beekeeping methods aim to obtain the maximum honey crop, season after season, without harming bees (Nicola, 2002). Modern movable- frame hive consists of precisely made rectangular box hives (hive bodies) superimposed one above the other in a tier. The number of boxes is varied seasonally according to the population size of bees.These include the top bar hive and the Langstroth hive.

The Kenyan Top Bar (KTB) hive is originated from Kenya. It was named after a volunteer worker who worked in Kenya. Some people in Zimbabwe refer to it as the coffin hive/boxes deriving the name from the shape of the hive. This is the most recommended type of hive for the beginners (Figure 1)

Plate 2.1: The Kenya Top Bar hives (KTB)

The Langstroth Hive

This is the most modern type of a hive. The Langstroth hive is the most productive of all the type of hives.

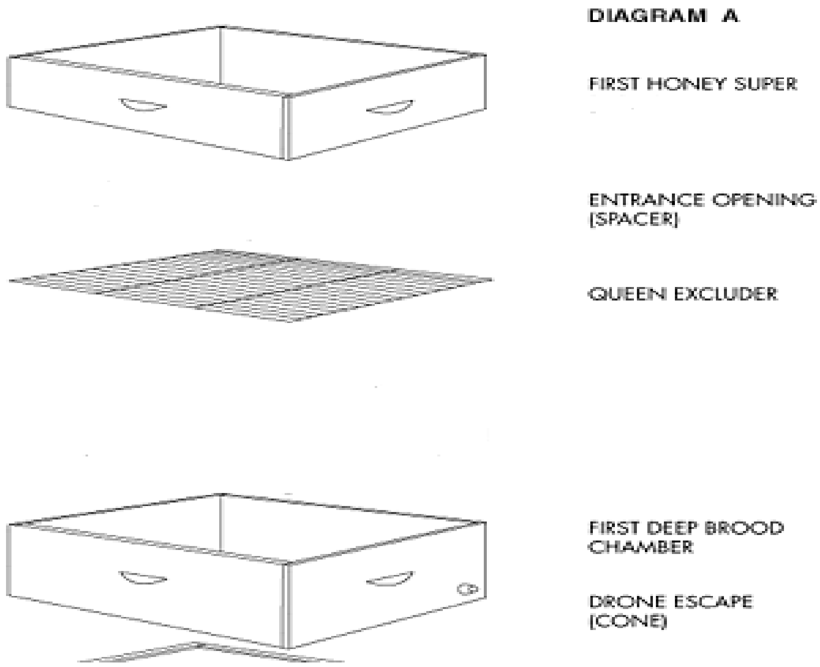

figure 2.1: The Langstroth Hive

This hive unlike the Kenyan top bar and other hives is made up of detachable components namely, the hive cover, the inner cover, the super chamber, the queen excluder, the brood box and the floor board. In the super chamber(s) and the brood box there are some moveable frames that are fitted with wax foundations. The hive cover acts as the roof of the hive and is usually made of a metal sheet. The rest of the is made of wood except the queen excluder that is made up of a metal gauze with holes that only permit worker bees to pass through. The gauze is fitted into a wooden frame. Unlike in the KTB hive, the brood chamber is specifically meant for brood rearing. Looking at the structure of the hive you would notice that this brood chamber or hive body is the largest in terms of volume. This has been designed so that enough brood and food (honey) is available in required proportions in the hive at any time of the year since the beekeepers are not going to disturb the chamber. During harvesting, the beekeeper is not supposed to disturb the brood box so that he/she leaves enough honey for the brood and the swarm in the brood box. The brood box is usually separated from the super chamber by a queen excluder. Since the beekeeper is not supposed to harvest honey from the brood box, the queen excluder serves the right purpose to ensure that the queen is confined to the brood box. Combs in the super should not at any given time have brood. If this happens when the queen excluder is on then it would mean that investigations should be carried out. It might be that the colony is now queen less and a worker bee is now laying eggs or that the excluder might be damaged as to allow penetration by the queen. The queen’s confinement to the brood box guarantees the probability of the beekeepers acquisition of honey only from the super(s) during harvesting. The movable frames fitted in the super and brood chambers are designed to allow standardized comb building and the availability of bee space between the combs. Wax foundations for the Langstroth frames are made in such a way that when fitted to the frames, to the bees they appear as unfinished combs and hence would encourage the bees to finish them off-thereby encouraging productivity(BKAZ, 2013).

Plate 2: Bee hives in a forest for honey production

(Source:Onwubuya*et al*. (2013).

2.6. Review of Empirical Studies

2.6.1 Theoretical basis of stochastic frontier model

Farm efficiency and the question of how to measure it is an important subject in developing countries' agriculture. There are three distinct approaches to measurement based on cost, profit, and production functions (Parikh *et al.*, 1995). Farrell (1957) distinguishes between technical and allocative efficiency (or price efficiency) as a measure of production efficiency through the use of a production frontier and cost function respectively. The cost function represents the dual approach in that technology is seen as a constant towards the optimization of firms (Chambers, 1983). The cost function approach is preferred over the profit function approach to avoid problems of estimation that may arise in situations where farm households realize zero or negative profits at the prevailing market prices(Kavoi*et al.*, 2010).

Efficiency study has assumed important dimension in agricultural production because scarce resources are combined to produce outputs. The success of any farm business depends on the ability of the farmer to combine the scarce resources in the right proportion. The efficiency of a firm consists of three components: technical, allocative and economic efficiencies. Technical efficiency is defined as the ability to produce a given level of output with a minimum quantity of inputs under certain technology. Allocative efficiency refers to the ability to choose optimum input levels for given factor prices, while Economic or total efficiency is the product of technical and allocative efficiencies. An economically efficient input-output combination would be on both the frontier function and the expansion path (Ogundari and Ojo, 2006).

2.6.2 Profitability of Improved bee farming activity

A reasonable and sustainable level of profitability is essential for the feasibility and continuity of an enterprise (Yildirim, 2006). Farm budgeting (Net farm income) can be used to evaluate the profitability of beekeeping. It is simply calculated as the difference between the total revenue and the total cost. The difference between the gross revenue and the total cost of production will be the profit or the net farm income (Olukosi and Erhabor, 1998). The total revenue represents the total number of wax and honey produced multiplied by the unit price. The total cost comprises of the variable cost and the fixed cost of establishing and running the farm.

Honey yield per beehive is a major factor, which affects the profitability of beekeeping enterprises (Jones, 2004), followed by the bee wax. Beekeeping enterprises provide benefits in terms of income, employment, decrease in population migration, pollination of crops and conservation of biodiversity.

Tijani*et al*. (2011) in a study of economic analysis of beekeeping in Borno State, noted that beekeeping has proved to be a profitable venture in the study area allowing those farmers that were engaged in it to obtained good returns; realizing gross revenue, total cost and net farm income of N14, 234.17, N5, 260.65 and N8, 973.74, respectively per colony. Beekeepers earned between N201,000 to N401, 000 and above annually from the enterprise. This indicates that a reasonable income can be earned from beekeeping in the study area. Thus, the higher the annual income of a farmer, the greater the scale of agricultural production he can undertake and the higher the profit in farming. Gamze*et al*. (2004), noted in his study on economic analysis of beekeeping enterprise in sustainable development, that the larger the size of a colony, the lesser the unit cost of honey production; he said further that large sized apiaries are found economically profitable, and as a result, honey production plays a very important role as a source of increased rural income in sustainable development in Turkey.

2.6.3 Improved beekeeping as it relates to Poverty Status

Improvement in family earnings from beekeeping has been reported by Crane (1992), he reported sufficient or ample income from beekeeping in America and Europe or

Mediterranean region where beekeepers owned a car or truck or even a small plane to monitor their apiaries. He opined that in Africa and Asia, beekeepers are rich with modern hives and modern beekeeping practices.

Income generated from beekeeping can be used to pay for education, health services, transport and housing. Beekeeping provides further employment for urban and rural peopleinvolved in the honey bee business and in producing equipment and protective clothing. In Manyoni district, Tanzania, for about 70% of beekeepers interviewed, income from selling bee products subsidized household economies by at least 30%(Mwakatobe and Mlingwa 2005).The beekeeping sector makes a significant contribution to the socio-economic development of people in Manyoni District from the household to district levels in terms of income generation, food security, health, material well-being, employment and agricultural development.

Honey has good domestic market all the year round with slight price change at different market points. In the rural communities of Amhara region, honey sales helps for the diversification of the incomes of farmers. Some farmer beekeepers of the region reported to earn up to 3000 Birr (about US$ 353) annually from honey sales only, which contribute the largest portion of their annual incomes (Kerealem et al., 2009). These facts indicate the high potential of apiculture as source and means of diversifications of incomes for the rural communities. Many resource poor farmers sell their honey to the local markets and use income to purchase livestock, agricultural inputs, food crops and other household items. Many beekeepers sell their honey mixed with beeswax without further processing. Honeybees can also be sold to meet cash requirements (Kerealem*et al.*, 2009).

CHAPTER THREE

METHODOLOGY

3.1 Description of the Study Area

The Federal Capital Territory is the home of Abuja, the capital of Nigeria. The territory was formed in 1976 from parts of former Nasarawa, Niger, and Kogi States and it is in the central region of Nigeria, bordered to the north by Kaduna State, to the east by Nassarawa State, to the south-west by Kogi State and to the west by Niger State.The Federal Capital Territory lies between latitudes 8^o 25'N and 9^o 20'N and longitude 6^o39' and 7o 45' East of the Greenwich meridian.Its size is equivalent to 0.8% of Nigeria (Mabogunje, 1977). It covers a land mass of about 8,000 square kilometers (Abuja master plan, 2000) and has a current projected population of 2,514,738 at 3.2 % national population growth rate. The FCT is divided into six area councils namely, Abaji, Abuja Municipal, Bwari, Gwagwalada, Kuje, and Kwali.

The vegetation of the FCT is normally classified as park savannah, with scattered trees, pockets of guinea savannah, woodland savannah, derived savannah and parkland savannah; which is suitable for modern beekeeping activities.Being centrally located, Abuja is blessed with a mix of agricultural produce such as tubers and root crops of the south (yams, cassava, maize and plantains) and grain (sorghum, guinea corn and rice) of the north.The dry seasons record the highest temperature when there are few clouds in the FCT (Balogun, 2001). Its temperature ranges from 30.4^{o}C and 35.1^{o}C. Mean annual rainfall is about 1400mm (Abuja master plan, 2000). The climatic information here depicts that the FCT has a vegetation and climatic condition that is favourable to beekeeping activities.

