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OGBOLOAGHA, Felicia Nkechinyere

DEPARTMENT OF AGRICULTURAL ECONOMICS

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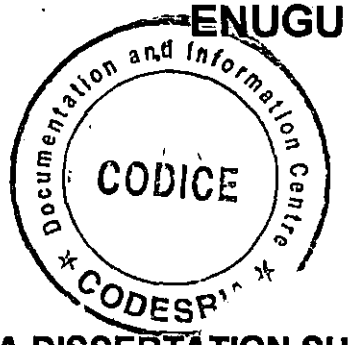
Economic Analysis of Beekeeping in Enugu State of Nigeria

2002

ECONOMIC ANALYSIS OF BEEKEEPING IN ENUGU STATE OF NIGERIA



A DISSERTATION SUBMITTED TO THE DEPARTMENT OF AGRICULTURAL ECONOMICS UNIVERSITY OF NIGERIA, NSUKKA, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF SCIENCE DEGREE IN AGRICULTURAL ECONOMICS

BY

OGBOLOAGHA, FELICIA NKECHINYERE
PG / M.Sc / 95 / 22203

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CERTIFICATION.

Ogboloagha, Felicia Nkechinyere, a postgraduate student in the Department of Agricultural Economics and with the Registration Number PG/M.Sc/95/22203 has satisfactorily completed the requirement for the degree of Master of Science in Agricultural Economics.

The work embodied in this dissertation is original and has not been submitted in part or full for any other diploma or degree of this or any University.

PROF S.A.N.D CHIDEBELU
SUPERVISOR

DATE

DR. C.J. ARENE
HEAD OF DEPARTMENT

DATE

DEDICATION

To the Greater Glory of God Almighty Father and to the blessings and joy of all my friends and relations.

ACKNOWLEDGEMENT

I am very grateful to God Almighty father who had made it possible for me to complete this work this day.

My immense gratitude goes to my dear supervisor. Prof. S.A.N.D Chidebelu for his amicable, interacting, but constructive and objective manner of criticism and supervision. My thanks go to all the Lecturers and non-academic staff of agricultural Economics Department, UNN for their profound assistance at various stages of this work. My appreciation goes to Mr. C.U. Okoye who provided some resource materials for this work; Sir. Eric. N. Amobi of No.12 Amobi. St. Nsukka. a good resource person whose farm equipments were used for some illustrations and Dr. P.C Ike whose brilliant contribution has made the completion of this work possible.

I would also show my regards to friends and relations, who contributed in one way or the other to the completion of this work.

ABSRACT

In this work, the financial and economic analysis of beekeeping enterprise in Enugu state were carried out. Specifically, the study examined the socio-economic characteristics of apiculturists in the study area, determined the financial and other requirements for entering into the business (including the beekeepers' sources of initial capital and the profitability of the enterprise), ascertained the effects of farmers' socio-economic factors and other variables on bee keeping, examined the marketing arrangements for the farmers' products, and identify the apiculturists' problems in the study area.

Data was collected using two sets of pre-tested questionnaires and participatory observation. In all, 50 beekeepers and 50 bee product buyers, making a total of 100 respondents, were randomly selected from five purposively chosen local markets and their local government areas in Enugu state.

The data collected were analyzed using percentages, means, frequencies, multiple regression, gross margin and net income.

Findings showed that traditional beekeeping was more predominant than the improved (modern) beekeeping which was new in this study area. Beekeeping was based on low capital inputs, which

made use of more personal funding and informal credit. However, beekeeping was profitable in the study area with a gross margin of N9,059.41. of the socio-economic characteristics of the beefarmers examined, only the technology used and the types and number of bee implements had serous positive relationships with the bee product output/farmers revenue. Bee product market was usually small and irregular. Bee product price ranged from N2,500.00 to N3,500.00 per 35.5kg basin. Composition of market audience groups was in the category of wholesalers, retailers and consumers.

Rampant forest destruction and lack of necessary facilities such as good infrastructure (roads and markets) and credit posed serious problems to the farmers' performance and their adoption of improved bee technology in the study area.

Government should endeavor to provide necessary infrastructure, credit and extension training facilities and programmes that would involve farmers' active participation in workshops and field demonstration and supervision.

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CHAPTER ONE

INTRODUCTION

1.1 Background Information

Apiculture, which is the art of keeping bees for the purpose of producing honey and other hive products, is as old as the origin of man. The honey bee, *Apis melifera adonsonaii* is acknowledged to be indigenous to Nigeria (Matsaers, 1991; Ugwunkwo, 1997). Apiary performs well in the tropics, especially in Nigeria because of its vast floral and human resources which are conducive to honey production (Bajowa, 1998). Attesting to this, one of the Israeli beekeepers, David Gertel, during his recent visit to Nigeria observed that Nigeria has the most ideal conditions for beekeeping either as a hobby or as a commercial venture (Kumuyi,2000). According to him, there were abundant flowers, fantastic weather, two high seasons (when one could harvest honey) and Nigeria was free from every known malady of beekeeping on record world wide and could cash in on this situation.

Beekeeping is beneficial to farmers. It is an additional income source and important foreign exchange earner from export of honey and

beewax. It assures farmers of good and quick income because its products have ready markets both locally and abroad (Bajowa, 1998). It helps to accelerate development and social upliftment of the rural women and the unemployed youths in the society by enhancing their living (Bajowa, 1998).

Odusan, a farmer from Ogun State of Nigeria was able to make a harvest that fetched him N31,500 from four out of 21 hives. Similarly, Gertel, an Israeli, could produce between 600 kg and 700 kg of beewax every year from about 700 hives. Ami Maimise could sell alone beevenom, a derivative of honey for about 10,000 per gramme which was an equivalent of N150,000.00 (Kumuyi, 2000; ITC/GATT,1977).

World honey production was estimated at more than 800,000 tons per year (ITC/GATT,1977) During the period 1971 – 1975, production fluctuated between 790,000 tons and 890,000 tons per year. Total world exports ranged from 113,000 tons to 155,000 tons annually from 1971 – 1975, corresponding to not more than 13 – 20 percent of total world production (ITC/GATT,1977) Africa and Common Wealth of Independent States appeared to be minor suppliers in absolute as well as in relative terms accounting in 1975 for 0.7 percent of world exports respectively.

Mexico and Argentina had traditionally been the two largest exporters. Mexico's major markets were the federal Republic of Germany, the United States of America, and the United Kingdom while Argentina's were the United States of America, the federal Republic of Germany and Japan. Argentina's honey was normally white and produced from alfalfa, white clover and thistle, while, Mexico supplied high quality honey of which the best known variety was probably the Yucatan from the Yucatan peninsula, (ITC/GATT,1977).

Bee products have many important uses in various industries. Medicinally, honey, the chief bee products, has been regarded as curative from very early times. It is used in treating wounds and bedsores. The honey renders the wound bacteriologically sterile within three to six days, and finally effects total healing (ITC/GATT, 1977; Efem, 1988; and Crane, 1993). It is believed to perform this task because of its propolis constituent, which has antimicrobial properties. Russian scientists have claimed good results from the use of ointments made from honey and fat on infested necrotic wound (Ioyrish, 1974). It is also used in the treatment of gastric ulcers and in medicines for children. Honey is fermented with

yeast to produce alcoholic beverages, the most popular one being mead (ITC / GATT, 1977).

The strong potentials for bee products as important agroforestry food and raw material sources, are also essentially due to the various uses of its products: honey, beewax, propolis, royal jelly, beevenom and pollen etc. Honey has been used as a sweetener in beverage production mostly taken by those who for medical reasons have to abstain from consumption of sugar (Alcobia, 1993; Ugwunkwo, 1997; Kumuyi, 2000). Honey is used in bread making and confectionery industries in the United States of America. Pastel (Greek), torrone (Italy) and halve (Turkey) are products made with honey (ITC /GATT, 1977; Akachukwu, 1995). Honey based products are available in many homes in the world such as medicinal cough syrup, cereals, honey spreads, drycake mixes and honey milk products. Honey is used extensively in tobacco products especially, cigarettes where hygroscopic nature of honey helps to keep tobacco moist (ITC/GATT, 1977).

Pollen collected by bees is rich in protein and is collected and eaten by men in many developed nations. Royal jelly is very nutritional and is produced by young bees. One kilogramme of it can sell for as

much as 500 U.S dollars. It is used for the treatment of sterility. It is eaten in many Asian and East European countries and America (Adjake 1988). Propolis collected from leaf barks and buds of trees, is used to seal off the entrance to the hive, if it is too large to be defended. It is used to block holes that let waters or predators into the hives. Propolis is used in a wide range of drugs, especially, for treating skin diseases. Propolis has antimicrobial properties and protects not only against intruders, such as Lizards, mice, moths but also diseases (Seeley and Visscher 1982).

Beewax is a multi-purpose natural product used in the manufacture of commodities. The largest use of beewax is the cosmetic industry which uses it to produce creams, lotion, lipsticks etc. Other major users include the pharmaceutical industry, polish and candle makers, crayon and pastel producers, carpenters and craftsmen, for example, metal casters. Beewax has over two hundred uses (Adjake, 1988). Gertel, an Israeli, noted the following bee pollinated crops: mangoes, avocadoes, apples, cucumbers, water melon, carrots, cabbages, besides many other species (Kumuyi, 2000). Odusan, a Nigerian, had aptly demonstrated combined plantation farming involving orchards and beekeeping. He has had about 80 percent reduction in flower abortion. Crop yield had

increased by almost 20 percent (Adjake, 1988; Sergen, Moulder, Beetsman and Sommeiger 1991). Odusan described beekeeping as cost –effective , less demanding of inputs. Beekeeping can be incorporated and integrated into the farmer's present schedule in existing farms of plantation or orchards, like rubber, citrus, oil palm, cashew and on arable fields like cassava farm. Some natural nesting sites can be managed (Akachukwu, 1995).

Beekeeping, an all year round activity, is not affected by seasonal variations (Akachukwu, 1995). However, honey yield depends largely on the climate, vegetation, bee race and the skills of the beekeeper (Sergen, et al, 1991). The season of the year determines to a large extent the bee products that are available in the hive, (whether honey is ripe/unripe), and the bee activities that are taking place in the hives. Honey produced each period also differs in taste, colour and constituency depending on vegetation and locality (ITC/GATT, 1977; Agrolads, 1998). The major source of honey is the nectar from flowering plants. In South eastern Nigeria, most of the flowering period is from August to December and honey flow continues till early April (Agrolads, 1998).

In spite of these important roles beekeeping plays in the economy of the practising country like Nigeria with the necessary natural endowment, and human resources, beekeeping is still very much unexplored. Secondly, its profitability studies have not been given adequate imperial attention. Little work done in beekeeping was directed to seasonal variations that affect bee product yield alone. Hence, the study aims at evaluating the profitability of beekeeping in Southeastern Nigeria.

1.2 Statement of the Problem

In Nigeria, in spite of the abundant resources and potentials for beekeeping and an increased demand for honey and its associated bee products, bee farmers are still dwelling in abject poverty. Up to date, most of the research works carried out in agriculture were focused on the management of crops, livestock and processing industries. Much of the work done in beekeeping was centered on honey production (which could be artificially produced or adulterated) and honey marketing. Enough work has not yet been carried out to explore the economics of beekeeping system in Nigeria, profitability or losses so as to find out the root causes of bee farmers poverty problem and proffer solutions.

Therefore, it is the aim of this study to provide empirical information on the beekeeping scenario in Nigeria, especially Enugu state.

1.3 Objectives Of The Study

The broad objective of this study is to investigate the economics of beekeeping in Enugu State. Specifically, the study attempted to:

(i) describe the various beeking enterprises and bee products markets in Enugu State

(ii) examine the socio-economic characteristics of apiculturists in Enugu state;

(iii) describe the management practices of apiculturists in the study area;

(iv) determine the financial and other requirements for entering into the business (including the beekeepers' sources of initial capital) and the profitability of the enterprise;

(v) ascertain the effects of farmers socio-economic factors and other variables on beekeeping;

(vi) examine the marketing arrangements for the farmers products;

(vii) find and discuss the apiculturists' problems in the study area, and

(viii) derive policy implications based on the findings.

1.4 Hypothesis

The null hypothesis of this study is that beekeepers' socio-economic characteristics have no significant effects on their revenue.

1.5 Justification of the Study.

The alleviation of poverty has been the watchword of economic policy in Nigeria. Government has previously pursued policy designed to improve the living standard of people through sustainable food and raw material production, enhanced income and generation of employment, (Oladunni, 1992).

Despite all machineries set up to better people's lots, farmers particularly have not benefited as a result of in borne socio – cultural problems among which are unequal access to improved technology, credit and infrastructure.

In the light of the above, a work of this nature seeks the development of technological skill and earning capability of farmers

through improved beekeeping is necessary. Factors that are major determinants of beefarmers' success in beekeeping would be considered. Knowledge of such factors would be crucial for policy makers in designing of managements and technological development programs for beefarmers comprising pensioners, unemployed youth and rural women and artisans).