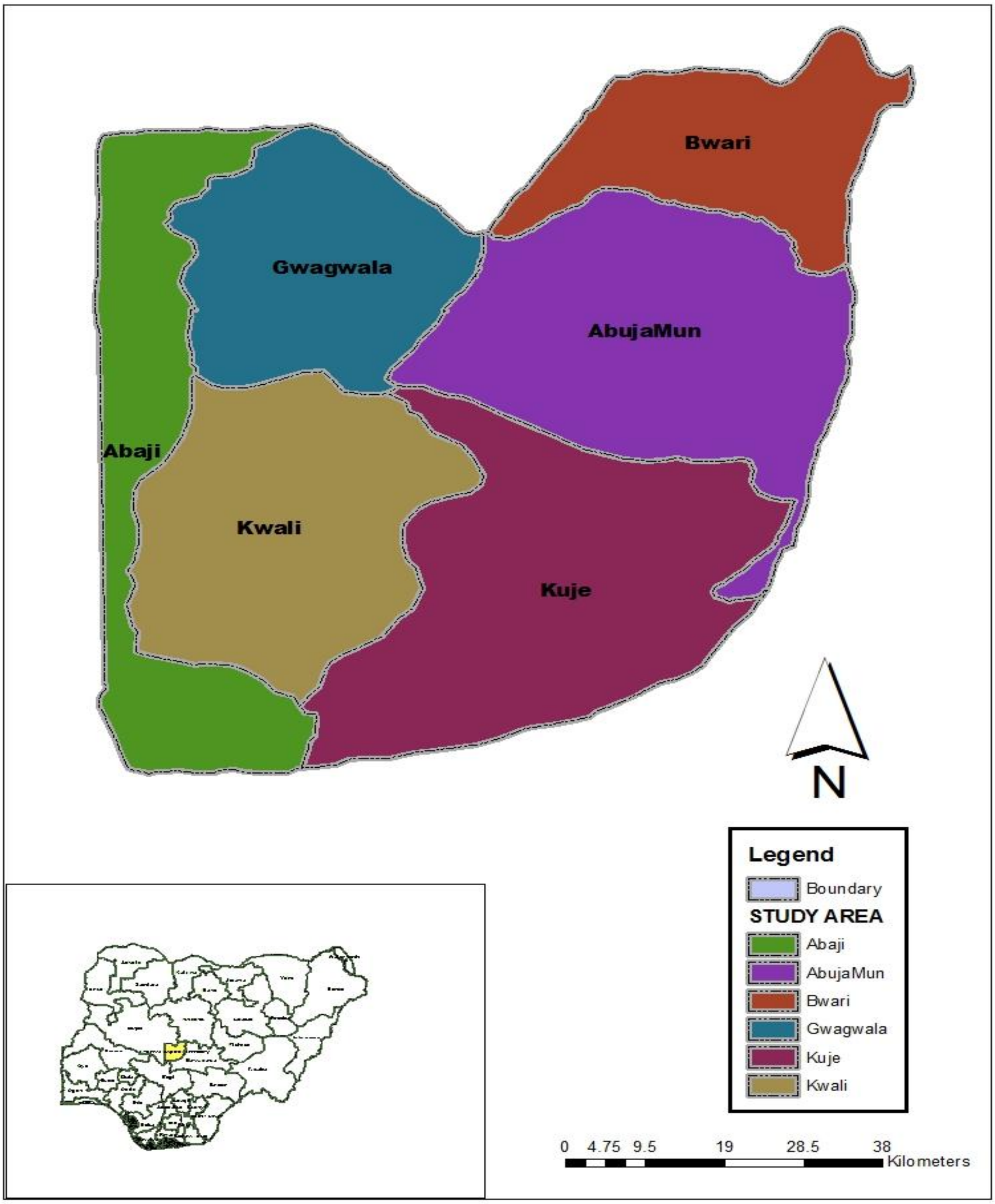

Figure 3.1: Map of Abuja showing the study area

3.2 Sampling Size and Sampling Techniques

The modern apiculture farmers in Abuja FCT were the target population for the study. A purposive sampling technique was employed for selecting the bee farmers. At first,three (3) area councils from the list of six (6) area councils were purposively selected, because of the predominance of beekeepers in the 3 area councils. This was discovered based on reconnaissance survey conducted in the area. The area councils selected are Abaji, Bwari,andKwali respectively. In the second stage, two villages were purposively selected based on the intensity of beekeeping activities. The villages are TunganBijimi and GidanJaba from Bwari, LeleyiGwari and Chikukufrom Kwali, Yaba and Gawu from Abaji. Finally, all the bee farmers in each of the villages were sampled for the purpose of this work because of their small population as shown in Table 3.1.

Table 3.1: Distribution of Respondents in the Study Area

Area Councils	**Villages**	**Sample Frame**
Abaji	Yaba	22
	Gawu	14
Bwari	TunganBijimi	31
	GidanJaba	27
Kwali	Chikuku	20
	LeleyiGwari	26
Total		**140**

3.3 Data Collection

Primary data were used for this study. These were collected with the aid of structured questionnaire. Information were collected on: households' socio-economic characteristics such as age, gender, educational level, farm size, farm income, non-farm income, extension contact, membership of association, household size, amount of credit received, number of income sources; household food expenditure and consumption; number of hives; number of colonies per production, honey and wax production, input and output prices and constraints faced by bee keepers, factors affecting efficiency, cost and returns from the enterprise; and effect of output/income from beekeeping on the livelihood of beekeepers.

3.4 Analytical Techniques

The analytical tools used to analyze the data collectedare**:** Simple descriptive statistics, farm budget analysis, Foster-Greer-Thorbecke (FGT) model,stochastic frontier model and Pearson correlation analysis.

3.4.1 Descriptive statistics

This involved the use of percentages, means, frequency distributions and standard deviations to describe the socio-economic characteristics, honey output, wax production, resource use, etc. This tool was applied to describe the socio-economic characteristics of the respondent bee farmers (objective i), and to identify the problems faced by beekeepers in the study area (objective v).

3.4.2 Farm budgeting (net farm income)

This was used to determine the profitability of beekeeping in the study area (objective ii). Net farm income was used to evaluate the cost and return to obtain a net profit. It is simply calculated as the difference between the total revenue and the total cost. The difference between the gross revenue and the total cost of production will be the profit or the net farm income (Olukosi and Erhabor, 1998). The total revenue represents the total number of wax and honey produced multiplied by the unit price. The total cost comprises of the variable cost and the fixed cost of establishing and running the farm. The equation for net farm income is given as

NFI = TR – (TVC + TFC) ……………………………….......... (2)

Where: NFI = Net Farm Income (₦)

TR = Total Revenue (₦)

TVC = Total Variable Cost (₦)

TFC = Total Fixed Cost (₦)

The fixed inputs are not normally used up in a production cycle. They will therefore be depreciated using the straight line method given by

$$D = \frac{P-S}{N} \quad \text{…………………………………....................(3)}$$

Where D = Depreciation (₦)

P = Purchase Value (₦)

S = Salvage Value (₦)

N = Life Span of Asset (₦)

3.4.3 Foster-Greer-Thorbecke's (FGT) weighted poverty index

The Foster, Greer and Thorbecke (FGT) measures of poverty are widely used because they are consistent and additively decomposable (Foster *et al*., 1984). For greater policy relevance on how the poor live and the economic environment in which they operate, the FGT model is used to determine the incidence, depth and severity of poverty. This was used to achieve part of objective (iii) to assess the contribution of improved beekeeping to poverty status of bee farmers; in line with how beekeeping will help farmers to stay above poverty line. Foster-Greer-Thorbecke (FGT) measures and subsumes the headcount index and the poverty gap, and provides the distributional sensitive measure through the choice of a poverty aversion parameter "α"; and the larger the value of the "α", the greater the weight given by the index to the severity of poverty (Anyawu 1997).

The General Foster, Greer and Thorbecke (FGT) poverty index ($P_{\alpha i}$) can be expressed as:

$$P_{ai} = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z-y_i}{z}\right)^a \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (4)$$

When:

$$a = 0, \qquad P_0 = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z-yi}{z}\right)^0 = \frac{q}{n} \qquad i.e\ poverty\ incidence\ or\ head\ count$$

$$a = 1, \qquad P_1 = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z-yi}{z}\right)^1 i.e\ poverty\ gap\ or\ depth$$

$$a = 2, \qquad P_2 = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z-yi}{z}\right)^2 \qquad i.e\ poverty\ severity$$

Where:

P is the poverty index,

αis a non-negative parameter, which takes the value 0, 1 and 2 and indicates the head count ratio, the poverty gap and the squared poverty gap respectively as stated above;

n = number of bee farmer households

q = the number of poor bee farm households

z = poverty line, that is, 2/3 of the Mean Per Capita Household Expenditure, MPCHE, of the bee farming households

yi = bee farm household per capita expenditure of the i^{th} household

3.4.4 Stochastic frontier model

The stochastic frontier production function was used to achieve objective iv. This was used to determine the technical, allocative and economic efficiency of beekeeping in the study area(objective iv) using the empirical Cobb-Douglas stochastic frontier production function was to determine the ctechnical efficiencies and the model is specified as follows:

$$lnY = b_o + \sum_{i=1}^{5} b_i \, lnp_i + \beta lnY_g + v + u \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots. (6)$$

$$lnC = b_0 + b_1 lnp_1 + b_2 lnp_2 + b_3 lnp_3 + b_4 lnp_4 + b_5 lnp_5 + \beta lnY_g + v + u.. (7)$$

Where:

Y = Output (litre)

P_1= Labour (man-days)

P_2= Baiting matrerials(numbers)

P_3= Land size (hectare)

P_4= Beehive (number)

ln = natural logarithm

b_0 = intercept

b_i = vector of technical parameter to be estimated

β = vector of output parameter to be estimated

v= random variability in technical efficiency that cannot be influenced by the farmer.

u= the deviation from the production frontier attributed to technical inefficiency.

The inefficiency effects Ui is as follows:

$U_i = \delta_0 + \delta_1 Z_1 + \delta_2 Z_2 + \delta_3 Z_3 + \delta_4 Z_4 + \delta_6 Z_6$ .... (8)

Z_1 = Age (years)

Z_2 = Household size(number)

Z_3 = Beekeeping experience (years)

Z_4 = Extension contact (number of contacts with extension agents per annum)

Z_5 = membership of beekeeping cooperative (years)

Z_6 = Amount of credit obtained (naira)

Z_1-Z_6 = are the scalar parameters estimated.