It would be an enlightenment into diversified revenue sources from export and sale of honey and other bee products.

It would expose rural dwellers to the potentials of natural resources and afford then the right of proper utilization and benefit for better living.

It would be an insight to policy makers and farmers on the place of beekeeping and its problems and their immediate solutions in the agricultural activities of the people in the study area.

This study will generate data for further research in agro forestry products (non timber) for necessary improvement.

CHAPTER TWO

REVIEW OF LITERATURE

2.1 Origin of the honey bee

Bees are insects of the order *Hymenoptera*. There are well over 20,000 species throughout the world and are taxonomically known as the super – family *Apiodea* (Agrolads, 1998). Honey bees of the genus *Apis* belong to the family *Apiadae*, a subgroup of this super family. They are exploited by man for their products and for other pollinating activities. There are four species of this genus, *Apis* . Three are native to Asia and one is native to the Euro-African region. All of them are similar in appearance but their sizes and colour differ.

The tropical honey bee, most common and better adapted to Africa and tropical conditions is *Apis mellifera adonsonaii* which lives in colonies throughout the year (Marieke,1991; Ugwunkwo, 1997). Other species are *Apis florae*, *Apis indica and Apis dorsata* (Lesley, 1991). The male bees (drones), which are stingless and larger than the worker Bees are present in the colony seasonally (Marieke, 1991).

Apis melifera (European bee) is a species of bees that is presently employed in beekeeping in Nigeria. In nature, the honey bee makes its

home in enclosed cavities for rearing broods and honey storage. It can use holes, shrub covered by climbers or any other cool, dark place as nests. Honey bee colony may occur at any height from ground level to 30 cm above ground levels. Large colonies are often found in valleys or near lakes. A black sticky material, called propolis, made of resins collected from trees by the bees, are used to fill up holes in the nest cavity. In order to maintain a dark environment, that favours the performance of honey bee, the entrance is covered partly or completely with a shield of propolis leaving a few holes (1.2 cm across) to pass through. The comb, which stores the honey, are built with wax produced by the worker bees from their wax glands. A comb may contain only worker cells or only drone cells or a combination of both. The nest is composed of 6-20 parallel combs, which are from 20 cm to over a metre (lm) long and attached to the roof of the nest but not to the sides. The honey bee, *Apis melifera* adonsonaii, is a honey producer. It pollinates crops excellently and has a gentle temperament while the queen is good egg layer (Schosfield, 1974; Reeve and Gamboa, 1983 and Marieke, 1988).

2.2 Bee Ecology

Climate and consequently vegetation affects honey production through its effect on nectar flow (Williams, Pickett and Martin, 1981). Nectar flow is totally dependent on the plant. Honey flow is a function of bee plant relationship in the use of a nectar flow by the honeybee colony to produce honey.

An identification of the bee flora is an integral part of the beekeepers' knowledge, which is built with experience (Akachukwu, 1995). Rainfall, temperature and sunlight affect plant and therefore determine the actual nectar flow; that is adequate rainfall, prior to flowering, stimulates high nectar flow, which consequently support a high honey yield. A season of good rainfall is nearly always followed by one of good honey and bee wax yield. Bee produces surplus honey during this period to keep their colony grow (Macrae and Robinson, 1993). Long dry season allows bee colonies to build up their population. An average sized colony of honey bees during the summer months, is composed of 40,000 – 50,000 worker bees, a few hundred drones and single queen bee, which is normally the mother of all the other members of the colony to which she belongs (Butler, 1958).

It is always advisable for apiary farmers to establish and keep good apiary calendar to follow up all the bee activities in the hive effectively. It is worth noting that for south eastern Nigeria, in January, various honeybee colonies have honey in store. The type of honey collected depends on the vegetation of the area and humidity (ITC/GATT, 1977). Honey is hygroscopic and draws water easily from the atmosphere . That is why honey from the rain forest zone is different from the honey collected from the savannah or middle belt of Nigeria.

Farmers should be conversant with the bee calendar, as it obtains in this part of the country to take good advantage of the period thus detailed below:

February is the beginning of peak of honey harvest otherwise known as honey flow .Peak harvest stretches to March. Both months are the peak periods or months, farmers harvest abundantly.

In March, honey is still available in the hive, however, the bees start collecting pollen busily because the queen mother is ready to lay eggs. In April, the brood chamber is filled with young ones (broods), and occasionally, the queenscence (new or younger queen) begins to emerge at the entrance of the hive that is a sign of preparation for

swarming . The farmer can now take " swarm control measures" (Agrolads,1998).

In May,or between April and May, is the period of decision to swarm or not. Swarming can be controlled by killing the old queen or preparing a new hive around the surrounding. In June, which is the peak of swarming, the bees must have taken a decision, their uniting power begins to reduce, they become uncomfortable because of overpopulation and shortage of food in the hive.

To decongest the hive, a set of bees leave with the old queen to settle on a more conducive environment, either in the wild forest or in an artificially managed hive provided for them. Life begins normally in the new colony. Farmers benefit from swarming, because as they monitor it and put out more hives, the farmers increase the bee colonies, and harvest more honey.This is a way of controlling migration (Schosfield, 1974). During swarming period, there is no honey or food for the bees. The bees should be fed in the hive with sugar syrup.

Swarming season is relatively pronounced and ranges from late April to August (Agrolads,1998). In August, they still feed on sugar syrup and on the few weeds that grow and flower around. Queen excluder is

used to confine the queen in the hive. In September, new colonies are now setling down, some of the Nigeria tropical crops start to flower and the bees begin to visit them and get nectar. Honey deposition is in full swing (Nwadukwe, 2000). Bush growth and flowering of forest trees coincide with the end of rainy season. At this period, the bees are busy again about their normal activities, collecting nectar, and producing a lot of honey.

In October, as nectar, pollen and other materials arrive in the hive, bees build honey combs, and with joyous noise, ripen the honey. And honey harvesting can start late October and early November to April of the subsequent year. Now the honey is ripe, the bees become alert, defensive and aggressive to any movement around the hive (Issa, 1998). December is also a good period of honey harvest.

2.3 Life cycle of honeybee

The honeybee is an insect with complete metamorphosis. It has four distinct stages of development in its life cycle, namely the egg, the larva, the pupa and the adult. The first three stages are referred to as the brood stage because they develop in the cells in the combs. Egg and

larva are in open cells and are cared for by the adult workers. These are called the open or unsealed broods. The larva changes into pupal stage which develops into adult form that emerges by itself from the cell. Adult bee could be either a queen, worker or drone.

There is only one queen in the colony at any point in time. She is the only female that is completely developed sexually as result of a total diet of royal jelly (bee milk) fed her during the developmental period. She is responsible for laying eggs and reproducing the young ones. She takes 16 days to develop into adult. From 5 to 7 days she has emerged, she takes series of mating flights with one or more drones. She is produced from a fertilized egg.

Drones are the male bees in the hive. Their proportion varies seasonally depending on how much food the worker bees can gather for the colony during the nectar period (Marieke, 1991). Their only function in life is to mate with virgin queen during the mating flight outside the hive. They die after mating the queen. They take twenty four days to develop from egg.

The workers are more numerous than either of the other two types in the colony . They are females that are not sexually fully developed . It takes twenty – one days for a worker to mature into adult bee. They perform various tasks both in the colony and in the field. Some of their duties include feeding the colony, taking care of the broods (young bees) and the queen, producing the beewax, building the honey combs, cleaning and clearing off dead cells, warming the brood nest and defending the colony. Hence, nest defence appears to be associated with volatile odours(Moritz and Hillestein,1990).They forage for nectar, pollen water and propolis. The ability of the honey bee to remember the time of the day a particular source of flower is available has been known for early 80 years (Von and Frisch,1967;Bagdany, 1978). They noted that cues associated with flower recognition are stored as a time linked set. The worker bees live for at least six weeks or longer depending on the degree of their activities. The busier they are in their life time, the shorter their life span (Kolmes, Winston and Ferynssia 1989; Robinson and Page, 1988 and Hilleshein, Koeninger and Moritz, 1989).

2.4 Behavioural Patterns of Honey Bees

Bee is a busy and social insect with larger number of signals to communicate and to feed. The queen and her offspring have increasing degree of intimacy. In every normal bee colony, there is a perfect co-operation between all the females. The queen produces all the eggs and leaves the care to the worker bees (Butler, 1958). The queen is highly specialized for producing eggs and offspring, while the workers feed the queen with royal jelly (Bee milk) throughout the period of incubation of eggs and also feed the young broods.

2.4.1 Communication:

The bee dance language is a special means of communicating information on a good nectar source, on a new nesting site to other bees (Von and Frisch, 1967; Schmaranzer and Stabenzer, 1988). The dance takes place on the comb in a pattern that indicates the direction, distance and quality of the source.

Bees also emit alarm pheromone in quick succession as a means of alerting others of an impending danger (Williams, Pickett and Martin,

1981). The complete blend of the queen pheromone is necessary to achieve the role of the dominant queen.

2.4.2 **Absconding**

This is abandoning of a nest site by a colony due to excessive disturbance of predators,bad management by keeper, diminishing resources in an area or the escape from sudden danger or death (Lesley, 1991). The bee colony will then migrate to a better area as a result of one or more of these causes. Bee colony must not be sited near a nesting site of ants. Bush burning produces smoke, which acts as tranquillizers and makes bees feel dizzy. Land preparation involving bush burning should be avoided as it makes bees want to abscond (Akachukwu, 1995).

2.4.3 Supercedure

This refers to queen replacement without colony division. If the old queen's reproductive capacity is reduced by age, the worker bees construct queen cells to produce a young queen to replace it. In supercedure the old queen does not leave the colony. The new queen mates, returns to the colony and begins to lay eggs. No competition exists between the two queens. The old queen is easily recognized by her

tottered wings and abdomen, which is worn out of hairs, some drones leave the colony to settle in a new site. In reproductive swarm, which happens when a colony has reached large size, the workers construct new queen cells and eggs are laid inside them. A few days before the emergence of the queen, the old queen leaves the colony with some of the workers and drones. Swarming is the normal way for bee colonies to increase and disperse in an area (Schosfield, 1974). Usually, scout bees are sent out to seek for new suitable nesting sites before swarming takes place (Robinson and Page, 1989b and Kolmea, Winston and Ferynssia 1989).

2.4.4 Swarming

This is a natural colony division or reproduction in which a separate group of bees with one or more queens, ten thousand or more worker bees and some drones leave the colony to settle in a new site. In reproductive swarming, which happens when a colony has reached large size, the workers construct new queen cells and eggs are laid inside them. A few days before the emergence of the queen, the old queen leaves the colony with some of the workers and drones. Swarming is the

normal way for bee colonies to increase and disperse in a new area (Schosfield, 1974). Usually, scout bees are sent out to scout for new suitable nesting sites before swarming takes place (Robinson and Page 1988; Kolmea, Winston and Ferynssia 1989).

2.4.5 **Building of Combs**

Bee build their combs parallel to one another according to the available space and shape. These combs, in their nests are attached only to the top of the nest. Hive frames are provided in artificial modern hives to allow bee movement for inspection and honey harvest with out scaring the bees. Bees build their combs in these frames (Schosfield, 1974; Agrolads, 1998). In constructing the combs, there is a standard operating space provided by bees themselves which allows for all other operations within the colony. It serves as a security device to edge out enemies who may not be able to operate within the constrained spaces. It also makes operations within the colony easier as much energy will not be spent (Agrolads, 1998). The space employed in commercial beekeeping is about 1 cm, though the common bee species create a base space of about 0.7 cm.

2.4. 6. Base – Bound:

All bees are base- bound. They will return to the exact position of their own hives even if the hive has been moved. Honey bees can cause prominent, unambiguous landmarks for navigation and to substitute for the sun under overcast conditions (Dyer and Gould, 1981; Lesley, 1991), and even to take precedence over available celestial cues under many circumstances (Von and Frisch, 1967). Landmark memory is pictorial and has horizontal resolution of 2.5 –30, (Gould, 1986c and Lesley, 1991). Landmark learning appears to take place predominantly on departure (Gould, 1988; Lesley, 1991).

A bee colony should not be more than 3km from its original place. In any case, if the colony should be moved, it should be done over a small distance at a time until the bees are fully relocated. No change should be made to the hive and its immediate surrounding during the time the young queen makes her mating flight. She orients herself when flying out in the first mating in order to be able to come back (Agrolads, 1998).

2.4.7 **Source Specification and Colour Attraction:**

When a scout bee discovers a new source of nectar, it communicates to other workers through bee dance. Honey bees learn to recognize the shape of flowers and store the information pictorially with resolution of about 8-10 (Gould, 1985; 1986b,1988a and Lesley, 1991). Real time visual resolution by contrast is of the order of 1.1 -50 (Seidl and Kaiser, 1982).