The stochastic frontier cost function was estimated by the Maximum Likelihood Estimation (MLE) using frontier Version 4.1.

$$lnC = b_o + \sum_{i=1}^{5} b_i \, lnp_i + \beta lnY_g + v + u \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots. (6) lnC$$
$$= b_0 + b_1 lnp_1 + b_2 lnp_2 + b_3 lnp_3 + b_4 lnp_4 + b_5 lnp_5 + \beta lnY_g + v + u \ldots\ldots (7)$$

Where:

C = Total cost (naira)

P_1= Cost of labour (naira)

P_2= Cost of baiting matrerials(naira)

P_3= Cost of transportation (naira)

P_4= Cost of beehive (naira)

P_5= Cost packaging materials (naira)

Y_g = Output of beekeeping farmers (naira)

ln = natural logarithm

b_0 = intercept

b_i = vector of cost parameter to be estimated

β = vector of output parameter to be estimated

v= random variability in the cost of production that cannot be influenced by the farmer.

u= the deviation from the cost frontier attributed to cost inefficiency.

The inefficiency effects Ui is as follows:

$U_i = \delta_0 + \delta_1 Z_1 + \delta_2 Z_2 + \delta_3 Z_3 + \delta_4 Z_4 + \delta_6 Z_6$ .... (8)

Z_1 = Age (years)

Z_2 = Household size(number)

Z_3 = Beekeeping experience (years)

Z_4 = Extension contact (number of contacts with extension agents per annum)

Z_5 = membership of beekeeping cooperative (years)

Z_6 = Amount of credit obtained (naira)

Z_1-Z_6 = are the scalar parameters estimated.

The stochastic frontier cost function was estimated by the Maximum Likelihood Estimation (MLE) using frontier Version 4.1.

3.4.5 Pearson correlation analysis

Pearson's correlation coefficient is a statistical measure of the strength of a linear relationship between paired data (beekeeping income and poverty status). This was used to achieve the remaining part of (objective iii) and to test the hypothesis which states that ''Improved beekeeping does not have significant relationship with poverty status of beekeepers in the study area.''.It is denoted by r and is by design constrained as follows $-1 \leq r \leq 1$. A statistically significant correlation coefficient in the range $0<r<0.3$ will be regarded as weak correlation; $0.3<r<0.6$ will be regarded as moderate correlation; $0.6<r<1$ will be regarded as strong correlation, while a correlation coefficient of 1 will be regarded as perfect correlation (Asogwa*et al*., 2012). The correlation coefficient (r) is estimated as follows:

$$r_{XY} = \frac{n\sum XY - (\sum X)(\sum Y)}{\sqrt{n\sum X^2 - (\sum X)^2}\sqrt{n\sum Y^2 - (\sum Y)^2}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (9)$$

Where:

r = correlation coefficient

X = beekeeping (this was given by the beekeeping income)

Y = poverty status (this wasgiven by the FGT weighted poverty indices)

3.4.6 Z- statistic

This was used to test the hypothesis which states that ‘‘Beekeeping is not profitable in the study area’’, that is there is no significant difference between the costs and returns of beekeeping in the study area. It was expressed as follows:

$$Z = \frac{\mu_1 - \mu_2}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (10)$$

Where;

Z = calculated Z value

μ_1= Mean returns of beekeeping

μ_2 = Mean cost of beekeeping

σ_1= Standard deviation of the returns of beekeeping

σ_2 = Standard deviation of the cost of beekeeping

n = sample size of beekeeping farmers (140)

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Socio-economic Characteristic of Respondents

4.1.1 Gender of respondents

The result of the socio-economic characteristics as revealed that all the sampled respondents in the study area were males. This implies that beekeeping in the study area is a male dominated farming activity and this could be as a result of lack of technical know-how on beekeeping by women in the study area. This compares favourably with Oluwatosin (2008) who reported that all the beekeepers in Ekiti State were males noting that women might be scared away from the business because of the age long fear of being stung by bees. Also, Tijani*et al.* (2011), reported of the dominance of males in beekeeping in Borno State, Nigeria.

4.1.2 Marital status of respondents

The result of socio-economic characteristics indicated that most of the respondents (95.6%) were married while very few (4.4%) were single. The high proportion of married respondents is an indication of the availability of family labour for their bee farming and also, a motivation for active participation in beekeeping to generate income for meeting the needs of their families. This is in line with Onwumere*et al.* (2012) who reported that majority (50%) of the bee farmers in Abia State were married and also, Famuyide*et al*. (2014) found that 79.4% of the bee farmers in Oyo State were married, implying that the married farmers can engage the family labour in carrying out some of the production operation.

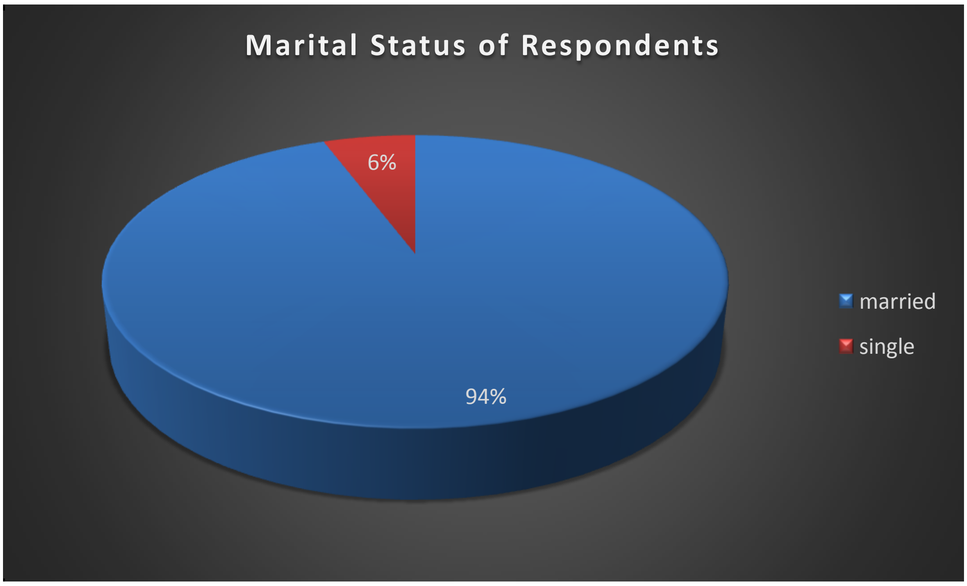

Fig. 4.1: Marital status of the respondents

4.1.3 Age of respondents

The result of the distribution of the respondents based on age as presented in Table 4.1 shows that majority of the respondents (62.9%) were within the age group of 30 – 39 years with a mean age of 37 years. This implies that most of the respondents were young and active and can therefore; participate actively in the day to day running of their beekeeping enterprise, can readily adopt better agricultural technologies for enhancing their productivity as they are not risk averse like older farmers. This is in line with Oluwatosin (2008) who reported that the modal age of beekeepers in Ekiti State was 31 – 40 years as indicated by 50% of the beekeepers and also,Tijani*et al*. (2011) found out that the modal class of the bee farmers in Chibok Local Government Area of Borno State was 31 – 35 as indicated by 38% of the beekeeping farmers. The next category was 20.7 % of the respondents within the 40 – 49 years age bracket and this is also an economically active age group. Very few (1.4%) of the respondents were above the age of 59 years.

Table 4.1: socio-economic characteristics of respondents

Variables	Frequency	Percentage
<u>**Age (Years)**</u>		
20 – 29	14`	10.0
30 – 39	88	62.9
40 – 49	29	20.7
50 – 59	7	5.0
> 59	2	1.4
Total	**140**	**100.0**
Mean	37	
Min	23	
Max	60	
Std. Dev	6.73	
<u>**Educational Status**</u>		
No formal education	12	8.6
Primary education	25	17.9
Secondary education	88	62.9
Tertiary	15	10.7
Total	**140 100.0**	
<u>**Household Size**</u>		
1 – 5	74	52.9
6 – 10	58	41.4
11 -15	8	5.7
Total	**140**	**100.0**
Mean 6		
Min 1		
Max	19	
StdDev	3.57	

Farming Experience (Years)		
1 – 3	63	45.0
4 – 6	43	30.7
7 – 9	24	17.1
> 9	10	7.1
Total	**140**	**100.0**
Mean	4	
Min	0	
Max	10	
StdDev	2.65	
Membership of Cooperative (Years)		
None	44	31.4
1 – 3	46	32.9
4 – 6	46	32.9
7 – 9	4	2.9
Total	**140**	**100.0**
Mean 5		
Min	0	
Max	25	
StdDev	2.69	
Access to Credits		
Access	122	87.1
No access	18	12.9
Amount of credit(₦)		
₦1 – ₦29, 999	9	6.4
₦30, 000 – ₦59, 999	111	79.3
>₦59, 999	2	1.4
Total	**140**	**100.0**
Mean = 31064.29		
Sources of Credit		
Personal Capital	18	12.9
Commercial banks	3	2.1
Friends and relatives	98	70.0
Cooperative	62	44.3
Total	**181***	

No. of Extension Contact		
None	52	37.1
1 – 3	28	20.0
4 – 6	25	17.9
7 – 9	27	19.3
> 9	8	5.7
Total	**140**	**100.0**
Mean 4		
Min	0	
Max	15	
StdDev 3.44		
Number of Beehive		
1 – 10	9	6.4
11 – 20	17	12.9
21 – 30	21	15.0
31 - 40	44	31.4
> 40	49	35.0
Total	**140**	**100.0**
Mean = 25		
Min	1	
Max	60	
Std Dev.	14.19	

4.1.4 Educational status of respondents

Generally education is thought to create a favorable mental attitude for the acceptance of new practices especially of information-intensive and management-intensive practices (Caswell *et al*., 2001). The result of the distribution of the respondents based on educational status as presented in Table 4.2 shows that majority (62.9%) of the respondents had secondary educational qualification and also, 10.7% of them had tertiary educational qualification indicated that the beekeeping farmers have a good educational status. This is similar to the findings of Babatunde*et al*. (2007) who found that 95% of beekeepers in Oyo State had secondary school education and more. Also, Ezekiel *et al*. (2013) reported that majority (90%) of the bee farmers in Oyo Statehad one form of educational background or the other. This implies that the bee farmers will be better able to understand improved management practices on beekeeping towards enhancing their production. This is in line with Sikibo*et al.* (2013) who opined that educated farmers committed in farming may be able to take up improved technologies faster because they understand the benefits associated with the technology, hence increasing their efficiency. On the other hand, educated farmers may be more engaged in other income generating activities and avail less attention to their farms, hence lowering their efficiency. Also, level of education is believed to affect the acquisition of technical and managerial skill, which can enhance efficient use of farm resources (Baruwa and Oke, 2012). Educational attainment enhances human capital and participation in labour market and has been widely accepted as a veritable tool for poverty reduction and improving peoples' welfare (Akerele and Adewuyi, 2013). Very few (8.6%) of the beekeeping farmers had no formal education in the study area.