The shape of flowers is learned primarily upon approach (Gould,1988), as well as colour. Least elements and four colours can be remembered (Menzil, Erber and Mesuhr, 1974; Menzil, 1990, and Gould, 1988b; Gould, 1988). Also when bees are provoked, they are more easily attracted to dark outfit than to bright coloured objects. It is advisable and safe to use bright bee suite in the field.

2.4.8 **Nest Odour and Bee sting.**

Every bee colony has a nest odour. No bee from another colony is allowed to enter a particular nest (except, it is carrying nectar). Honey bee also uses chemo- perception to discriminate between non specific and specific nest odours based on developmental, sexual and kinship cues

within the hive (Page, Robinson and Fondrick, 1989b). Bees also react strongly to certain smells such as alcohol, soap, perspiration and perfumes. Volatile odours play a central role in mating and aggregation behaviour during the swarming process (Getz, 1991). To avoid bee sting, one should not carry smell while inspecting the hive or express fear or panic.

Any intending beekeeper should accept that beesting is a part of the practice. Protective clothing (bee suit) is worn to reduce the incidence to a bearable minimum. Movements that are rapid and banging against the hive may result in provoking further aggression from the bees. Bees crushed around the hive emit alarm pheromene which provokes other worker bees to sting. If there is any crushing, smoke should be puffed around the area (Schosfield, 1974; Collins, Rinder, Tucher, Sylvester and Lackett, 1980 and Breed, Robinson and Page, 1990). Starters may have swelling when stung initially, but as the body gets immune to the bee venom, swelling becomes less severe. Should one react very adversely to beesting, it is advisable to stop beekeeping immediately. On the other hand, beesting is therapeutic to a malaria patient (Issa, 1998).

2.5 Agronomic Aspects of Apiculture

2.5.1 Basic Needs of Bees; Bee Loving Plants:

Foraging workers can fly to long distances of up to 3 km radius, but having abundant resources close to the colony conserves energy and enhances honey yield (Agrolads, 1998). It is good to encourage good floral bee loving environment. Farmers can make good output of bee products by establishing and growing fragrant crops that attract bees on their farms.

The following crops are among the bee loving plants and good honey sources on farmers' farms: *citrus sp*, various species of mint and thyme as well as milk vetch. (*Astrogalous spp*), thistle (*cirsium spp*) and *Euphoebia* are the main sources of nectar in the mountains (Abubakar, and Seibert, 1990).

In the lowlands, major sources of honey include some leguminosae like the clover (*Trifolum spp*), Lucerne or alfalfa (*Mediago satira*) and sainfon (*Onobrychris*). Honey from *Astragous spp* together with thyme and mint family is preferred by consumers since it does not

granulate even when kept for a long time without processing and this attracts a higher price (Abubakar 1990,; Ugwunkwo, 1997). The honey that comes from mountainous region is therefore darker in colour in comparison with other honey.

Most of the plants that are visited by bees begin to flower during the dry season. Worker bees therefore become more active during this period(Akachukwu,1995). Some of the species which were identified as honey plants in the study area and which flower during the dry season are:

Barlinia grandiflora (vetch tree); *Grilicidia sepium*, (Judae tree), *Moringa oleifera*, (Horse radish tree) *Parkia biglobosa* (Locus bean tree), *Ceiba pentaridra* (cotton tree). *Hidergarden barteri*, (flame tree), *Spondias mombia* (Hog plum), *Spethodea componculata* (Africana Tulip tree), *Bulighia sapida* (Akee Apple), *Borassus acethipum* (Dum palm), *Bonbaz buonopozense*, (Red silk cotton tree) *Pentachlathra macrophilla*(Oil bean tree). *Militia thonninga* (Thonringa melletia), *Albiza glaberima* (Maiden hair tree). *Eleasis guiniensis* (Palm tree). Cocos nucifera, (Coconut).

Beekeepers can always site their hives on plantations and orchards. They should equally discourage deforestation, bush burning and indiscriminate use of herbicides on their farms. In Kaduna state of Nigeria, the Niyya farm is an integrated farm where orchards are kept as well as honey bees, which produces honey on commercial basis (Kumuyi, 2000). Also, in Ado–Odo, Ogun State, Mr. Sesan Odusan has been benefiting from combining plantation farming with beekeeping. This is of advantage to the farmers as the bees will assist in pollination, fast fruiting and good crop yield of their crops (Darwin, 1876 cited in Lesley, 1991; Shuel, 1981 and Kumuyi, 2000).

2.5.2 **Nectar**

Nectar is a sugary secretion of plants, which is 70-80 percent water (Macrae and Robinson, 1993). It is the carbohydrate or energy component in the diet of the bees. Worker bees take the nectar from the flowers, and convert them to honey that are stored in cells. The ripening process (i.e. conversion of nectar into honey involves reducing the water content and adding small amount of enzymes (Schosfield, 1974).

The secretion of nectar from the flowers varies generally according the temperature of the day. The secretion is also affected by rainfall. A long period of drought reduces the water content of the nectar and sometimes stops it completely.

The substantial secretion of nectar from a variety of blooms at one time is known as "honey flow". It is most important that the beekeepers should get his stock up to strength for each of these honey flows. They do not occur in the same districts and at the same time. The beginners should be conversant with the flora in their districts to make the best out of the season. The lime tree produces very large quantity of honey, but this crop is very fickle, starting about the first or second week in July, and terminating at the end of July. Those who rely on this crop are often frustrated by wet July, but when the weather is favourable, surplus of upwards of 75 lb per hive is not an over estimation (Schosfield, 1974).

2 5.3. **Pollen**

Pollen is the powdery material found in flowers and naturally used for pollination and fertilization of crops to produce seeds in plants (Agrolads,1998). Pollen is stored as beebread in the cells of the

honeycomb and later fed to the young bees. Insufficient pollen causes lack of protein, decrease in the brood level and consequently, decline in the colony strength (Schosfield, 1974). Good forestry establishment and use of favourable cultural practice to encourage vegetative and flowering growth for pollen production is always useful to beekeeper in their environment.

2.5.4 Tree and Flower Buds

These are collected by the bees to make propolis. Propolis is a resinous substance from the plants. It contains a chemical known as turpine, which acts to limit bacterial and fungal growth in the colony environment. Propolis is used to seal small cracks and holes in the colony for reinforcing and repairing old combs as well as for covering dead insects in the colony which may be too big for them to remove (Agrolads, 1998).

2.5.5 Water:

A close source of fresh water is helpful to a colony. It allows the colony to devote more effort to foraging for nectar. Water is needed for cooling the hive on hot days and the bees also use it to mix honey before they can feed on it.

2.5.6 **Home:**

A bee's home is called a hive. It is needed as a place for the bees to raise their young ones. They build the wax combs, store their pollens, nectar and also use it for protection against wind, rain, heat, cold, pests and other danger (Akachukwu, 1995). In case, these requirements are not available, the keeper should provide them, otherwise, the colony absconds or dies.

2.6 **Institutional and Cultural Practices in Apiculture: (Administration / Hive Management**

Honey bee has been kept for profit by man for several thousand years (Butler, 1958). Beekeeping gradually took the place of bee hunting and evolved throughout the centuries. The act is now practiced with further discoveries of the widespread uses of bee products. The gap between its demand and supply widened dramatically (ITC/GATT, 1977). Man started studying the science of bee family and has been able to manage the bees for greater productive advantage, not with standing their wild nature, although control over the genetic and behavioural pattern has not been achieved to the same degree as in other domesticated animals (Agrolads, 1998).

Over the centuries, man has developed single protocols of management practices to tap these resources. The historical development of bee- human relationship started with bee hunting. It then proceeded to BEE – HAVING and presently here is the practice of BEE – KEEPING (Schosfield, 1974).

Bee – hunting involves honey hunters collecting honey from the wild and from hollows of trees in a method that is destructive to honey and beewax and to bee colony in general. This makes use of naked fire to kill the bees to avoid their stings. Honey obtained from this type of activity is of low quality, polluted with bits of old combs ,broods and ashes from the grasses used to prepare the fire. Besides the already mentioned problems, this method reduces honey yield too. Some of the honey in the market or used in homes are obtained by this method. (Agolads,1998).

In bee-having, man provides housing for bees in hollow tree trunks, broken bucket, gourds, baskets etc for bees to colonize. This does not give room for proper management. Inspection is carried out by observing the combs through provided holes to know when there is enough honey on store for harvesting. (Komeil,1990; Ugwunkwo, 1997). These are practices employed in the traditional bee management and

they are devoid of systematic operations (Cook, 1989;Abubakar,1990). Bee –having is an improvement over bee – killing, but falls short of the technologies used in modern bee keeping. Harvesting of honey under this system requires use of naked fire too and this is disastrous to bees also.

2.7 The Hive and Types of Beehives:

Hive is the natural home of bees. Based on the level of design and construction, hives can be categorized into traditional, intermediate and high technology movable frame hive. Hive types are often also graded according to whether they are fixed comb or movable comb frame. Hence, the following categories of hives are used: fixed comb hives, movable comb hive and movable frame hive. Most traditional hives are fixed comb hives, most intermediate level hives are movable comb hives, while movable frame hives are employed in high technology hive (Agrolads, 1998).

2.7.1 Traditional Hives

Pottery hives

Pottery hive or the cooking pot hive is the same vessel that people use to carry water from spring and rivers to their homes. To form a brood chamber, a cooking pot of the size used by a family of ten people is required. Second pot forms the super. It is cheap. It is durable and not liable to be attacked by termites. The pot vessel is broken at the bottom in order to allow for extension attachment of another pot for honey storage. It is laid on its side on tree branch (Komeil, 1990 ;Ugwunkwo, 1997).This is mostly used in Kurdistan and Nigeria.

Clay hives: are used in Kermanshased and are made from clay material roughly 55-65 cm, long and 20 – 25 cm in diameter with narrow mouth of 3-4 cm (Komeil, 1990). There is no room for extension.

Log hives: are made from log and are used in many parts of the world (Komeil, 1990). They are about 75- 100 cm long and 30-40 cm in diameters.

Basket hives: Comprise pliable twigs from tree especially willow and are found in Azarbayan, Huristan, Hamedan and Kurdistan (Komell, 1990).

Wooden board hives: are cylindrical and skillfully made from wooden boards. The hives are 65 – 75 cm long, 30 cm wide (Komell, 1990). They were developed 30 – 35 years ago in the central parts of Iran and are often used in Isfahan by migratory beekeepers (Komell, 1990).

Mud hives : are used in Hamadn and Luristan. The are coated with either dung or a mixture of mud and chopped straws (Komell, 1990).

2.7.2 **Modern hive:**

This is used in modern beekeeping. It is in form of a box with removable top. Inside this box, the combs are contained in a wooden frame which the beekeeper can remove for inspection. This box is called *brood – chamber* of the hive and forms the permanent place where the young bees will be reared. A complete set of modern hive is partitioned into bottom board, queen excluder, honey super top, ventilation screen, inner cover and other outer cover. It is called the Langstroth high tech – bee hive". The overall depth for the Langstroth frame is 23.5 cm. The

overall depth of Langstroth for a shallow frame is 15.9 cm and contains about 10 to 15 replaceable frames (Agrolads,1998).

During the season, when the bees can gather more food than their requirements, the cover of the brood chamber is removed and another box containing frames is installed above the brood – chamber. This second box is called super. It is used for storage of honey and can be removed with out disturbing the brood nest (Nwadukwe, 2000).

With the modern hive, the beekeeper starts the seasonal management with clearing the hives and fixing of the foundation hive frames. The hive is baited with sugar syrup or palm wine to feed the bees and make them colonize the hive. The reason for putting the super chamber is to reduce the incidence of swarming and level of congestion in the brood nest and obtain high yield of honey. This will encourage the bees to stay in the hive from one season to the next and the beekeeper does not depend on arrival of new swarms next season.

2.8 **Site selection**

Good honey production begins with the right choice of site for the apiary and the correct use of this site (Sergen, Moulder, Betsma and

Sommeiger, 1991). Site would be in an area with several sources of nectar within a radius of one kilometer. Although bee can cover an area within a radius of 3km, it is preferred to place the bees in the middle of the forage. The shorter the distances the bees have to fly, the less the energy lost and the higher the honey production. The site must not be water logged in the rainy periods. There should be enough suitable drinking water for the bees in the immediate surroundings. If not a drinking place should be provided for the bees for instance a water container (in the shade) from which water drip slowly . if an open container is used to provide water, always leave some piece of wood floating on top for the bees to land on, otherwise, they will drown. When working with defensive African or Africanized bees, the apiary should not be in the vicinity of inhabited area where there are regular agriculture or livestock activities. as a rule the following distances are considered safe. 100m in forested area, 200m in shrubbing and 300m in open land (Nwadulawe, 2000). Moreover, owing to the aggressive nature of the African bee it is not advisable to place hives right on the farm but near it, 100-120 metres away from crops is good. Bees can travel about 3 kilometers to visit a plant. Bees sited about 150 metres away from a productive area of the

farm will allow labourers to clear weeds turn the soil and work the crops. (Agrolads 1998 ; Issa, 1998).

The apiary should be near the farmer's homes to save money and time that should have been spent on transport during inspection. There should be good paths to and from the farm to facilitate movement for the farmers and their containers on the farm.

Hive must always be protected from hot sun. Hives should be placed under a tree which offer sufficient shade. Additional roof of currigated iron, straw or leaves can be placed to cover the top of each hive. The hives should be placed in such a position that the flight entrances are out of the prevailing wind direction.

Hive should be placed at slight angle so that their slight entrance is 1cm lower than the rear of the bottom board and the rain water can not run into them.

Cattle and or large game can not walk around the hives. The site of the apiary should be fenced round.

Raccons: Hives should be suspended from the branches of a tree, or home made pole construction with wire about 1m above the ground.

Toads: In humid tropics, toads are notorious bee eaters, Hive should always be placed 50cm above the ground to discourage toads.

Ants and Termites: Ants are great threat to bees. Hives should be protected from ants and termites with grease. A collar of zinc or aluminum can be placed to each leg of the stand with grease under side of these collars once a year or old crankcase oil. Weeds should not be allowed to grow around the stands because they form a bridge for the ants. Old rubber mate or linoleum can be placed under hive stands.

Thieves : Man is the main enemy of bees in some areas. The robbing of bee hive is a common hazard. Apiary should be kept within a short distance of a guarded dwelling or it can be wrapped with a chain and pad lock. People in the neighbourhood of the apiary should not have any reason to disturb the bees. They should be informed well and action should be taken openly in case there is compliant.

Bush fire: In savanna region and other regions with long dry spell, the danger of seasonal bush fire might cause problem in setting up a proper

apiary. It is one main reason for beekeepers to put their hive up on trees. A wide area around the apiary should always be cleared as fire guard.Weeds and shrubs be kept down from time to time.

2.9 Preparing the hive and siting the apiary

The most attractive smell to a swarm of bees looking for a home is that associated with bees. A little beewax and propolis can be melted and poured into the hive (Nwadukwe, 2000). Foundation combs are necessary to inform the bees ahead of time on how to construct and align their combs (Agrolads, 1998) Palm wine, sugar syrup, honey or used honey combs can be used as baits to attract bees. Other methods include:

1. **Collection of bee swarms from the wild into the beehives; or** buying from an already established bee colony. In either of them, old swarms are disturbed in their original habitat These are swarms which have already established and built some combs with some broods and honey. The chance of these swarms staying in the hive is small. The entire colony should be moved to the hive at the same time (Sergen et al, 1991). All the combs should be collected with the aid of knife and smoke to scarce the bees from the combs. The combs are carefully fitted on the

cells of the hive frames. The bees should be finally swept or driven into the hive. The bees oriented themselves, so the hive should be placed about 5 or 6 km from the area where they were found.

In baiting system of stocking the hive, a small hive with already two old frames of movable hive can be used as baits. The hive is placed on a tree or a roof that offers it protection from the wind. This should be placed in the desired place the very day the swarm enters it. The bees will begin to orient themselves on the position of the hive. The hive can later be moved over a long distance some weeks after. It can be moved back to the desired place. The hive can later be moved over a long distance some weeks after. It can be moved back to the original place.

Some old hives can be kept at least one around home to bait a swarm, which is often in spring or at the beginning of the dry season. In some countries, the ministry of Agriculture and or forestry makes small colonies of bees available (Sergen et al, 1991). After the hives are occupied, they are set on stand, not less than 50 cm from the ground to prevent pest, water logging and splashing from destroying the hive. (Akachukwu, 1995; Agrolads, 1998). Raised platforms made of bricks are ideal because they stand the test of time and weather. Hive stands could

also be made of metal or termite proof wood. Hives should be grouped together. Up to 30 hives can be kept in one place, as part of the colony may also swarm these empty hives. This in a way takes advantage of swarming and controls migration.

(a) The beekeeper should also clear the bush around the hive to avoid bush fires.

(b) Keep the hive under a shade provided by tree / shrubs;

(c) Locate hives within flying distance of a perennial water source; hives should be about 10 cm from the pathway and protected from the sun, the wind and excessive rain and water logging (Akachukwu, 1995; Nwadukwe 2000)

(d) Once the hives are installed, swarms should be allowed to enter the hives, during the swarming period (April – August); and swarming time (8a.m to 10 a.m and 4 p.m – 6 p.m. This will occur frequently.

(e) When the main nectar flowers bloom, the beekeeper should remove the roof of the hive and install the super chamber.

If the hives are occupied early in dry season, the bee will construct their brood nest and be ready to produce honey later the same season. If however, they arrive later in the dry season, it will be better for the owner to leave them undisturbed until the next season.

The nectar and pollen sources should be within the flying radius of bees i.e. 3 km of the hive location.

II Other beekeeping tools

These vary depending on the technology used (Agrolads 1998) and include:

-**Hive stands**: Raised platform made of bricks are ideal. Metal or termite proof wood can also be used

Smoker: which consists of a firebox with a rate to hold the smouldering material, and a nozzle to direct the smoke and a below.

Smoker Fuel: coconut husk, dried corncobs, dried cow dung, old sacks leaves etc.

Bee Veil: protects the face against bee stings. The ordinary round wine and nylon mesh or mosquito netting is ideal. It is usually made to fit over a wide brim hat, which serves to hold them onto the hat. The mesh material should be preferably dark.

Bee suit: Bee suit should be a loose fitting and of light coloured, smooth textured material. A collar on the shirt helps in getting the lower part of the veil bee tight, while the trouser legs should be staffed into socks. High boots should be worn;

Hive tool: This is a flat piece of steel sharpened at one end for inserting between hive boxes to separate them. It is bent over the other end for separating the frames. It should be strong enough to bear ones whole wait;

Bee gloves: Strong and supple with gauntlets which come up over the sleeves and have elastic at the top.

A brush or Quill: used to sweep the bees from the combs. The tip of the brush must be soft;

A swarm catcher: A small beehive with five or six frame. It is used for securing a swarm of honeybee for the purpose of hiving.

Match box: This is needed as an apartment for the queen bee when a swarm or a colony is being transported.

Baiting material: Usually made of sticky swelling material I spoon – fed cheaped jam + 2-3 sponful of honey + 0.01L of water (b) caked beewax

dry cassava powder, granulated sugar, a ball of lime, lavender with sweet smell.

2.10 **Hive Management**

Beekeeping can be carried out with low level technologies or sophisticated high level technologies (Agrolads, 1998). The beekeeper should be conversant with the factors required to have the best output of beeproduct. In beekeeping, man employs his understanding of bee biology in providing a good housing and management for the best attention, have plenty of food and keep his bees free from diseases. (Schofield, 1974). Beekeeping is the method employed in modern hive system. Here, the beekeeper gets the bees under control by intelligence, confidence, gentleness and use of smoke and ovoid nervousness. The beekeeper should understand that all movement around hives should be slow, and deliberate.

Inspection involves the estimation of colony's size after a swarm has been housed. This is carried out during the day in modern beekeeping, when the weather is not sunny, preferably when there is no thunderstorm on the way. The farmer should carry out inspection on his hives every two (2) weeks or every nine to fourteen days for diseases and

abnormalities, such as pest attacks, raindrop, predators, food shortage. Swarming must be monitored. The beekeeper should check for the presence of the following: eggs, larvae, capped workers, broods or drone brood, queen, wax and moth larvae.

2.10(a) **Apiary Records**

Beekeepers should keep proper records of condition of each colony on hive cards especially when there are several colonies. The records should include the following: the date of inspection, the hive number, the time of hiving the colony, presence of brood combs and number, presence of drone combs and queen cells, the food supply, presence of swarm cells, any action taken and dates, honey yield record, and number of honey combs. Any other particulars such as aggressiveness, laying capacity of the queen must also be noted (Sergen et al, 1991)

Honey and beewax production records should express the date of harvest; hive number, location, quality and remarks. Record of apiary expenses should include date, items purchased, quantity value and remark (Sergen et al, 1991).

If a colony appears to be weak, the beekeeper must not fail to unite or strengthen it by adding bees and combs from stronger hives replacing old mother with a younger queen. Beekeeper must not fail as well to remove anything that can cause obstruction to the bees movement such as, spider and cobwebs and clear out hives when colony has died by use of burning punk wood, cow dung or dried stems of locally abundant Eryophobia plants to produce smoke (Cook, 1989; Morse and Roger, 1990). According to Ntenga and Mugonge (1991) and Ugwunkwo (1997) traditional system of beekeeping does not require these details. There is no systematic seasonal management similar to that practised by modern beekeepers. In modern beekeeping seasonal management starts with clearing the hive and fixing of the foundation hive fames. The hive is baited with sugar syrup or palm wine to feed the bees and make them colonize the hive. If colonies appear to be weak, they are united; the old queen is replaced with new queen. Swarming is also checked by providing other necessary conditions that make bees feel safe in the hive. The farmer must inspect the hive every nine to fourteen days after disease and abnormalities such as, pest attacks, rain drop, predators. Swarming must be monitored and finally general supervision practices

and harvesting are carried out. Use of naked fire during harvesting or chemicals is strictly avoided because they are obnoxious to honey bee.

Regular feeding of a colony with small quantities of sugar solution or (diluted honey) stimulated the development of brood, particularly after the harvesting of honey. This will enable them to withstand the dearth period. Brown sugar should not be used because it causes diarrhoea among in the bees. Frames can be removed from the hive so that the farmer can let in the feeder. The feeder can also be placed on top of a small wooden tray, which is placed in the flight entrance. The hive should not be opened to avoid provoking the bees to aggression. Fermented sugar solution is poisonous to bees and cannot be used to feed the bees. Feeding stops as soon as the bees no longer take up the sugar.

Lack of pollen means a serious shortage of food for the brood and will reduce the population of bees in the hive. Under this condition, pollen substitute can be given to them such as soybean flour. To avoid swarming before the main nectar flow, farmers should make sure that brood nest of strong colonies are not too crowded or bound by honey by

adding empty frame within the brood nest. This will control swarming, but may not prevent it completely.

2.10 (b) Management During Growth Of The Colony

Brood nest is gradually spreading over the various comb, foundation sheets and strips. Building of combs causes bees much energy. If less collection of nectar is noticed due to (bad weather or poor honey flow), the beekeeper should feed the bees small quantities of sugar solution. It is advisable to provide a honey super chamber with its flight entrance closed when the brood chamber is filled with food and broods. The bees should be able to colonize all the frames. Therefore, it is important that adjustment of the hive (no of chambers provided) should be to the size of the colony. It is good for beekeepers to decrease the number of combs when the colony gets smaller. (Sergen, Moulder, Beetsma and Sommeiger 1991). Queen excluder should always be placed between the brood and honey super to prevent the brood from developing in the honey chamber.

The rate of development depends greatly on the honey flow and weather. If a colony seems not to grow and weak, the beekeeper should

check for the quantity of food and drinking water available for the bees in the surrounding and also the disease out break in the colony.

2.11 **Bee Product Harvesting:**

Bringing a colony to maximum strength is one of the important preparations for bee product harvesting. This is done particularly when the colonies appear weak. This is only applicable to hives with loose frames as it obtains in modern beekeeping. It does not work in fixed comb hives used in traditional beekeeping. The beekeeper introduces a frame with capped brood from a stronger colony to a weaker or getting the flight bees of a colony into another colony. The later is possible only when the flight bees are carrying nectar and must have been familiar with the site of the new hive, else the guards of the new hive will block entrance to them. The beekeeper can enlarge a colony by uniting two small colonies together (exchanges the frames between the brood and honey chamber or the queens from the two colonies as earlier mentioned, at the start of the season.

In the later, one of the queens from either colonies is removed. Both of the queens may be allowed to stay under the normal

supercedure, the next day only the queen usually the younger one will remain alive. The older queen must have died or swarmed with some bees to a safer place. The bees of the two colonies to be united must develop a common (Sergen et al, 1991). This can be achieved using the newspaper or wire mesh. Some holes are pricked on a newspaper to allow exchange of smell, and a hive without buttom is placed on top of the hive with newspaper. This will allow the bees to gnaw the paper slowly away and mix up easily. The paper is later on removed. Ventilation screen can be used for the same purpose as well.

Posting or preventing swarming is another easy means of strengthen a bee colony. This can also be accomplished by providing extra brood chamber, which keeps the queen and workers active and prevents them from swarming. The queen can be clipped on one of her wings at the beginning of the season.

Migratory beekeeping permits the beekeepers to travel with their hives and obtain more honey. The beekeeper should be careful about the choice of site for his hives. This site should be free from disturbance, theft, cattle, game, fire, termites and spray of chemicals.

The time to harvest bee products depends on the extent of honey flow of the period. Honey flow begins in a given locality, when many bee forage plants start flowering. The source of bee product or honey to harvest can be one kind of plant for instance pure Eucalyptus honey or many different kinds of plant.