4.1.5 Household size of respondents

The result of the frequency distribution of the respondents based on household size as presented in Table 4.1 shows that majority (52.9%) of the bee farmers had household size of 1 – 5 persons and this does not conform to the finding of Onwumere*et al.* (2012) who found that the household size of the bee farmers in Abia State was largely 5 – 9 as indicated by 48% of the bee farmers. This was followed by a household size of 6 – 10 persons as indicated by 41.4 % and the least was 11 – 15 persons as indicated by 5.7% of the bee farmers. The mean household size of the bee farmers is 6 persons and this is indicative of a relatively small household size of the bee farmers in the study area. A large household size could mean higher family labour source in traditional agriculture. However, alarge household size also means more mouth to feed, such that for a given farm size, large households could produce a smaller market surplus (Minot *et al.,* 2006).The situation might be worse still if the increase in household size translates into more dependants who do not contribute to the household income as the measures of poverty are also very higher among household with higher number of dependants (Akerele and Adewuyi, 2013).

4.1.6 Respondent's years of bee farming experience

Increase in farming experiences leads to a better assessment of the important and complexities of good farming decision-making including efficient use of input (Omonona*et al.,* 2010). Majority (45%) of the respondents had 1 – 3 years of bee farming experience as shown in Table 4.1. This was closely followed by a bee farming experience of 4 – 6 years as indicated by 30.7% of the respondents in the study area. Very few (7.1%) had been farming experience above 9 years. This implies that bee farming is not an age long farming activity in the study area and this is also clearly indicated by an average bee farming experience of 4 years in the study area. This further implies that the bee farmers in the study area are yet to have a full understanding of the changes that comes with production over a long period of time. This result compares favourably with Oluwatosin (2008) who re8ported that 75% of the beekeepers in Ekiti State had 1 – 5 years beekeeping experience suggesting that the beekeepers were relatively new in the business. However, this result is in contrast with the findings of Tijani*et al*. (2011) who found out that majority (40%) of the bee farmers in Chibok Local Government Area of Borno State had 16 – 20 years of beekeeping experience.

4.1.7 Distribution of respondents based on membership of beekeeping cooperative

The result of the frequency distribution of the respondents based on membership of beekeeping indicates that majority (68.6%) of the bee farmers were members of farmer's cooperative in the study area while 31.4% of them were non-members of any of farmer's cooperative in the study area. Due to the participation of a larger proportion of the bee farmers in cooperatives, they have the tendency of benefitting from gains of farmer's cooperative such as timely access to inputs, market and credit facilities, unlike the bee farmers who were non-members of farmer's cooperative. This is in line with Sikibo*et al*. (2013) who noted that farmers who are members in producer organizations are able to benefit not only from the shared knowledge among themselves with respect to modern farming methods, but also from economies of scale in accessing input markets as a group.

4.1.8 Distribution of respondents based on years of membership of beekeeping cooperative

Association helps farmers to mitigate problems associated with market imperfections and reduce transaction costs, hence increasing the level of production (Sikibo*et al*., 2013). The result of the distribution of the respondents based on years of membership of farmer's cooperative as shown in Table 4.1 revealed that 32.9% of the bee farmers had 1 – 3 years of participation in farmer's cooperative. Also, the same proportion (32.9%) of respondents had 4 – 6 years of participation in farmer's cooperative. This is an indication that majority of the respondents had 1 – 6 of participation in farmer's cooperative with a mean of 3 years of participation in farmers suggesting that the extent or level of participation in farmer's cooperative in terms of years by the bee farmer's is low despite the fact that a larger proportion of the bee farmers are currently members of farmer's cooperative and their willingness to remain members for a longer period of time cannot be guaranteed. It is worth noting that the higher the number of years of participation in farmer's cooperative, the higher the extent or level of participation in terms of time and the better the willingness of farmers to remain members for a longer period of time.

4.1.9 Respondent's access to credit

The result indicates that most (87.1%) of the respondents had access to credit in the study and only a small proportion (12.9%) had no access to credit. This result implies that since most of the bee farmers had access to credit, they were able to acquire the necessary inputs for beekeeping thereby ensuring that production was not hampered. As noted by Zeller *et al*. (1997) access to credit ensures the alleviation of the capital constraints on agricultural households, and thus can significantly increase the ability of poor households with little or no savings to acquire necessary agricultural inputs, and encourage the adoption of labor-saving, higher-yielding technologies and therefore increasing land and labor productivity, a crucial factor in encouraging.

4.1.10 Amount of credit obtained by respondents

Farm credit either from the formal or informal sources remains the major means of improving farm capital investment (Oboh and Kushwaha, 2009). The result presented in Table 4.1 shows that most (73.9%) of the beekeeping farmers in the study area obtained credit of ₦ 30, 000 – 59, 999 and only very few (1.4%) of them obtained credit above ₦ 59, 999 for beekeeping. The average amount of credit obtained for beekeeping purpose in the study area was ₦ 31, 064.29 suggesting that the amount of credit obtained is low and this cannot give room for expansion of beekeeping activities by the farmers. The amount of credit obtained by farmers is very important as it is not enough to have access to credit but the amount obtained should be worthwhile to enable the farmer meet up with the financial obligation of his farm. However, Adebayo and Adeola (2008) were of the opinion that in modern farming business in Nigeria, provision of agricultural credit is not enough but efficient use of such credit has become an important factor in order to increase productivity.

4.1.11 Sources of Credit available to respondents

The result presented in Table 4.1 shows that the major source of credit in the study area is from friends and relatives as indicated by 70% of the bee farmers. This is closely followed by cooperative as indicated by 44.3% of the bee farmers. Only very few (2.1%) of the beekeeping farmers indicated that commercial banks as their source of credit. This result implies that credit was largely obtained from informal sources (friends and relatives and cooperative) in the study area than formal sources (commercial banks). This could be attributed to the limited formal sources of credit in the study area and the excessive bureaucratic procedure of securing credit from formal sources. This result is in line with the findings of Adebayo and Adeola (2008).

4.1.12 Distribution of respondents based on access to agricultural extension

The result of the distribution of the respondents based on access to agricultural extension as revealed that majority (62.9%) of the beekeeping farmers had access to extension in the study area while 37.1% of them had no access to extension. This implies that access to extension was high among the bee farmers in the study area and therefore, there is the tendency that their access to information on improved beekeeping management practices better than the bee farmers who had no access to extension. This is in contrast with Onwumere*et al.* (2012) who reported that majority (75%) of the bee farmers in Abia State had no access to extension visit.

4.1.13 Distribution of respondents based on number of agricultural extension contact

The result of the distribution of the respondents based on number of agricultural extension per annum as presented in Table 4.1 shows that 20% of the beekeeping farmers had 1 – 3 number of extension contacts, 19.3% of the bee farmers had 7 – 9 number of extension contacts and only few of them had above 9 number of extension contacts. The average number of agricultural extension contact was 3 and this result implies that despite the accessibility to agricultural extension by a larger proportion of the bee farmers in the study area, the intensity of extension contacts was very low. Therefore, the benefits of agricultural extension must have eluded most of the bee farmers in the study area as a result of the low intensity of extension contact.

4.1.14 Distribution of respondents based on number of beehives owned

The result of the distribution of the respondents based on number of beehives owned is presented in Table 4.1. This shows that a larger proportion (35%) of the bee farmers had more than 40 beehives. This was closely followed by 31.4% of the bee farmers who indicated that they had 31 – 40 beehives. The least was 1 – 10 beehives as indicated by 6.4% of the bee farmers in the study area. The average number of beehives owned by the bee farmers in the study area was 36 beehives and this implies that a larger proportion of the bee farmers had high number of beehives suggesting that beekeeping farming is prevalent in the study area. This does not conform to the findings of Babatundeet *al*. (2007) who found an average of 28 beehives in Oyo State.

4.2 Profitability of Beekeeping in the Study Area

The result presented in Table 4.2 shows the average costs and returns of beekeeping per hive which was largely the Kenyan Top Bar hive of 4 feet length and 2 feet width (0.7 m^2) in the study area and the farmers owned an average of 36 beehives as shown on the result in Table 4.9.

The cost of labour constituted a larger proportion (36.51%) of the total cost of production incurred by the bee farmers. This is in line with Babatunde*et al.* (2007) who found that labour cost accounted for the largest share of total cost of bee production in Oyo State. The least (0.45%) was the cost of uncapping knives. From the fixed inputs employed in bee farming in the study area, the depreciation on beehive constituted a higher cost than the cost of other fixed inputs. From the two cost components of the total cost of beekeeping incurred, the variable cost component constituted majority (61.66%) of the total cost incurred in the beekeeping. The total cost of production per hive was ₦ 19, 685.82 from a total variable cost of ₦ 12, 139.04 and a total fixed cost of ₦ 7, 546.78. Two products obtained from beekeeping in the study area were honey and bee wax. The average honey output was 56.70 liters and the unit price was ₦ 700 while the average bee wax output was 50.1 Kg and the unit price was ₦ 250. The total revenue generated per hive was ₦ 52, 200.38 with honey contributing ₦ 39, 680.28 and bee wax contributing ₦ 12, 520.10. The calculated net farm income per hive was ₦32, 514.56 and this implies that beekeeping is profitable in the study area and has the potential of contributing immensely to the financial base of the farmers. The estimated net farm income is higher than the net farm income of ₦ 9753.34 per hive obtained in Oyo State by Babatunde*et al*. (2007) and also, the net farm income of ₦ 8,973.74 obtained in Chibok Local Government Area of Borno State by Tijani*et al*. (2011). The returns to naira invested of 2.67 implies that for every one naira invested in bee farming in the study area, a profit of ₦1.67 is generated and this is a further indication of the profitability of beekeeping in the study area. This agrees with Onwumere*et al.* (2012) who found that the gross return per naira invested in beekeeping was 1.68. It can be say that beekeeping in the study area is a viable investment option that can be exploited for job creation and income generation coupled with the high demand for beekeeping products especially honey.

Table 4.2: Average costs and returns of beekeeping per hive of 0.7 m^2per production cycle.