There are several mechanisms in plant world which trigger flowering (Sergen, et al, 1991). In the temperate zone, this is mainly temperature and length of daylight. In the tropics, where temperature and day length do not vary much during the year, flowering is often determined by rain and draught. In the humid tropics, most the plants begin to flower after a few fairly dry weeks. Exceptions are citrus varieties, which flower after the rains have started. In very dry areas, flowering usually occurs at the start of raining season. The beekeepers must note the plant, which the bee fly. It is good for beginner to know the time bee forage plant flower to get over view of the "honey flow."

The harvesting of honey can start 3 – 4 weeks after the start of a good honey flow (Sergen, et al, 1991). The best harvesting time in South eastern Nigeria is the dry season with warm nights (Nwadukwe, 2000). By

this time, the bees begin to seal the honeycombs. A comb with 2/3rd the cell containing capped honey is ripe. It is advisable to harvest combs with capped honey as the uncapped honey contains too much water and will start to ferment. Combs containing brood should not be harvested.

In fixed comb hives, only the combs at the sidewalls can be removed. In hives with loose frames and bottom boards the frames are loosened, while the board is turned upside down. A 0.75 liters of this honey sells for ₦150 at the local markets. It also sells between ₦ 3,500 to ₦ 4000 for 25 litres. Honey that looks too clean is object of suspension that it is highly adulterated with sugar and other liquid (Ugwunkwo, 1997).

In modern bee product harvesting, the beekeeper makes sure he removes only the combs with honey. The combs should be applied some smoke to keep the bees away from it or weaken them. Once the bees have gone, assessment of the quality of honey may be made prior to collection. It is important to establish the correct degree of humidity of honey by employing special method. Usually, an empty comb is put between the hives and the comb full of honey causing a good dehydration of honey on about 48hrs (Agrolads, 1998). It is also important to operate

with maximum hygiene and to leave fair supplies of honey for the bees, thus, assuring survival when food is scarce (Macrae and Robinson, 1993). Any bees on the combs are brushed into the hive with brush or quill. The frame and top bar are replaced after harvesting and the hive cover also is returned in its place. Fresh water is sprinkled on the bees that have fallen on the ground weakened by smoke to regain strength

In South eastern Nigeria, harvesting could start in October and end in April. Harvesting is done every 4 weeks on the average. The rate of harvesting hive depends on the strength of the colony and honey yield;

In traditional beekeeper, pots are installed on top of very tall trees; the beekeepers have to climb heights with naked fire to kill the bees before harvesting is carried out. Modern beekeeping requires the beekeeper to cut off the new combs against one side of the hive leaving 1cm of comb for both sides. To avoid robbing, combs should be kept in pots or buckets and closed. It is advisable to put combs with little or no capped honey in a separate container. At the start of harvesting, the beekeeper should pour some smoke under the lid of the hive, wait a while

and then take the frames with capped honey out of the honey super and brush off the bees.

At the end of honey flow the bees enter into rest period, when the worker bees are repairing and reconstructing the combs and the entire nest. The beekeeper should check whether the bees have enough food or the bees are being troubled by ants, termites, and wax moths. Flight entrance can be closed with course mesh or nails in such a way that mice and lizards cannot get in but bees can always get out. All the combs that are not always occupied by bees must be removed as the bees do not defend them against wax moths which, if allowed to invade the colony will cause the colony to abscond. The frames are stored in well-protected and ventilated space. The frames are covered with mosquito nesting and coated with light colour and not dark colour as small mites might destroy the combs. A greater proportion of the honey in the market, particularly local market are harvested with traditional smoke and about 10 litres of honey are collected from each hive (Ntenga and Muogongo, 1990; Ugwunkwo 1997).

2.12 **Bee Product Marketing**

Marketing in agriculture is defined as the performance of all business activities involved in the flow of food products and services from the point of initial agricultural production until they are in the hands of the final consumers (Arene, 1998).

Honey which is the chief product in beekeeping is either removed from the combs (extraction) or the combs are sold directly. Hence, two major types of honey are available in the market. They are comb honey and extracted honey. Comb honey is graded higher in the local markets and attracts a higher price (Jonathan, James, and Wardells,1989).

According to ITC/CATT, (1977), world production of honey was estimated at over 800,000 tons a year less than 20 percent of this enters the world trade. Fifteen countries, about half of which were developing countries accounted for 90 percent of world honey exports with Mexico, China and Argentina together accounting for over 50 percent of total exports in 1975 (ITC/CATT, 1977). In 1984, world honey export totaled 270,000 tons of which 60 percent came from the tropics. Demand has

increased much more on recent years as a result of higher living standard, a greater interest in natural foods, the emergence of new importing and more aggressive marketing by packers and retailers in some markets. However, supplies have not been increasing with increase in the demand (op. cit).

The bulk of honey marketed in the world is used for table/household consumption, while the balance is used for industrial purposes. In most countries, consumption of table honey usually accounts for 85 – 95 percent of total consumption (ITC/CATT, 1977). Industrial demand has declined in most countries in recent years owing to the rise in honey price and the emergency of low priced substitutes: such as isommerized corn syrup. Industrial honey was used chiefly in both confectionery and cereal industries. It was also used in the homes as spread on bread but some quantities especially in the United States of America are used in household as natural sweetners, primarily in home baking (Macrae and Robinson,1993; Agrolads, 1998).

In most countries, domestic honey is regarded as having the highest quality, by consumers, followed by foreign honey that most

resembled domestic varieties. Light coloured honey are usually more acceptable than darker ones but the later sells well in some countries, for example, the United Kingdom, liquid honey is much preferred to crystallized creamed or set honey (Macrae and Robinson, 1993).

2.13 **Constraints To Beekeeping.**

One of the major things of concern in beekeeping is that the dominant bee race in west Africa, Apis melifera adonsonii is very aggressive and proves very difficult to manage. It has an usual propensity to abscond . Bee sting is very painful and disorganizing, and can result to ones death under heavy attack. It also costs good amount of money to treat a bee sting victim (Ugwnkwo, 1997).

Forest destruction by hunters of wild games, farmers, builders and beekeepers with fire from traditional smoke used to pacify the bees depletes bee population and vegetation. In traditional beekeeping, siting hive on trunks of big trees can involve risks of loosing one's life in climbing such tall trees. Agrochemicals some beekeepers used to kill the bees especially in advanced countries militate against bees and affects the quality of honey during harvesting period.

Diseases and pests of honeybees are other constraints in beekeeping. Most prominent pests of bees in the hives is trachael mites (Acarpis woodii). This was found first in U.S.A in 3rd July, 1984 (Morse and Roger, 1990; Ugwunkwo, 1997). They estimated that half of the honeybee colonies in the United States of America have died of mite infestation, since the time. The recent spread of Vorroa Jacobsoni and tropidae laps cleareac must alert the beekeeping world to the irrevocable problem which man can cause by importation of diseased honey bees (Dejong, 1988). This problem is imminent in Africa, south of Sahara because of the existence of the Apis florae, a species of honeybees.

Unavailability of organized market also constitute limiting factor to effective apicultural practice. In addition, rural beekeepers lack the necessary knowledge and techniques of processing beewax of marketable quality and product. This also reduces the profitability of beekeeping enterprise (Ugwunkwo, 1997). It is clear that rural farmers still face a problem of low productivity but no identification of the causes of this problem has been made (Merieke, 1988; Ugwunkwo, 1997).

Sale of adulterated honey is common, particularly, in urban markets. This affects demand and prices of honey seriously. Adulterated honey is easily identified by honey experts in the market. Hence, honey that looks too clean is an object of suspicion that it resembles imported honey, which is considered to be highly adulterated (Ugwunkwo, 1997).

CHAPTER THREE

METHODOLOGY

3.1 The Study Area

Enugu State is the study Area. She is one of the 36 states of the Federation and is located between latitudes 6° 53'N and 7° 06'N and longitudes 6° 55'E and 7° 55'E. Enugu State was created from the old Anambra in August 27th, 1991. She occupies an area of about 8,002 95 km^2 and has a total population of about 2,124,065 (NPC official Gazette, 1992). Enugu state is bounded in the East by Ebonyi state, to the west by Anambra state, to the North by Benue and Kogi states and to the South by Abia and Imo States.

Enugu state has 17 local Government Areas which are grouped into three agricultural zones; namely: Awgu zone, comprising Awugu, Ani – Nri, Oji River, Nkanu East, Nkanu West, and Enugu South Local Government Areas; Enugu zone comprising Enugu East, Eziagu, Igbo Etiti and Udi Local Government Areas; and Nsukka zone which is made up of Igbo – Eze North, Igbo – Eze South, IsiUzo, Udenu and Uzo – Uwani (ENADEP, (1997) cited in Ugwunkwo, 1997). Enugu State has her

capital at Enugu city in Enugu North Local Government metropolis, which was formerly the base of coal mining.

Agriculture is the major activity of the people as nearly every adult has a farm. Their major agricultural activities include hunting, planting of field and plantation crops, livestock rearing and beekeeping. In addition, Industrial and commercial activities have been on the increase in the recent past. Some of the industries are mainly agro processing industries located in the major towns of the various local Government Areas of the state (Ike, 1995).

Beekeeping is successful in Enugu State because of the favourable environmental factors prevalent and available to honey bee in the study area. There are prevalent flowering, bee – loving forest vegetation of plantation crops, herbs and shrubs, which are good nectar sources to honey bees. This is combined with good tropical climate of average temperature of about 25° C and 1,754 mm average rainfall.

3.2 Sampling Procedure

A preliminary survey was conducted around the 17 local Government Areas (LGAs) of Enugu State to identify five major beekeeping local Government Areas and their markets. The five major beekeeping Local Government Areas and markets were: Eke Nimbo in Uzo – Uwani Local Government Area, Afor Opi in Nsukka Local Government Area, Obollo Afor in Udenu Local Government Area,Nkwo Ibeagwa in Igbo Eze South Local Government Area, Afor Umunko / Nkwo Ogbede in Igbo Etiti Local Government Area.

In the second phase of the survey, 10 beekeepers and 10 beeproduct buyers were randomly selected from a stritified group of 100 respondents of each identified market and its locality of the five selected Local Government Areas. This gave a total of 50 beekeepers and 50 bee product buyers and a total sample size of 100 respondents for the study.

3.3 Data Collection

Data for the study were principally collected from primary sources. Primary data were obtained by the use of two sets of pre-tested questionnaire administered to 50 beekeepers and 50 beeproduct buyers. Questions were asked regarding socio-economic characteristics of beefarmers and their effects on beeproduct output, the financial

requirements for entering into beekeeping, marketing arrangement for bee product, management practices of the apiculturists in the study area, constraints to effective beekeeping; profitability of beekeeping and other variables that were relevant to the research.

Some of the primary data were collected using participatory observation whereby the researcher observed the scene, participated, monitored and recorded some of the activities on the spot. The researcher observed sites; hive installation, apiary inspection and sales of beeproducts among other things. Data were collected in the daytime within and at the interval of market days for each locality when honey harvesting was timed and carried out. At the market scenario, sales of bee products : mixture of liquid honey and honey combs were transacted with 35.5 kg basin as the standard measure in every locality, which sold between ₦ 2,500 and
₦ 3,500.

Out of the 50 copies of questionnaire administered to the beekeepers, 44 were well completed and returned. Out of another 50 copies of the questionnaire administered to the beeproduct buyers, 42 were completed and returned.

copies of the questionnaire administered to the beeproduct buyers, 42 were completed and returned.

3.4 Data Analysis

The specific objectives of this study were achieved with different analytical tools. Objectives (i) (ii) (v) and (vi) were achieved using descriptive statistics such as percentages, means and flow charts. Objective (iii) was realized with the use of Gross Margin analysis and Net income analysis, and objective (iv) with the use of multiple regression analysis.

3.4.1. Gross Margin Analysis

Gross Margin (GM) is total revenue (TR) or gross income less total variable costs (TVC) per 35.5kg basin of beeproduct. i.e. GM = TR – TVC. Here, total revenue equals value of production (or sales) of bee products, home consumption as well as quantity given out as gift. Gross margin indicates the profit relative to sales after the direct production costs are deducted. From the gross margin, farmers Net Income was calculated as (GM –TFC), where TFC is total fixed cost.

3.4.2 The Multiple Regression Models

The multiple regression model was implicitly specified as $Y = (x_1 x_2, x_3, x_4, x_5, x_6, x_7, x_8, x_9, x_{10} ei)$.

Where Y = average bee farmers total revenue from sale of bee farmers' output in Naira (₦)

X_1 = Technology of the beekeepers.

X_2 = Sex of the beekeepers (male = 1 female = 0).

X_3 = Educational attainment of beekeepers in years.

X_4 = Variable cost in (₦) including costs of materials used in beekeeping (implements).

X_5 = Type and number of implements including the hives used by beekeepers.

X_6 = Distance of the hive site from beekeepers house / market (in km)

X_7 = Age of the beekeepers in years.

X_8 = Primary occupation of the beekeepers either farming crop or livestock = 1, others, mechanic, welding, patent medical dealing, schooling etc. = 0.

X_9 = Years of experience of beekeepers in beekeeping in years.

X_{10} = Labour use in beekeeping in (₦)

ei. = error term.

The explicit representations of the model were: (a) The ordinary linear form.

$$Y = b_0 + b_1X_1 + b_2 X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 + b_{10}X_{10} + ei.$$

(b) = the semi log.

$$Y = \log b_0 + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + b_4 \log X_4 + b_5 \log X_5 + b_6 \log X_6 + b_7 \log X_7 + b_8 \log X_8 + b_9 \log X_9 + b_{10} \log X_{10} + \log ei.$$

(c) = the double - log form.

$$\text{Log } y = \log b_0 + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + b_4 \log X_4 + b_5 \log X_5 + b_6 \log X_6 + b_7 \log X_7 + b_8 \log X_8 + b_9 \log X_9 + b_{10} \log X_{10} + \log ei.$$

The functional form that gave the best fit with respect to R^2, used for measuring the goodness of fit, and F-test, for measuring the overall significance of the regression, was selected and used for the analysis.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 General description of the various beekeeping enterprises and bee products' markets in Enugu state:

During the survey, the researcher observed that 86.4 percent of the hives used by the beekeeper in the study area are made with traditional technology, while 13.6 percent of the hives are operated with modern technology. It is also observed that 21 of the hives installed were not colonized because of wrong site selection. Eight of the 21 hives were placed facing the windward direction where wind was blowing directly opposite the flying direction of the bees. Six of the 21 hives were colonized and later vacated because of unfavourable conditions and other disturbances around the hive sites, such as ants/ termite attacks, bush firewater splash and roaming animals. It was also observed that about 33 hives, though colonized, were not thickly populated. The rest 167 hives were well managed and colonized. On the whole, a total of 221 hives of both traditional and modern types in the ratio of 203 hives to 18 hives(approximately 11:1) were used for the study. The average number of hives per beekeeper was five; with the average beekeeper using the

traditional system having five while those with modern hives averaged three.

It was found that the average yield of bee products per modern hive is 49.4 kg where as the average yield of bee products per traditional hive is 36 kg. The average total yield of bee products for all the farmers both modern and traditional per annum is 202 kg, which is the yield for approximately 6 bee hives. It was also observed that modern hives are harvested as many times as the combs mature and ripen contrary to traditional hives which are harvested once. The modern hive frames are movable and can be replaced after harvesting.

For both traditional and modern beekeeping technologies, hives are returned to their positions after harvesting. This is to allow for further production of beeproducts. This is to enable the bees scared away and threatened with smoke or fire at the time of harvesting, to return to their hives and continue their normal life processes. It should be noted that bees are base and home – bound and must return to their hives under favourable conditions. Traditional hives are fastened in position with ropes to tree branches and straws are placed beneath them. Modern hives are elevated above ground with well-balanced and strong hive

stands that are termite / ant proof. Except in extremely difficult cases, the local pot hives are broken to facilitate harvesting.

The traditional beekeeping technology which is predominant in the study area takes advantage of harvesting in the night with naked fire. It makes use of the following implements: matchets, buckets, ropes, basin, axes, clay pot hives, torch light, bicycles, a lighter, and ladder.

4.2 Socio – Economic Characteristics of Apiculturist in Enugu State

Socio – economic characteristics that were considered with beekeepers' ability to perform in the enterprise were identified. Among these include age of beekeepers, educational attainment,. Sex, years of experience, beekeeper's primary occupation and household size / labour use.

4.2.1 Age of Beekeepers

Findings from the field data analysed in Table 4.1 indicate that people from the ages of 20 to 45 years are active in beekeeping, 43.2 percent are between 26-35 years of age, 29.5 percent are within 36 and 45 years. It is shown in the Table that as the ages of the beekeepers increased beyond 35 years, the level of participation declined.

Traditional beekeeping, which dominates in the study area, involves a lot of strenuous activities that could only be carried out by youth who have the agility and endurance to do them. It involves climbing tall trees to install the hives and harvest bee products. During harvesting, the beekeepers must be clever and fast enough to scare away worker bees with naked fire, defend themselves against bee sting and fastened their grips on trees to avoid falling down. Youths are often employed in traditional beekeeping. They offer labour to bee owners and share the proceeds from the sales of bee product or take their portion of bee products. These youths also form a part of the family labour used in beekeeping. The widows, aged and people who were incapacitated depended on them.

Table 4.1 Distribution of Beekeepers According to Age:

Age in years	Frequency	Percentage
25 or less	13	29.5
26 – 35	19	43.2
36 – 35	9	20.5
46 – 55	1	2.3
Above 55	2	4.6
Total	**44**	**100**

Source: Field survey

4.1.2 Educational Attainment of the Beekeepers

Table 4.2 indicates that about 86.4 percent of the respondents had formal education, with 40.9 percent attending senior secondary school, 11.4 percent junior secondary school and 2.3 percent tertiary institution. The remaining 13.4 percent had no formal school training.

The implication is that while people of all educational background practice beekeeping, most of the beekeepers in the study area are educated with 55 percent having post primary education. This augurs well for the practices, which may require literacy.

Table 4.2 Distribution of Respondents According to Educational Attainment.

Level of Education	Frequency	Percentage
No formal education	6	13.6
Primary (1-6 years)	14	31.8
J.S.S.E. (7-9 years)	5	11.4
S.S.E. (10-12 years)	18	40.9
Tertiary education (13-16)	1	2.3
Total	44	100

Source: Field survey

4.2.3. Primary Occupation of Beekeepers in the Study Area.

Table 4.3 shows that beekeepers in the study areas having various primary occupation, while beekeeping is only part time or a complimentary revenue source. Nevertheless, farmers are the major beekeepers accounting for 68.2 percent of the beefarmers population in the study area.

Extension personnels are advised to disseminate information on beekeeping to all rural dwellers irrespective of their primary occupation

Table 4.3 Distribution of the Respondents According to their Primary Occupation:

Primary occupation	Frequency	Percentage
Farming (crops and livestock)	30	68.2
Trading (patent medicine dealing)	2	4.5
Artisan (welders, mechanics etc.)	8	18.2
Schooling	4	9.1
Total	**44**	**100**

Source: Field survey.

4.2.4 Years of Experience of the Beekeepers:

About 64 percent of the beekeepers have been in the business for six years or less, while 36 percent have had ten or more years of experience (Table 4.4).

These imply that beekeeping has attracted recent entrants perhaps due to economic circumstances in the area. Among the beekeepers who have been in the business under seven years, 26.7 percent said they are there because their business in the urban areas folded up during religious or political disturbances in the country particularly in the northern states. The internally displaced persons

relocated themselves and businesses home. They are able to learn the arts and skills of beekeeping within a short period and combine it with other artisan work (welding photographing, mechanic etc). The students among the beekeepers said beekeeping fetches them money to pay their school fees and solve other financial problems in their parents' large families. Those beekeepers who were there for 10 years and over are experts with wealth of experience and mastery of beekeeping. They control large number of apiaries within a given honey flow and are able to control bees in their wild behaviour.

Table 4.4 Distribution of Respondents According to Years of Experience in Beekeeping

Years of experience	Frequency	Percentage
Less than 5 years	2	4.5
5 years	22	50
6 years	4	9.1
10 years	12	27.3
Above 10 years	4	9.1
Total	**44**	**100**

Source : Field survey.

4.2.5 Household Size and Labour Use in Beekeeping in the Study Area.

Table 4.5 indicates that household size is positively related to labour use in beekeeping. About 63.8 percent of the respondents depend on the family labour provided particularly by male members of the family. About 13.6 and 22.8 percent including those who have not had families hired labour or share labour which benefit from share of the proceeds respectively. None of the respondents indicated that he managed his apiary alone.

The implication is that family labour use is rampant, and it reduces labour cost in beekeeping as well as on the farm. Labour is imputed since often no actual payment is made.

Table 4.5 Distribution of Respondents According to House Hold Size and Labour Use in Beekeeping in the Study Area:

Labour use	Frequency	Percentage
Family labour	28	63.8
Hired labour	6	13.6
Combined labour	10	22.8
Total	**44**	**100**

Source: field survey.

4.2.6 **Sex of the Beekeepers in the Study Area.**

About 86.6 percent of the beekeepers in the study area are males, and 13.4 percent are females. Men are more fit to manage traditional type of beekeeping which is obtainable in the study area. This is because the system involves a lot of climbing tall trees to install the hives and harvest bee products. Tradition forbids women from climbing trees. Consequently women depend on their male children's labour or hired labour to install hives and or harvest the hive.

4.3 Management Practices of the Apiculturists in the Study Area.

There are two types of management practices observed in the study area:

The traditional management system and improved or modern management system.

4.3.1. **Traditional Beekeeping System in the Study Area.**

About 81.8 percent of the respondents practise traditional beekeeping. All the respondents using traditional technology said that they used local pot hives which they carry up the branches of trees during flowering periods that precedes honey flow. These trees are usually tall

trees like oil beam trees, Iroko and *Irvingis gabonensis*. They usual practice is for one beekeeper to climb up while the other remains on the ground. The climber beekeeper tie one end of a long rope round his waist, the other end of the rope round the neck of the pot hive and climb up the tree via a ladder. The beekeeper clears the ways and prunes the leaves with matchet as he moves up the branches. He climbs until he gets up to the junction of branches. He assumes a good position and pulls up the pot hive with the aid of the rope, placing the straws at the base of the hive as support for the hive and laid the hive by the side and fastens it with rope to the branches around. The other beekeeper stays on the ground at the foot of the tree to push up the hive to him. The essence of pruning the leaves of the branches is to create an increased view for bees to locate the hives and colonize them.

About 21.1 percent of the traditional beekeeper said that they tie two pots head long and introduce flight entrance on the bottom of the smallest pot and fasten both to the tree branches. The rest of the respondents, who use one big pot each, cover the mouth with a veil and pierce a hole to serve as flight entrance on the veil. All the respondents using traditional methods install their pots during honey flow and

swarming periods. This would enable the swarm of bees, which are disturbed in the original colony passing by to colonize them finding them conducive.

All the beekeepers using traditional technology carry out hive inspection. This is done irregularly starting from the second week after hive installation. Unlike in modern beekeeping, inspection in traditional beekeeping is indefinite and is after hive installation is done from the ground to the tree. The presence of the bees swarm on and around the branches of the tree and hive gives the farmer signs of colonization of the hive. Inspection should have continued until after harvesting of the hive products and the pot returned if it were still in good condition.

All the beekeepers indicated that they harvest the hive products as soon as they notice bees flying on and out of the pots and around the branches noisily and joyously. This is at the time of honey flow (late October to early April in South Eastern Nigeria) shortly after flowering of some trees that are good nectar source and pollen contents to the bees. Further sign for time of harvesting is honey drops noticed on the flight entrance and cracks of the pot hives giving sweet aroma to the surroundings. The traditional beekeepers mentioned that they use the

following implements during harvesting: buckets, ropes, basins, torch-light, bicycle, axes and matchets. At hive installation implements used are ropes, matchets and axes. These implements serve complementary roles in their crop and livestock farms.

Harvesting in traditional beekeeping is only in the night to avoid harassment from bees. All the traditional beekeepers indicated that their hive sites are as far as their farms from home. They travel distances in bushes to operate their apiaries in the night to avoid harassment from bees. All the beefarmers in traditional bee system mentioned that they use naked fire on the bees in addition to other measures used to control bee temperament. Their harvesting of hive products is once in a year (a honey season). They travel distances into the night in bushes to harvest and carry their bee products home or direct to market on head portrage or by bicycle.

All the traditional beekeepers said that during harvesting, one of the beekeepers ties one end of the rope to the handle of a metal bucket and the other end round the waist as it were in hive installation. The beekeeper then masks himself and climbs through a ladder, up to the junction of tree branches, balances well for harvesting operation. He pulls

up the bucket and the bundle of dried straw to serve as full material or wood and lights it with a lighter or matches to fight and kill the bees. Sometimes the clay pot hives are broken or destroyed to hasten harvesting .The other beekeeper stays at the foot of the tree to receive the bucket and pour out the bee products into basins. The bucket will be pulled up

Further investigations and findings show that 15.7 percent of the traditional beekeepers do not use hives on some of their bee sites. This category is able to locate bee colonies on hollows of trees, anthills and rocks on their farms and among the trees in the forests. Some of them in the process of bee hunting discover the treasures, which they claim and tap. They use axes to remove the covering part of wood and harvest the bee products at night when the bees are weak, asleep and less busy or inactive. All the traditional beekeepers said they use torchlight to see through the bushes. See figs. I and II

FIG. I: A TRADITIONAL BEEKEEPER INSTALLING THE HIVE.