Items	Value(₦)	% contribution
A. Variable cost		
Cost of labour	7, 188.00	36.51
Cost of transportation	1, 550. 33	7.88
Cost of baiting materials	2, 300.21	11.68
Cost of packaging containers	1, 100.50	5.59
Total variable costs(TVC)	**12, 139.04**	**61.66**
B. Fixed cost		
Depreciation on:		
Beehive	2, 129.44	10.81
Honey extractor	1, 800.00	9.14
Hive stand	350.14	1.78
Smoker	821.55	4.17
Uncapping knives	95.60	0.49
Uncapping trays	188.11	0.96
Bee garment	561.94	2.85
Rent	1, 600.00	8.13
Total fixed costs(TFC)	7, 546.78	38.34
Total cost	**19, 685.82**	**100.00**
C. Revenue		
Average honey output (litre)	56.70	
Unit price of honey	700.00	
Revenue from honey	39, 680.28	
Bee wax output (kg)	50.10	
Unit price of bee wax	250.00	
Revenue from bee wax	12, 520.10	
Total revenue (TR)	52, 200.38	
D. Net farm income	32, 514.56	
Returns to naira invested(TR/TC)	2.67	

4.2.1 Test of hypothesis

The result presented in Table 4.2.1 shows that the difference between the average returns of beekeeping per hive (₦52, 200.38) and the average cost of beekeeping per hive (₦19, 685.82) is statistically significant at 1% level of significance. This is because the calculated z value of 6.34 is greater than the z critical one-tail (1.65) and the z critical two-tail (1.96). This result implies that bee farming is profitable in the study area and therefore, the null hypothesis was stated as ''beekeeping is not profitable in the study area'' is rejected and the alternate is accepted.

Table 4.2.1: Z test result showing significant difference between costs and returns of beekeeping

	Costs(₦)	**Returns(₦)**
Mean	19, 685.82	52, 200.38
Z calculated	6.34***	
Z Critical one-tail	1.65	
Z Critical two-tail	1.96	

NB: * Implies 1% level of significance**

4.3 Contribution of Beekeeping to Household Income

4.3.1 Households total income from beekeeping enterprise

The result presented in Table 4.3 shows that majority (35%) of the beekeeping farmers had an annual income of ₦300, 000 – 399, 999 from their beekeeping enterprise which is an indication that the beekeeping is a good income generating enterprise in comparison with the national civil servants minimum wage of ₦216, 000 per annum (₦ 18, 000 per month) in Nigeria. This is closely followed by 33.6% of the respondents with an income of ₦200, 000 – 299,999. The least proportion of the farmers (1.4%) had annual income of ₦1 – 99, 999 and above ₦ 499, 999. The mean annual income of the beekeeping farmers was ₦ 309, 671.43 and this suggests that it possess the potential for generating high income in the study area if resources are properly managed.

Table 4.3: Distribution of respondents based on total income from beekeeping enterprise

Total income(₦)	Frequency	Percentage
1 – 99, 999	2	1.4
100, 000 – 199, 999	13	9.3
200, 000 – 299,999	47	33.6
300, 000 – 399, 999	49	35.0
400, 000 – 499, 999	27	19.3
> 499, 999	2	1.4
Total	**140**	**100.0**
Mean309, 671.43		

4.3.2 Impact of Beekeeping on the Poverty status of the Beekeeping Farmers

The poverty status of the beekeeping farmers was established before determining the impact of beekeeping on their poverty status. The result presented in Table 4.3.1 shows the determination of the relative poverty line in the study area. The bee farmers Mean Per capita household expenditure (MPCHE) was ₦25200.45 per week and the two-third MPCHE was ₦ 16800.30 indicating that the poverty line of the study area is ₦ 16800.30 per week. This result implies that the bee farmers whose households weekly food and non-food consumption is below ₦ 16800.30 are considered to be poor while those whose food and non-food consumption is ₦ 16800.30 and above are regarded as non-poor. Using the relative poverty line of ₦ 16800.30 in the study area, the poverty headcount index which is the share of the population whose income or consumption is below the poverty line is 0.30. This implies that 33% of the bee farmers in the study area constituted the share of the population that cannot afford to buy a basic basket of goods (food and non-food) to meet their household needs. Therefore, a larger proportion of the bee farmers (70%) in the study area are non-poor and this could be attributed to their economic empowerment through income generating activities of which beekeeping is one of such activities. As noted byAjao and Oladimeji (2013) beekeeping offers an unexploited succor capable of salvaging the people from abject hunger and povertyand it offers opportunities for empowering and developing the rural populace by making them self-reliant and depend less on the government.

Table 4.3.1: Determination of relative poverty line in the study area

Items	**Amount (₦/week)**
Household food expenditure	5913600.00
Household non-food expenditure	642760.00
Household total expenditure	6556360.00
Per capita household expenditure (PCHE)	1776631.54
Mean Per capita household expenditure (MPCHE)	25200.45
2/3 MPCHE (Poverty line)	16800.30

The poverty gap index of the bee farmers which provides information regarding how far households are from the poverty line is estimated to be 0.39. This implies that the mean aggregate food and non-food consumption shortfall of the poor bee farmers relative to the poverty line across the whole population of the bee farmers was 39% and therefore, the poor bee farmers are not too far away from the poverty line and can easily move out of the poverty trap.The poverty squared poverty gap index of the bee farmers which is a measure that takes into account not only the distance separating the poor from the poverty line (the poverty gap), but also the inequality among the poor is estimated to be 0.45. This implies that the severity of poverty amidst the poor bee farmers is 45% and this has the tendency of rising when the number of poor people increases, or the poor get poorer, or the poorest get poorer in comparison with other poor people and vice-versa.

Table 4.3.2: Poverty profile of bee farmers

Items	**Results**
Poverty line (₦)	16800.30
Poverty headcount	0.33
Poverty gap	0.39
Poverty severity	0.45
Poor (%)	33
Non-poor (%)	67

Hypothesis testing

The result of the Pearson correlation in Table 4.3.3 shows that beekeeping is negatively related to poverty in the study area as indicated by the correlation coefficient of -0.684and the relationship is statistically significant at 1% significance level. This indicates that an increase in beekeeping income leads to a decrease in poverty level of the beekeeping farmers and vice versa. The implication of this is that beekeeping is a viable means of alleviating the poverty status of the bee farmers and therefore, enhancing the productivity of beekeeping which will invariably improve the income from beekeeping will be very instrumental in reducing poverty among the bee farmers in the study area. This is in line with Famuyide*et al*. (2014) who noted that beekeeping is a veritable means of creating jobs particularly for the unemployed youth and poor rural populationthereby serving as practical way of reducing poverty. Also, Onwbuya (2004) was of the opinion that bee farming can help alleviate poverty in rural areas.

Table 4.3.3: Pearson correlation result showing relationship between beekeeping income and poverty status

	Poverty	**Beekeeping income**
Poverty	1	-.684***
Beekeeping income	-.684***	1

NB: ***P< 0.01

The null hypothesis which was stated as ‘‘Improved beekeeping does not have significant relationship with poverty status in the study area’’ is rejected as the result in Table 4.3.3 shows that there is a significant negative relationship between beekeeping and poverty at 1% significance level. Therefore, the alternate is accepted.

4.4 Economic Efficiency of Beekeeping in the Study Area

4.4.1 Estimated technical efficiency of beekeeping farmers

The model specified was estimated by the maximum likelihood (ML) method using FRONTIER 4.1 software developed by Coelli (1995). The ML estimates and inefficiency determinants of the specified frontier are presented in Table 4.4. The study revealed that the generalized log likelihood function was -171.432. The log likelihood function implies that inefficiency exist in the data set. The log likelihood ratio value represents the value that maximizes the joint densities in the estimated model. Thus, the functional form that is, Cobb-Douglas used in this estimation is an adequate representation of the data. The value of gamma (γ) is estimated to be 0.82 and it was highly significant at ($p<0.01$) level of probability. This is consistent with the theory that true γ-value should be greater than zero. This implies that 82% of random variation in the output of the farmers was due to the farmers' inefficiency in their respective farms and not as a result of random variability. Since these factors are under the control of the farmer, reducing the influence of the effect of γ will greatly enhance the technical efficiency of the farmers and improve their output. The value of sigma squared (σ^2) was significantly at $p<0.01$ level of probability. This indicates a good fit and correctness of the specified distributional assumptions of the composite error terms while the gamma γ indicates the systematic influences that are unexplained by the production function and the dominant sources of random error. This means that the inefficiency effects make significant contribution to the technical inefficiencies of beekeeping farmers.

However, the estimated coefficients of all the parameters of production function (beehive, baiting material, labour and land size) were positive and significant at $p<0.01$ level of probabilityand hence play a major role in beekeeping production in the study area except baiting material which is negative and statistically not significant. The average technical efficiency for the farmers was 0.87 implying that, on the average, the respondents are able to obtain 87% of potential output from a given mixture of production inputs. Thus, in a short run, there is minimal scope (13%) of increasing the efficiency, by adopting the technology and techniques used by the best beekeeping farmer.

The estimated coefficient for beehive was 0.481 which is positive and statistically significant at $p<0.01$ level. The estimated 0.481 of beehive implies that increasing beehive by a unit will increase honey output by 48.1% which means, all things being equal the output will increase. The significance of beehive is however, due to the fact that beehive determines to a large extent the output obtained. If modern beehive is adopted it offers opportunities for empowering and developing the rural populace by making them self-reliant and depend less on the government. This is in line with the findings of Awotide and Adejobi (2006) who opined that increase in beehive increases honey output and it also has direct bearing on the cost of production which consequently translates to more profit to the farmers.

The coefficient of labour was 0.237 which is positive and statistically significant at $p<0.01$ level. This implies that an increase in labour usage will increase honey output by 24%. Though, traditional system of agricultural production still prevails, with its characteristically low technical base, high reliance on manual labour. In the study area, labour is obtained from both the family and hired labour. It was observed that farmers used a combination of family and hired labour for their farm operations.

This is in line with several studies by Umoh (2006) and Okike (2000) which show the importance of labour in farming, particularly in developing countries where mechanization is rare on small scale farms. In the study area, human power plays a crucial role in virtually all farming activities.

The estimated coefficient of land size was 0.294 which is positive and statistically significant at $p<0.01$ level of probability.Farm size is an indicator to the level or scale of production of an individual farmer. The finding of this study is consistent with Ekong (2003) who reported that most Nigerian farms are small-sized family farms in which family members contribute the required labour.Positive relationship has been established between farm size and improvement in households' income and its technical efficiency (Jayne *et al*., 2005). The larger the farm size of the household, the higher the expected level of food production.