FIG. II: A traditional clay pot hive installed on the tree.

4.3.2 **Modern Beekeeping in the Study Area:**

About 18.2 percent of the beekeepers involved in modern beekeeping technologies use movable hive frames, wooden box hives and smokers instead of clay pot hives and naked fire. Hive stand is used instead of tall trees as in traditional beekeeping. The height of the hive stand is usually 50 cm above the ground. This saves the beekeeper time and other inconveniences spent in climbing up and down a tree. All the modern beekeepers use baiting materials which are either sugar syrup, palm wine or old honey combs that their fragrance / odour might attract bees to colonize the hives.

About 75 percent of modern beefarmers stock their hives and establish fully grown bee colonies by taking advantage of swarming period. They do this by placing new baited hives near fully-grown bee colonies that are about to swarm. This is one of the swarm control measures applied in modern beekeeping. This is centrally important and an advantageous technique of improved beekeeping that contrast traditional beekeeping system. About 12.5 percent of the modern beekeepers establish apiaries from wild colonies on and around their

farms. They are able to achieve this by baiting their hives and collecting bees with bee bags and dropping them into their hives. The bees orient themselves and stay.

In any case, the beekeepers feed these bees constantly with sugar syrup and palm wine at the initial stage. These bees continue on this ration until they are able to fend for themselves. About 27.5 percent of the beekeepers feed their stock with soybean cake at nectar and pollen scarce periods and when flowers are not in bloom. They also feed them clean water, which is usually put on flat plastic plates with a stick crossing the plate to serve as perching material so that bees are not drowned.

All the modern beekeepers carry out hive inspection initially, once every nine days and later, forth nightly to make sure that the bees are in good condition. In all the cases, queen excluder is used to separate the brood chamber from the honey chamber. This helps to improve the quality of bee products, reduce the water and waste particles' content of bee products, and hence, facilitate ripening process of honey. They all indicated the use of various control measures against pests of beefarms, such as termites, red ants and rodents. The main control measure is more of application and smearing of condemned engine oil or grease on

the legs of hive stands .They all mentioned they use flat light boards of aluminum coating to cover the top of the hives from excessive heat and rain drops. All the modern beekeepers maintain the bees and apiary surrounding by keeping down bushes around. These are done early in the morning, before the bees' activities start or late in the evening. They have to close the flight entrance to stop any bee coming out to attack them.

All the beekeepers who use modern technology said they harvest their hives products by day time early in the morning or late in the evening to avoid clashing with the bees, to avoid sweating that can cause offensive odours to the bees which make them aggressive. They employ smokers which are either filled with dried cow dung or straw that produce smoke. The smoke is applied on the bees to weaken them and scare them from stinging. This action is carried out by one of the beekeepers, while the other beekeeper does the harvesting. Also, harvesting is done in stages. Frames with ripe honey are harvested at a time and the frames returned to the hive for refilling. This exercise would rather be called "honey picking" instead of honey harvesting. As soon as the frames are returned, the bees start to deposit materials (nectar, pollen and saliva) on them again.

About 50 percent of the beekeepers use old, condemned clothes, stockings, gloves and shoes in place of bee suite, rain boot and hand gloves. Also 34.5 percent of these are women. This group of respondents said they learn about modern beekeeping at workshops and seminars organized for family support programmes, women forum and Development and Family Economic Advancement Programmes. They mentioned they are able to manage their beefarms themselves with their children's help particularly during inspection and harvesting of hive products, which involves teamwork. The rest 62.5 percent of modern beekeepers were males. This group also said they are trained to manage and keep bees at seminars and workshops organized for the farmers' fora, associations and councils by governmental and non – governmental agencies. About 27. 5 percent of them are able to keep records of what is going on in their farms, but not very accurate records.

The implication is that modern beekeeping involves the participation of people of all classes and sexes. It is not very tedious and it neither requires climbing of tall trees nor destruction of bee stocks. Also it reduces the amount of risks involved in accident and bush fire. In addition, accidents and injuries sustained from falls from tall trees, night

travels inside the bush, bite from snakes, burns from fire as well as cut from thorn and machetes are curtailed by use of modern bee techniques. Further more, contamination of bee products with ashes and wastes from straws, naked fire used to kill the bees and water from the brood in traditional beekeeping makes the quality of honey low and reduce the shelf –life of the honey. This is improved upon by the use of queen excluder to separate the honey chamber from brood chamber in modern beekeeping as it is observed in the study area. Male and female beekeepers alike can gainfully engage in modern beekeeping and succeed. See figs. III and IV

Fig. III: Modern hive frames are arranged in the wooden box hive.

Fig. IV: Modern wooden box hive is set on a hive stand in the field.

4.4 Determination of Financial and Other Requirements for Entering into Beekeeping in the Study Area.

In as much as beekeeping is cheap to run, it is never a resource free venture. Beefarmers have some minimal resources commitments that enable them take off well (i.e financial and material requirements). They are rural farmers, more in their peasant nature with their initial financial setbacks. They have no access to formal credits, therefore, they had to resort to informal means of getting it through Isusu Age grade, inheritance from family wealth, gifts etc. Other requirements such as material and labour are easier for them to provide.

4.4.1 Sources of the Initial Capital:

The beekeepers in the study area are all small holders who have no access to bank lending. Moreover, their financial needs are small. They are able to source their initial capital from income from the farms and other occupations, borrowing money from Isusu age grade collections, money received as gifts from friends and relations, money realized from sale of family cash crops and other family properties and artifacts.

Table 4.6 shows that most of the initial capitals are obtained from personal saving (represented by 52 percent) and average amount of capital is N2762.20.

The high dependence on personal funding and informal financial sources leaves the enterprise with low capital base. This makes the beekeepers to be reluctant to adopt modern beekeeping technologies, which they feel is more capital intensive than the traditional beekeeping.

Table 4.6 Distribution of the respondents according to Source of Initial capital for beekeeping an Average Amounts per Source.

Source	Amount (N)	Percentage%
Personal saving	1,435.60	52 Inheritance
	1,65.70	6
Borrowing (non formal financial)	-	6
Institutions (Isusu Age Grade)	1,022.20	37
Gifts from relatives and friends	138.10	5
Total	N2,761.60	100

Source: field survey

4.4.2 **Level of Capital Investment in Beekeeping:**

About 43.2 percent of the beekeepers enter beekeeping enterprise with between N2000 and N2,500. Also 34.1 percent start the business with between N2,500 and N3,000. Whereas 9.1 percent and another 9.1 percent of the respondents move into the business with amount ranging from N3,000 to N3,500 and N3,500 to N4,000 respectively. Only 4.5 percent of the respondents invest above N4,000 in the business as indicated on table 4.7. The average amount invested is N2671.73, The implication is that there is no absolute financial barrier to entry into the enterprise. Hence, virtually any body can undertake beekeeping.

Table 4.7 Distribution of the Respondents According to Their Financial Investment.

Initial fund invested	Frequency	Percentage
From N2000 – N2,500	19	43.2
From N2,500 – N3,000	15	34.1
From N3,000 – N3,500	4	9.1
From N3,500 – N4,000	4	9.1
Above N4,000	2	4.5
Total	44	100

Source: field survey

4.4.3 Profitability of Beekeeping in the Study Area

The total income or revenue of the beekeepers was determined from the total products of their output, (which is in the mixture of honey and honey comb). The products were measured with 35.5kg basin which sold between ₦2,500 and ₦ 3,500 at the prevailing market price per 35.5 kg. The average selling price was ₦2,681 for the period. About 65.9 percent of the beekeepers receive a total revenue between ₦5000 and ₦10,000. The rest 34.1 percent realize between N15,000 and N40,000. The overall total revenue for the beekeepers was calculated and the average total revenue per individual beekeeper for the study was determined. The average total revenue for both systems was N11,279.41. Also the average total revenue for modern beekeepers was N15,501.40, whereas the average total revenue for traditional beekeepers was N10,798.23. From the total revenue, gross margin and net income for the modern and traditional beekeepers were calculated using income analysis. See tables 4.8 and 4.9.

Table 4.8 Income Analysis for Average Traditional Beekeeper:

Item		Total
Revenue		₦. K
Sales from beeproducts:		
honey, beewax and others		10,798.23
Expenses.		
Variable costs		
Baiting material	200.00	
Hives (clay pot, average of 5 pots)	750.00	
Labour cost	375.00	
Transport cost	700.00	
Total variable cost. TVC		2025
Gross Margin (TR – TVC)		8773.23
Fixed costs.		
Depreciation on items such as (Matchet, Ladder, Bucket, Basin, and Torch Light).		210.00
Net income (GM – TFC)		8563.23

Source: field survey:

Fixed cost in the traditional beekeeping include costs on items such as matchet, bucket, basin, ladder and torchlight.

Fixed costs were depreciated using the straight-line method of depreciation. These items were depreciated with an assumed salvage value of zero. The useful number of years of these items were determined by the respondents as follows, matchet , bucket and basin (10years). Torch light and ladder (2years). Total value of depreciated cost was N210.00. The calculated net income value for the traditional beekeeping method was N8563.23.

Table 4.9: Income Analysis for Modern Beekeeping.

Item		Total
Revenue		**₦. K**
Sales form Honey, beewax and other beeproducts.		15,501.40
Expenses		
Variable costs		
Baiting material	200.00	
Labour cost	150.00	
Transport cost	400.00	
Total variable cost (TVC)		750.50
Gross margin (TR – TVC)		14,750.00
Fixed costs		
Depreciation on items		
Wooden hives average of 3 hives	360	
Bee knife	200	
Hive stand	100	
Hive tool	20	
Hand gloves	60	
Matchet	70	
Metal bucket	20	
Basin	50	
Total Fixed Costs		700.00
Net Income. (GM – TFC).		14,050.00

Source: field survey:

Fixed cost in the modern beekeeping included costs on items such as wooden hives, matchet, bucket basin, bee knife, hive tool, hive stand, hand gloves.

Fixed costs were depreciated using the straight-line method of depreciation.

These items were also depreciated with an assumed salvage value of zero.

The useful number of years of these items were determined by the respondents as follows: wooden hive, machete, bucket, basin, hive tool and bee knife, = 10years whereas hand gloves and hive stand were 2 years.

Total value of depreciated cost was ₦. 700.00

The calculated net income value for the modern beekeeping method was N14,050.90.

4.5 Effects of Socio – Economic Factors on Beekeeping.

The data gathered on socio-economic factors were analysed with different regression models. viz, linear, semi –log and double log.

The functional form that gave the best fit with respect to the R – Square values was the semi – log. The result of the regression analysis of the equation based on the 44 respondents is as follows.

$Y = 7.766 + 6.205X_1 - 3.50 X_3 + 2.798 X_3 + 2.076 X_4$

SE	.565	.000	.005	.143	.102	
T(cal)	13.732	4.316**	-.638	.190	.203	+ 2.589

$X_5 - 4.64 X_6 + 1.809 X_7 - 2.37 X_8 + 2.752 X_9 - 250X_{10}$

SE	.013	.016	.017	.011	.O45	.216
T (CAL)	1.97**	- .292	1.035	-2.119	.613	-1.157

$R^2 = 0.693$

F = 7.434

SE = Standard error

T(CAL) = T-values (calculated)

Examination of the variables in the equation reveals that X_1, i.e. the technology use of the beekeepers considered by the nature and level of application of the technical and managerial skills acquired of the beekeepers with coefficient (6.205) and X_5 i.e. types and number of

implements including the hives used by beekeepers with coefficient (2.589) were significant at the five percent level.

This implies that efficient skill acquisition and application combined with proper use of good implements are strongly and positively related to increased beeproduct out puts, hence increased revenue of beefarmers irrespective of the type of system.

The above factors have contributed 69 percent of the increase in beeproduct revenue in the study area. The reason for a high coefficient of multiple determination (R^2) shows that most important variables were included in the model. The remaining 31 percent was due to unexplained variables not included in the model such as seasonal variations, type of vegetation, type of bee race, etc.

However, the overall regression equation was statistically significant at five percent level of probability, since F – statistic 7.434 was slightly greater than the critical F– ratio (2.04). Based on the fact that F-statistic was significant at five percent level, it was evident that socio–economic factors of the beekeepers had significant effects on bee product out put or revenue of the beekeepers in the study area .

Therefore, the null hypothesis which stated that socio – economic factors of the beekeepers had no serious effects in bee product output/ revenues of the beekeepers in the study area was rejected while, the alternative hypothesis was accepted

4.6 Marketing Arrangements

4.6.1 Disposal of Beekeepers' Output:

After harvesting of bee products from the bush the previous night, beekeepers transport them home or to nearby markets to dispose of them immediately. The market are usually small and organized at road sides of major roads leading to major towns, about two to four kilometers from the hive sites. Harvestings are done on anticipated major market days, which came up usually once in every four days in a week. The bee product are sold in honeycombs, whole and unprocessed usually with 35.5kg, basin (standard measure) that could certain liquid honey and the comb.