Table 4.4: Results of Maximum Likelihood Estimates of Stochastic Frontier Production Function ofBeekeeping Production

Variables	Parameters	Coefficients	Std. error	T-Value
Constant	β_0	6.327***	0.354	17.859
Beehive	β_1	0.481***	0.173	2.780
Baiting material	β_2	-0.187	0.152	-1.235
Labour	β_3	0.237***	0.068	3.496
Land size	β_4	0.294***	0.115	2.557
Inefficiency variable				
Constant	Z_0	0.475	0.908	0.052
Age	Z_1	-0.017***	0.003	-5.667
Household size	Z_2	-0.062**	0.028	-2.214
Beekeeping experience	Z_3	-0.070***	0.011	6.372
Education	Z_4	0.076	0.105	0.720
Extension contact	Z_5	-0.025*	0.014	-1.793
Cooperative association	Z_6	-0.312***	0.128	-2.438
Credit	Z_7	-0.027	0.041	0.663
Diagnostic Statistic				
Sigma-square	(σ^2)	0.745*	0.041	1.761
Gamma	**(γ)**	0.596***	0.274	3.270
Log likelihood function	*L/f*	-181.569		
LR test	5.804			
Total number of observation	140			
Mean efficiency	0.81			

***p<0.01, ** p<0.05and *p<0.1

The estimated result of the inefficiency model is contained in Table 4.4.1. Generally, a negative sign on a parameter means that the variable reduces technical inefficiency, while a positive sign increases technical inefficiency. The results show that all the technical inefficiency variable except education and credit were statistically different from zero.

The resultshowed that there is a significant and negativerelationship between age and technical inefficiency at p<0.01 level. This implies that beekeeping farmers withmore age exhibited significantly more technically efficient than farmers with less age.Age has been found to determine how active and productive the head of the household would be. The age of the farm business manager is likely to influence his attitude, motivations and behavioural patterns which in turn influence sensitivity to risk investment behaviour (Onyebinama, 2004).Olarinde*et al.*, (2008) empirically estimated the technical efficiency of bee-keeping farms and also identified the socio-economic factors that determine the level of estimated technical efficiency of the sampled respondents.

Household size showed a negative relation with predicted technical inefficiency and is significant at $p<0.05$ level. The implication of this is that increase in household size decrease technical inefficiency by magnitude of -0.062. This may be due to farmers access to family labour because as the number of people in a household increases, a pool of family labour becomes available and this could lead to specialization. According to Amaza, Joseph and Yakubu(2009) opined that the significance of household size in agriculture hinges on the fact that the availability of labour for farm production, the total area cultivated to different crop enterprises, the amount of farm produce retained for domestic consumption, and the marketable surplus are all determined by the size of the farm household. However, Ahmed (2011) argued that large household size is associated with increased household consumption expenditure which reduces the money that could be used for production purposes. According to the report of Oluwatayo*et al.*, (2008), there is a positive and significant relationship between household size and farmers' efficiency in production. However, the absolute number of people in a certain family cannot be used to justify the potential for productive farm work. This is because it can be affected by some important factors namely; age, sex and health status. Essentially, it is the composition of the household that determine labour supply for the accomplishment of farm operations.

Beekeeping experience was negative and significant at $p<0.01$s. This shows that increase in beekeeping experience in honey production would reduce technical inefficiency. Farmers' experience could be associated with skill accumulation which could enhance productivity and resource allocations thereby reduce technical inefficiency.

The coefficient of extension contact was negative and significant at $p<0.1$ level. This means that an increase in extension contact will lead to increase in technical efficiency. This finding is in line with the study of Ajani (2000) who observed that extension contact enhance farm productivity and efficiency in his study of resources productivity in farming in Northern area of Oyo State, Nigeria.

Membership of cooperative was negative and significant at $p<0.01$ level. The negative coefficient for membership imply that membership of association reduces technical inefficiency in honey production. Membership of association could affords the farmers the opportunity of sharing information on modern farming practices by interacting with other farmers. Okike (2000) noted that the reduction of inefficiency effects through farmers belonging to cooperatives is linked to cooperatives being a source of good quality inputs, information and organized marketing of products.

4.4.2 Estimated Stochastic Frontier Cost Functions

The Maximum Likelihood (ML) estimates of the stochastic frontier cost parameters for beekeeping are presented in Table 4.4.1. For the cost function, the sigma ($\sigma^2 = 0.464$) and the gamma (γ=0.71) are quite high and highly significant at 1% level of probability. The high and significant value of the sigma square (σ^2) indicate the goodness of fit and correctness of the specified assumption of the composite error terms distribution (Idiong, 2005). The gamma ($\gamma = 0.763$) shows that 76% of the variability in the output of bee farmers that are unexplained by the function is due to allocative inefficiency.

The results of stochastic frontier cost function for honey production are shown in Table 4.4.1. The estimated coefficients of the parameters of the cost function are positive except that of cost of transportation which is negative. The cost beehive, cost of labour and cost of output are significant at $p<0.01$ level. The coefficient of the cost of beehive was positive and statistically significant at $p<0.01$. This implies that beehive are important in honey production. This indicating that if there is an increase in cost of beehive, the total cost of production will increase.

The coefficient of the cost of labour (0.223) was positive and significantly related to the total cost of beekeeping production at $P<0.01$ level. This implies that a unit increase in cost of labour will increase the total cost of honey production by 22.36% *ceteris paribus*. This agrees with the finding of Ogundari*et al*. (2006). The coefficient of output (-0.207) was negative and significantly related to the total cost of beekeeping production at $P<0.01$ level. This implies that a unit increase in output will decrease the total cost of beekeeping by 21% *ceteris paribus*. However, increase in output ought to bring about increase in total cost of production. This observed result can be attributed to reduction in the unit cost of production as output increases as a result of economics of scale. This result is in line with the result of Ashagidigbi*et al*. (2011) who also found that output of poultry was significant and positively related to the total cost of production.

Table 4.4.1: Maximum Likelihood Estimates (MLE) of the Stochastic Frontier Cost Function of beekeeping farmers

Variables	Parameters	Coefficients	Std. error	T-Value
Constant	β_0	8.493***	0.429	19.752

Cost of Beehive	β_1	0.116***	0.041	2.823
Cost of Baiting material	β_2	0.125^{NS}	0.038	0.302
Cost of Labour	β_3	0.223***	0.071	3.150
Cost of transportation	β_4	-0.009 ^{NS}	0.025	-0.341
Cost of output	β_5	-0.207***	0.080	-2.578
Inefficiency variable				
Constant	Z_0	-0.312***	0.128	-2.438
Age	Z_1	-0.031*	0.018	-1.697
Household size	Z_2	-0.673**	0.027	-2.454
Beekeeping experience	Z_3	0.076 ^{NS}	0.105	0.720
Education	Z_4	-0.070***	0.011	6.372
Extension contact	Z_5	-0.025	0.024	-0.793
Cooperative association	Z_6	-0.027 ^{NS}	0.041	0.663
Credit	Z_7	-0.1500*	0.078	-1.922
Diagnostic Statistic				
Sigma-square	(σ^2)	0.464***	0.133	3.474
Gamma	**(γ)**	0.746***	0.071	10.40
Log likelihood function	*L/f*	-164.321		
LR test	18.971			
Total number of observation	140			
Mean efficiency	0.64			

It was revealed that farmers' age was negative and significant at p<0.1%. This implies that increase in age would decrease allocative inefficiency. It means that older farmers are more allocatively efficient in the use of resources and cost reduction of the inputs. It could be attributed to the fact that older farmers tend to be more efficient in financial expenditure that could increase their allocative efficiency. This implied that prudent financial expenditure is important for effective and efficient allocation of scarce resources for higher productivity and income.

Household size showed a negative relation with allocative inefficiency and is significant at p<0.05 level. This means that farmer with higher household size tends to be more cost efficient than their counterparts with smaller household size. This implied that as beekeeping farmers in the study area increase their household size, this would increase their allocative efficiency. This disagrees with the finding of Asogwa*et al.* (2011) who reported a positive relationship between household size and cost inefficiency.

The estimated coefficients for education was negative and significant at $p<0.01$ level. The negative coefficient for education implies that allocative inefficiency reduces as this factor increases. This implies that educational attainment is very important in allocative efficiency of beekeeping farmers. According to Lockhead*et al.* (2000) education is a central ingredient in a strategy to improve agricultural productivity especially where the use of modern inputs are emphasized.

Access to credit has a negative coefficient and significant at $p<0.1$ levels which implies that as the amount of credit obtained by the farmers increases, their cost inefficiency decreases thereby increasing their cost efficiency.. This implies that an improvement in access to credit would reduce allocative inefficiency to beekeeping farmers. In addition, access to credit is an avenue towards efficient allocation for the purchase of necessary farm inputs. This is in conformity with the result of Ashagidigbi*et al*. (2011) who reported a negative and significant relationship between credit and cost inefficiency.

4.4.3 Distribution of respondents according to technical, allocative and economic efficiencies of beekeeping farmers in the study area.

4.4.3.1 Distribution of beekeeping farmers according to technical efficiency estimates

The frequency distribution of the technical efficiency estimates for beekeeping farmers in the study area as obtained from the stochastic frontier model is presented in Table 4.4.2. It was observed from the study that 73.5% of the farmers had technical efficiency (TE) of 0.81 and above while 22.5% of the farmers operated at less than 0.8 technical efficiency levels. The farmer with the best and least practice had technical efficiencies of 0.96and 0.34 respectively. This implies that on the average, output fell by 19% from the maximum possible level attainable due to inefficiency.

The study also suggest that for the average farmer in the study area to achieve technical efficiency of his most efficient counterpart, he could realize about 20.4 percent (1-0.81/0.96*100) cost savings while on the other hand, the least technically efficient farmers will have about 68.75 percent (1-0.34/0.96*100) cost savings to become the most efficient farmer.

4.4.3.2 Distribution of beekeeping farmers according to allocative efficiency estimates

The allocative efficiency estimates presented in Table 4.4.2, indicate that it ranged from 0.24 to 0.92; the mean allocative efficiency was 0.64. The result indicates that average beekeeping farmer in the state would enjoy cost saving of about 39.1 percent (1-0.64/0.92*100) if he or she attains the level of the most efficient farmer among the respondents. The most allocatively inefficient farmer will have an efficiency gain of 82.6 (1-0.24/0.92*100) in honey production if he or she is to attain the efficiency level of most allocatively efficient farmer in the state. This finding is in line with Lockhead*et al.* (2000) who observed that the mostallocatively inefficient farmerwill have an efficiency gain of 89.6 percent in beekeeping production if he or she is to attain the efficiency level of most allocatively efficient farmer in the state.

4.4.3.3 Distribution of beekeeping farmers according to economic efficiency estimates

The frequency distribution of the economic efficiency estimates for beekeeping farmers in the study area as obtained from the stochastic frontier model is presented in Table 4.4.3. It was observed from the study that 42% of the farmers had economic efficiency (EE) of 0.61 and above while 52% of the farmers operate at less than 0.6 efficiency level. The mean economic efficiency of the 140 sampled farmers in the study area was 0.52. The farmer with the best and least practice had economic efficiencies of 0.83 and 0.08 respectively. This implies that on the average, output fall by 48% from the maximum possible level due to inefficiency.

The study also suggest that for the average farmer in the study area to achieve economic efficiency of his most efficient counterpart, he could realize about 57.8 percent (1-0.52/0.83*100) cost savings while on the other hand, the least economically inefficient farmers will have about 98.8 percent (1-0.18/0.83*100) cost savings to become the most efficient farmer. However, the average economic efficiency of the beekeeping farmers was 52 percent. This indicates that beekeeping farms were fairly economically efficient.

Table 4.4.2: Frequency Distribution of Technical, Allocative and Economic Estimates from the Stochastic Frontier Model

Efficiency Level	Technical Frequency	Percentage	Allocative Frequency	Percentage	Economic Frequency	Percentage
< 0.2	0	0	11	7.86	12	8.57
0.21-0.40	13	9.28	8	5.71	21	15.00
0.41-0.60	11	7.86	51	36.42	47	33.57
0.61-0.80	14	10.00	34	24.29	49	35.00
0.81-1.00	103	73.57	36	25.71	11	7.86
Total	140	100	140	100	140	100
Minimum	0.34		0.24		0.18	
Maximum	0.96		0.92		0.83	
Mean	0.81		0.64		0.52	

4.6 Constraints Encountered in Beekeeping in the Study Area

A number of constraints were enumerated by the respondents as shown in Table 4.20. Inadequate capital (69.3%) ranked as the first constraint encountered by the bee farmers and this constraint could hinder the timely purchase of inputs for beekeeping and it could also be a barrier to the expansion of the scale of production. This agrees with

Oluwatusin (2008) who reported that lack of capital was the major challenge confronting beekeepers in Ekiti State as indicated by 91% of the beekeepers. The problem of theft (52.1%) ranked second and this was equally reported by Tijani*et al*. (2008) as one of the problems of beekeeping in Chibok Local Government Area of Borno State. Since beekeeping is the means of livelihood to most of the beekeeping farmers, they have to develop means of securing their farms through keeping a close watch of their hives, fencing or hiring a security guard to watch over their hives so that the losses associated with theft can be avoided. High cost of labour(45%) rankedthird. The problem of high labour cost could be due to the risky nature of beekeeping arising from bee stings and this was equally reported one of the constraints confronting beekeeping in Abia State by Onwumere*et al*. (2012). The high cost of labour in the study area could be responsible for making cost of labour constituting the highest cost component in beekeeping and therefore the bee farmers have to ensure that labour is efficiently utilized. The other constraints confronting bee farming in the study area were absconding of bees (40%), inadequate extension (38.6%), aggressiveness of bees (27.1%) and poor market price (15.7%) as indicated by the bee farmers.

Table 4.20: Frequency distribution of the constraints in beekeeping

Constraints	**Frequency**	**Percentage**	**Rank**
Inadequate capital	97	69.3	1^{st}
Theft	73	52.1	2^{nd}
High cost of labour	63	45.0	3rd
Absconding of bees	56	40.0	4th
Inadequate extension	54	38.6	5^{th}
Bees aggressiveness	38	27.1	6th
Poor access to improved technologies	35	25.0	7^{th}
Poor market price	22	15.7	8th
Total	437*		

NB: The total frequency exceeded the sample size due to multiple responses

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Summary

The broad objective of the study was to assess the contribution of improved apiculture to household income and poverty alleviation in Abuja, Nigeria. The specific objectives were to describe the socio-economic characteristics of the beekeeping farmers, determine the profitability of beekeeping, assess the contribution of improved beekeeping on the poverty status of bee farmers, determine the economic efficiency of beekeeping, and identify the problems faced by beekeepers in the study area. A multi-stage random sampling technique was employed for selecting the representatives of bee farmers. The first stage involved the purposive selection of 3 councils (Bwari, Kwali and Abaji) from the list of 6 area councils, because bee farmers are concentrated in the 3 area councils. The second stage, involved the purposive selection of two villages based on the intensity of beekeeping activities and finally all the bee farmers in each of the villages were selected to give a sample size of 140 respondents. Primary data were used for this study and the data were collected with the aid of structured questionnaire.The analytical tools used to analyze the data collected were descriptive statistics, farm budget analysis, z-statistic, Pearson correlation, Foster-Greer-Thorbecke (FGT) model, and stochastic frontier model.

The result revealed that all the sampled respondents in the study area were males, most of the respondents (about 96%) were married, majority of the respondents (62.9%) were within the age bracket of 30 – 39 years with a mean age of 37 years implying that that most of the respondents were young and active, majority (62.9%) of the respondents had secondary education and also, 10.7% of them had tertiary education indicated that majority of the bee farmers have a formal education. The mean household size of the bee farmers is 6 persons and this is indicative of a relatively small household size of the bee farmers in the study area, majority (45%) of the respondents had 1 – 3 years of bee farming experience with a mean of 3 years and most (73.9%) of the bee farmers in the study area obtained credit of ₦ 30, 000 – 59, 999 and only very few (1.4%) of them obtained credit above ₦ 59, 999 for beekeeping.

The result revealed the total cost of beekeeping incurred, the variable cost component constituted majority (61.66%) of the total cost incurred in the beekeeping. The total cost of production per hive was ₦ 19, 685.82 from a total variable cost of ₦ 12, 139.04 and a total fixed cost of ₦ 7, 546.78. The total revenue generated per hive was ₦ 52, 200.38 with honey contributing ₦ 39, 680.28 and bee wax contributing ₦ 7, 520.10. The calculated net farm income per hive is ₦32, 514.56 and this implies that beekeeping is profitable in the study area and has the potential of contributing immensely to the financial base of the bee farmers.

Themean annual income of the bee farmers from beekeeping (₦ 309671.43) was higher than that of the bee farmers income from on-farm activities (₦ 162212.86) and off-farm activities (₦ 16285.71) indicating that beekeeping contributed a higher proportion to the total income of the bee farmers. This implies that beekeeping activities is the major source of livelihood of the bee farmers in the study area. The percentage contribution of the income generating activities of the bee farmers shows that the percentage contribution of beekeeping activities to total income was 70%, the percentage contribution of on-farm activities to total income was 28% while the percentage contribution of off-farm activities to total income was 2%. This clearly indicates that beekeeping is the major contributor to the total income of the bee farmers in the study area and therefore, measures aimed at enhancing the productivity of the beekeeping activities of the farmers will improve their income level and invariably, the well-being of the bee farmers.

The finding shows that economic efficiency of the beekeeping farmers varied from 19% to 85% implying that there is a wide variation in the economic efficiency estimates of the bee farmers. The mean economic efficiency of the bee farmers was 58%. The relatively wide variation in economic efficiency estimates of the farmers is an indication that most of the farmers are still economically inefficient in the use of resources for production and there still exists opportunities for improving on their current level of economic efficiency by a magnitude of 42%. Therefore, the bee farmers in the study area were not maximizing profit given the output level and resource allocation.

The finding also revealed that beekeeping is negatively related to poverty in the study area and the relationship is statistically significant at 1% significance level. This indicates that an increase in beekeeping income leads to a decrease in poverty level of the bee farmers and vice versa. The implication of this is that beekeeping is a viable means of alleviating the poverty status of the bee farmers and therefore, enhancing the productivity of beekeeping which will invariably improve the income from beekeeping will be very instrumental in reducing poverty among the bee farmers in the study area.

Constraints associated with beekeeping were inadequate capital (69.3%) ranked as the first constraint encountered by the bee farmers and this implies that the financial obligations of running the bee farm. The problem of theft (52.1%) ranked second. High cost of labour(45%) rankedthird. The other constraints confronting bee farming in the study area were absconding of bees (40%), inadequate extension (38.6%), aggressiveness of bees (27.1%) and poor market price (15.7%).

5.2 Conclusion

Based on the findings of this study, it could be concluded that beekeeping production in the study area is profitable by returning ₦1.67 kobo to every ₦1.00 spent. This enterprise has huge potentials for contributing immensely to household income and poverty alleviation in the study area. The implication of the study is that technical and allocative efficiency in farm production among the farmers could be increased by 19 and 36%, respectively through better use of available resources given the current state of technology. This can be achieved through improved farmer-specificfactors. These results call for policies aimed at encouraging new entrants especially the youths who are agile and stronger to go into beekeeping farming.

5.3Recommendation

The following recommendations have emanated from the findings of the study so as to enhance beekeeping production in the study area:

i. The study has established that beekeeping is a male dominated farming activity since all the beekeepers were males. Based on this result, it is strongly recommended that government and non-governmental organization should sensitized women on the opportunities in bee farming and also, trained on the technical know-how of beekeeping so that they can take advantage of the opportunities (income generation and poverty reduction) that beekeeping in the study area.

ii. The result of this study has revealed that beekeeping is a profitable farming activity that contributed higher income to the beekeepers than other on-farm activities and off-farm activities. Hence, beekeeping is a viable income generating activity that can create jobs for the teeming unemployed youths and it is therefore recommended that it should be integrated in the Youth Empowerment in Agriculture Program (YEAP) in the study area.

iii. Despite the high profitability of beekeeping in the study area, the bee farmers were economically inefficient as they had a mean efficiency of 52%. In the light of this, it is recommended improving on their current level of economic efficiency by a magnitude of 48% is feasible but can only be achievable by ensuring effective resource utilization and minimization of production costs especially labour cost given the current level of technology at their disposal.

iv. Inadequate capital was the major constraint limiting beekeeping in the study area as indicated by the bee farmers and therefore, it is recommended that the bee farmers should leverage beekeeping association as an avenue to access finance, inputs, technical information and market. There is need for the bee keepers to join the association and participate actively so as to benefit from the gains of association.

v. The problem of inadequate agricultural extension has to be properly addressed in view of the vital role of extension. Hence, it is recommended that more extension agents should be trained on modern beekeeping so that they can effectively disseminate beekeeping information to the farmers

5.4Contributions to knowledge

This study has made the following contributions to the body of knowledge:

i. This study has been able to establish that the net farm income per hive of 4 feet long and 2 feet width ($0.7m^2$) in the study area is ₦ 27, 514.56 and this implies that beekeeping is profitable in the study area and has the potential of contributing immensely to the financial base of the bee farmers. The return to naira invested of 2.67 implies that for every one naira invested in beekeeping in the study area, a profit of ₦ 1.67 is generated.

ii. The study has shown that the mean annual income of the bee farmers from beekeeping (₦309671.43) was higher than that of the bee farmers income from on-farm activities (₦ 162212.86) and off-farm activities (₦ 16285.71) indicating that beekeeping contributed a higher proportion (70%) to the total income of the bee farmers. This has brought to the public knowledge on the potential of beekeeping in the study area as a high income generating enterprise.

iii. The study has shown that beekeeping is negatively related to poverty in the study area as indicated by the correlation coefficient of -0.684and the relationship is statistically significant at 1% significance level. This indicates that an increase in beekeeping income leads to a decrease in poverty level of the bee farmers and vice versa. The implication of this is that beekeeping is a viable means of alleviating the poverty status of the bee farmers.

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APPENDIX I: RESEARCH QUESTIONNAIRE

(A) Background information on the questionnaire

(i) Name.. ii) Area Council………………..
(iii) Village...................................iv) Date of interview.................................

(B) Socio-economic characteristics

(1) Age of the respondents.................. (years)

(2). Gender (i) Male ( ) (ii) Female ( )

(3) Marital status (i) Married ( ) (ii) Single ( ) (iii) Divorced ( ) (iv) Seperated ( )

(4) Level of Education:(i) No Formal education ( ) (ii) Primary ( ) (iii) Secondary ( ) (iv) Tertiary ( )

(5) How long have you been involved in modern beekeeping............ (years)

(6) Does extension officers visit you? Yes ( ) No ( )

(7a) If yes, within a month, how many times did extension staff visit you last season…2013

7b)How many times had extension staff visit you thiscurrent season? 2014

(8) Do you belong to beekeepers/farmers association or cooperative society (a) Yes ( ) (b) No ( )

(9a) If yes, how long have you been in the association or cooperative............... (years)

(9b) If no, why? Give reasons………………………………………………………….

(10) Family size (indicate the number of people depending on you for a living) ………….

(11) How many of your household members fall within the following age group:

Age group (yrs)	No. of males	No. of females
0 – 20		
21 -40		
41 – 60		
60 & above		

(12) Do you have access to credit (a) Yes ( ) (b) No ( ). If yes, indicate the source and the amount given:

(i) Agricultural bank (NACRDB) ₦.......................... (ii) Commercial bank ₦.......................

(iii) Cooperative ₦......................(iv) Friend/Relatives₦....................... v) Others…………,

(14) How much (on the average), do you earn from all beekeeping activities you are involved in: thus,

Weekly ₦ **Monthly ₦** **Quarterly ₦** **Yearly ₦**

Honey

Other beehive products

(C) Other sources of income to the respondents

(15) Are you engaged in any other On-farm activity, aside beekeeping? (i) Yes ( ) (ii) No()

(16) If yes, choose from the following sources of income (as applicable to you), and specify how much your household earns from them:

S/N	Income Source	Amount in Naira			
		Weekly	**Monthly**	**Quarterly**	**Yearly**
1	Cash crop production income				
2	Food crop income				
3	Tree crop income				
4	Livestock production income				
5	Wage employment (money earned by working (labour) for others)				
6	Remittance income(money sent by children and relative)				
7.	Others				

(17) Do you work during off-farm periods? (i) Yes (ii) No. If yes, indicate the work on the table below:

S/N	Off – Farm activities	Amount Earned (₦)			
		Weekly	Monthly	Quarterly	Yearly
1					
2					
3					

(19) Are there other working members in your household? Yes or No? If yes, mention the job & money earn?

S/N	Job/off Farm activities	Amt Earned (₦) Weekly	Monthly	Quarterly	Yearly
1					
2					

(D) Inputs Used: I. Farmland Worth

(20). Farm Size ………… (ha). (21) Kindly indicate the ownership type of the land you cultivate

(a) Borrowed ( ) (b) Purchased ( ) (c) Gifted ( ) (d) Rented ( ) (e) Inherited ( ) (e) Others specify ....

(22) What is the worth for a hectare of land perseason ?₦.....................

23. II. Labour Used: Hired Labour**(fill in the boxes as appropriate)**

	ADULT MALE		ADULTFEMALE		CHILDREN		TOTAL
Activity	**No.**	**Days**	**No.**	**Days**	**No.**	**Days**	**Man-days**
Care of Apiary e.g. Weeding							
Harvesting of honey							
Processing of honey							
Collection of beewax and other beehive products							
Others							

N.B: Adult is 18 years and above. **Family Labour.**

	ADULT MALE		ADULT FEMALE		CHILDREN	
Activity	**No.**	**Days**	**No.**	**Days**	**No.**	**Days**
Care of Apiary e.gWeeding						
Harvesting of honey						
Processing of honey						
Collection of beewax and other beehive products						
Others						

24. What is the cost of adult labour per day? ₦ --------------------

III. Hives and other bee keeping materials

25.What type(s) of hives are you using?

26.Whatis the cost of an hive? ₦ -------------

27.List the honey harvesting/processing equipment/materials you possess:

………………..**E. Farm Output & Income Level**.28. State your yield in the last Five

(4) years, or less if you are not up to 4years in beekeeping.

Year	No. of Hives	No. of Colonies (it comprises of worker, drone & queen bees)	Age of colonies	Honey yield (litres /bottles	Unit Price Perlitre (₦)	Yield from other hive products e.gbeewax	Unit Price (₦)	**Total Revenue (₦)**
2011								
2012								
2013								
2014								

29. State your yield in the last Four (4) years, or less from other On-Farm existing practice:

Year	Cash crop	Food crop	Tree crop	Livestock	Wage employment (money earned by working (Labour)

for others)

2011

2012

2013

2014

31. **State your Cost of production as follows**:

Year	Fixed Cost Amount (N)	Variable Cost Amount (N)
2011	Land Area Beehives Hive stands Smoker Honey Extractor Bee garment Uncapping Knives Uncapping trays **TOTAL**	Honey packaging containers Labels Straining cloths Baiting materials Depreciation on hives and Other equipments Labour wages Transportation Miscellaneous expenses **TOTAL**
2012	Land Area Beehives Hive stands Smoker Honey Extractor Bee garment Uncapping Knives Uncapping trays **TOTAL**	Honey packaging containers Labels Straining cloths Baiting materials Depreciation on hives and Other equipments Labour wages Transportation Miscellaneous expenses **TOTAL**
2013	Land Area Beehives Hive stands Smoker Honey Extractor Bee garment Uncapping Knives Uncapping trays **TOTAL**	Honey packaging containers Labels Straining cloths Baiting materials Depreciation on hives and Other equipments Labour wages Transportation Miscellaneous expenses **TOTAL**
2014	Land Area Beehives Hive stands Smoker Honey Extractor Bee garment Uncapping Knives	Honey packaging containers Labels Straining cloths Baiting materials Depreciation on hives and Other equipments Labour wages

	Uncapping trays **TOTAL**	Transportation Miscellaneous expenses **TOTAL**

F. BEEKEEPING IMPACT ON POVERTY ALLEVIATION

32. Do you foresee a future in beekeeping as a key to alleviating poverty in your area council? Yes orNo33.When and where did you acquire the knowledge of beekeeping? When…Where….

34. Can you say that bee keeping business has alleviated poverty in your life and that of your household? a. Yes ( ) b. No ( )

35. To what extent has beekeeping business impacted your household? High ( ) b. Low ( )

36. Are there other benefits you and your neighborhood derive from beekeeping? Yes ( ) No ( ) if yes, specify…………………………………………………

37. Are you aware of any National Policy on beekeeping and honey production? Yes /No

If yes, state it……………………………………………………………………………

38. Are you aware of any agency (Government or private) providing training or assistance to beekeepers? Yes ( ) No(). If yes, state the name and address of such agency …..........

G. Expenditure: FOOD EXPENDITURE

Kindly provide information on the following crops (only on those you have purchased or produced).

39.

Food Crops	Raw Food purchased last week/ month for household consumption		Amount consumed from last season's production		Already Cooked food purchased outside last week/month	
	Qty	Amount (N)	Qty	Amount (N)	Qty	Amount (N)
Yams						
Maize Grain						
Maize Flour						
Millet Grain						
Millet Flour						
Beans						
Rice						

Guineacorn						
Potatoes						
Others						

ii. Household expenditure (Non-staple expenditure)

40. Indicate the amount purchased of the following items for household consumption

Non-staple food expenditure	Items purchased last week or month		
	Yes=1, No= 0	If yes, Qty purchased	Purchased value (₦)
Salt/Potash/Maggi			
Groundnut oil			
Palm oil			
Fish(fresh/smoked/dried)			
Fresh milk			
Poultry			
Bush meat			
Vegetables			
Beverages-sugar			
Bread			
Others:(i)			
(ii)			

iii.Household Expenditure: Non- food Expenditure

Also indicate the amount purchased of the following items for household consumption

Items	Last Week		Last Month	
	Qty	Amount(N)	Qty	Amount(N)
Cigarettes, tobacco, kola nuts				
Charcoal, fuel wood				

Kerosene				
Shoes(leather, plastic, slippers)				
Clothing(fabric and cloth)				
Purchase of motor vehicles				
Purchase of motor cycles				
Purchase of bicycles				
Repairs of vehicles/bicycles				
Home repairs(painting, roofs, plastering)				
Kitchen utensils(pots, cups, plates, etc				
Furniture(beds,tables,chairs,etc				
Petrol for vehicles				
Detergents				
Pomades				

iv. Durable items

S/no	**Items**	**When purchased**	**Yes =1, No= 0**	**No.**	**Current value (₦)**
(i)	Radio				
(ii)	Television				
(iii)	Kerosene stove				
(iv)	Wood/Charcoal stove				
(v)	Generator(home use)				
(vi)	Extra land				
(v)	Fan				

(vi)	Other electrical appliances				
(vii)	Others, specify				

H. Beekeeping Constraints:

31) List in other of importance the problems/challenges you face in keeping bees.

No	
1	
2	
3	
4	
5	
6	
7	
8	

30. Can you please enumerate the ways you use to overcome the above challenges?

1

2

3

4 X

5

6

7

8

THANKS FOR COMPLETING THIS QUESTIONNAIRE.

Plate 3: the instructorsshowing the researcher the output (honey)from the production

Plate 4: the researcher inspecting the bee hives in the forest