The prices of bee products are never steady each market day. Bee farmers gave out the products for any price between N2,500 and N3,500 per basin. Different market audience (groups) have demand for bee products in the local markets. Among them are wholesalers (who) bought in big bulk of up to 355kg amounting to ten basins a day and resell at the

immediate point of collection. Retailers buy and process the products into honey and beeswax and retail their wares in cans and bottles of 25 liters and 0.75lb per lucozade bottles respectively. Retailers usually buy between two and three basins consumers bought one basin at most for consumption. There is also a group who buy processes honey and store in large quantities in cans. They shift these cans to major town or supply to industries on wholesales. As can be seen from Table 4.10, about 66.7 percent of buyers of bee products were retailers. 24.7 percent were wholesalers whereas 9.5 percent were consumers.

Table 4.10Distribution of respondents according to their market Group or Categories.

Group/Category	Quantity collected Kg	Frequency	Percentage
Consumers	35.5	4	9.5
Retailers	35.6 – 106.5	28	66.7
Wholesalers	106.6 – 355	10	23.8
Total		42	100

Source: Field survey.

The market groups in Table 4.10 form the distribution channel through which beeproducts are distributed in the study are. Distribution of

beeproducts in the study area follows the normal distribution channel of normal agricultural items.

Prices of bee product are lower at the peak period which is early March to late April. At the period, marketers buy a lot of bee products, process and store them (honey in jerry cans and beewax in bags for good market periods). Beewax has little demand except for the shoe repairing industries, which collect them. (See Figs V) .

FIG. VI: Picture of Beeproduct Market scene in the study area.

4.6.2 **Local Market Arrangement for Disposal of Bee Product in the Study Area.**

More studies were conducted to find out places of higher supplies. Table 4.12 showed that Opi Market in Nsukka L.G.A and Ibagwa market Igbo Eze South were dominant sources of bee product supply, followed by Umunko Ogbede market (Igbo Etiti L.G. A.) Obollo Afor (Udenu L.G.A.) and Nimbo (Uzo- Uwani L.G.A) See Table 4.11

Table 4.11 Distribution of Respondent Buyers According to Places of Purchase of Bee Products.

Place of purchase	Frequency	Percentage
Opi Nsukka L.G. A	10	22.8
Ibagwa Igbo Eze South L.G.A	10	22.8
Nimbo, Uzo- Uwani L. G.A	5	10.8
Umunko – Ogbede, Igbo Etiti L.G.A	11	32.2
Obollo Afor , Udenu L.G.A	6	11.2
Total	42	100

Source: field survey.

4.7 Problems of Beekeepers in the Study Area:

The predominant problem of beekeeping in the study area was poor infrastructural facilities for disposal of beeproducts (27.3 percent.) This included poor market facilities, narrowness and unsteadiness of market prices and poor condition of roads to and from the farms and markets. Another problem was forest destruction which was reported to be caused by bush fire set on bushes by hunters who chased wild games, farmers clearing their farm land and contractors of roads and houses who used heavy machine to destroy forests. These were followed by injuries sustained from beestings, cuts from machetes, burns from naked fire, falls from trees, bites from snakes, insects, and thorns. Lack of extension and credit services from government and non governmental organization left farmers with low capital base. See table 4.12.

Table 4.12. Distribution of Respondents According to their Problem in Beekeeping in the Study Area.

Problems of Apiculturists	Frequency	Percentage
High cost of beekeeping Equipment	2	4.5
Poor roads	8	18.2
Poor market for bee products	12	27.3
Forest destruction	8	18.2
Poor honey yield	2	4.5
Lack of govt. intervention Inform of extension and credit to farmers	2	4.5
Injuries to the beekeepers	3	6.9
Total	44	100

4.8 Expectations of Beekeepers From Government.

As shown on table 4.13 about 36.4percent of the respondents wants government to control informational deficiencies, infrastructural impediments to mobility by improving condition of roads and expanding markets for bee products. They too expected government to intensify interventions in pricing systems, use price supporting, restriction and

sanction for quality control and protect resource poor farmers against market failures, risks, and uncertainties.

About 22.7 percent of them would want government to check off excessive forest destruction that depletes natural resources, particularly bee resources. They prefer the government that would ensure reserves of the necessary bee product resources to encourage bee farmers into production year round.

However, a few beekeepers were conservative and contented with the traditional bee system. Many would rather collect loans from government and receive extension training to help them improve upon their old system.

Table 4.13 **Distribution of Respondents According to their Expectations from Government**

Expectations of Beekeepers	Frequency	Percentage
Expansion and improving markets and roads	16	36.4
Promulgation of forest reserve laws	10	22.7
Organising workshops and seminars	6	13.6
Extension Service	4	9.1
Provision of credit assistance	8	18.2
Total	44	100 Source:

Field survey

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Summary

This study was conducted to economically evaluate beekeeping in Enugu State. The study aimed to: examine the socio – economic characteristics of apiculturists in Enugu state and their management practices; determine the financial and other requirements for entering into beekeeping in Enugu state and profitability of the enterprise; ascertain the effects of socio- economic characteristics of apiculturists and other factors on beekeeping enterprise; examine the marketing arrangements for the products; determine the problems of the apiculturists in beekeeping in the study area, and derive policy implications based on the findings.

Five major beekeeping Local Government Areas and markets in Enugu state were selected during the preliminary survey. A random sample of 100 respondents comprising 50 beekeepers and 50 beeproduct buyers were made. Primary data were collected using participatory observation and two pretested sets of questionnaire. Data generated

were analysed using multiple regression, t – tests, descriptive statistics and gross margin /net income.

Findings showed that traditional beekeeping was predominant in the study area. This involved traveling into forests in search of beeproducts; climbing of tall trees and killing the bees with naked fire during harvesting of bee products in the night. Only 18.2 percent of the beekeepers used modern bee technologies. However, they were not conversant with many aspects of modern beekeeping. Other beekeepers found modern beekeeping capital intensive in terms of material, finance and time inputs. They also complained that they lacked proper training assistance from governmental and non – governmental extension and agencies.

The study was examined under the following: socio – economic characteristics of the beekeepers, technology use of the beekeepers (its nature and level of technical and managerial skills of application), types and number of implements used by the beekeepers; education, age, sex, years of experience, and primary occupation of the beekeepers, labour use, distance of the hive site from market / home, and variable costs of implements. Among these variables, nature and level of technology use

and types and number of bee implements properly managed by the beekeepers had serious positive relationship with output / revenue of beeproducts.

Beekeeping in the study area was based on low capital inputs. Beefarmers depended more on personal funding and informal credit. Beekeeping was highly profitable in the study area with a gross margin of N9,059.41k.

While people of all educational background practiced beekeeping, most of the beekeepers in the study area were educated. In the same vein, people of different occupational settings were involved in beekeeping. Beekeeping is encouraged for both old and new entrants alike. The main contributing factors to output/ revenue increase were the type and number of the bee implement and the nature and level of technology use of the beekeepers. Age of the beekeepers has positive relationship with output/revenue in their active life span years (25 – 45 years).

Modern beekeeping allowed participation of all classes of people and sexes. It was less tedious and required neither climbing of tall tress nor destruction of beestocks. Rate of accidents and other risks like fire

burns, cuts from machets, bee sting, fall from tall trees and death of bees were reduced.

Traditional beekeeping involved male youths participation alone because of its stressful climbing skills. Male youths offered labour to bee owners particularly the widows, aged and incapacitated people on their beefarms. They also formed part of the family labour used in family beekeeping, hence labour cost become inputted, since no actual payment was made to value labour cost. Quality and shelf life of honey from modern beekeeping are assured and longer.

Beeproduct marketing was usually small and was not regular.. Beeproduct price was not always steady each market day. It varied between N2,500 to N3,500 per 35.5kg basin (i.e. standard measure for beeproducts). Wholesalers, retailers and consumers formed major market groups in the study are.

Poor infrastructures in terms of roads (feeder roads), marketing facilities characterised by narrowness and unsteadiness of product prices and middlemen exploitative tendencies resulting from informational deficiencies affected mobility and marketing of bee product and their profitability in the study area. Forest destruction by bush fire or earth

people and sexes to participate actively, gainfully and reduce high dependence on hired labour;

ii. Beekeeping should be supported with effective extension programme involving active training and participation of farmers in workshops, seminars, practical field demonstrations and supervision all based on modern beekeeping technology.

iii. Farmers should be convinced and encouraged to adopt improved modern packages that reduce risks and losses involved in traditional beekeeping.

iv. Credit should be made available to beefarmers to enable them procure beekeeping implements and operate on larger scales of modern beekeeping system.

v. Forest destruction by bush fire and earth moving machines should be regulated, kept in cheek to provide conducive beeloving environment for bees, hence, enacting appropriate forestry reserve laws and edicts will be helpful..

Above all, government should provide and always maintain good infrastructures, such as good roads (feeder roads) to and from apiary site

and markets for easy mobility and disposal of resources to and from the apiary markets.

5.4 **Areas Needing Further Research**

Research should be conducted in the following areas.

- Modern technology adoption needs of bee farmers in Enugu state of Nigeria;
- Training needs of bee farmers on record keeping in apiculture in Enugu state;
- Profitability of modern beekeeping in Enugu state of Nigeria; and
- Expansion and improvement needs of bee product market in Enugu State.

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QUESTIONNAIRE FOR BEEKEEPERS

Please tick ( ) where appropriate.

(A) General Socio – economic characteristics of beekeepers.

(1) Town or Village

(2) Local Government Area.

(3) Sex male or female

(4) What is your occupation

(a) Primary occupation .....

(b) Secondary occupation.....

(5) Your educational Background

(a) No formal education

(b) Attempted primary school 16years

(c) Completed primary school

(d) Attempted Secondary school J.S.S

(e) Completed Secondary school S.S.S

(f) Tertiary institution

(g) Others please specify.

(6) Age of the beekeepers.

(a) 20 years or less

(b) 21 – 30 years

(c) 31 – 40

(d) 41 – 50

(e) Above 60 years

(7) Marital status

(a) Single

(b) Married

(c) Divorced

(d) Widow

(8) Family size

(a) 1-5 members

(b) 6-10 members

(c) 11 –15 members

(d) Above 15 years

(e) Others please specify.

MANAGEMENT PRACTICES

(9) How many years have you been into beekeeping

(a) less than 5 years

(b) 5 years

(c) 6 years

(d) 7 years

(e) 8 years

(f) 9 years

(g) Above 9 years

(10) How did you get into and learn beekeeping?

(a) By observing and harvesting bee product from willd bee colonies around.

(b) By protecting beecolonies in your farm and in the forest.

(c) By providing artificial home (hives) for bees on farms and in the forest.

(d) Were taught and traning by other beekeepers.

(e) Other specify.

(11) Have you undergone any training since you entered into beekeeping Yes / No

(12) If your answer to question (11) is yes, who organised the training for your?

(a) Government.

(b) Group of beekeepers or bee farmers association.

(c) Bee product buyer association

(d) Agencies on beekeeping.

(e) Óthers please specify.

(13) How many times have you attended the training.

(a) Less than 5 times

(b) 5 – 10 time

(c) 11 – 15 time

(d) other please specify

(14) Is your business improved by your training?

(a) Yes

(b) No

(c) Do not know

(15) Which of these types of beehives below do you use in your bee farm?

(a) Modern hive frame.

(b) Gourd

(c) Log

(d) Pottery

(e) Clay pot

(f) Others please specify

FINANCIAL ASSESSMENT OF BEEKEEPING IN THE STUDY AREA (EXPENSES)

(16) How many beehives do you have on different position of your farm?

(a) less than 5 hives

(b) 5 – 10 hives

(c) 11 - 15 hives

(d) 16 - 20 hives

(e) 21 - 25 hives

(f) Above 25 hives

(17) Other materials you use in beekeeping are:

Specify the quantity of each

Langstroth modern frame hive

Smoker

Hive tool

Hive stand

Bee veil

Bee suit

Rain boot

Sugar syrup/palm wine

Head Gloves

Basin

Bucket

Local clay pot

Ladder

Rope

Light / match

Small axe

Logs

Bicycle

Naked fire

(18) How much did you buy each of the item indicated.

(19) How many of these items do you have? Indicate each.

(20) How many of them have you repaired since use?

What number was bought?

(21) How many of them have you replaced since use?

At what amount?

(22) What are your sources of initial capital

SOURCES	AMOUNT (N)
(a) Bank loan	
(b) Isusu Age Grade	
(c) Gifts from friends	
(d) Personal Savings	
(e) Inheritance	

(23) What is the source of labour in your farm?

(a) Family labour

(b) Hired labour

(c) Self labour

(d) Leased share labour

(e) Joint labour

(24) How much over all did you spend to hire labour on your bee farm

N.....

(25) How far is the apiary from your home or market.

(a) less than 1km

(b) 1 km – 2 km

(c) 3 km – 4km

(d) others (specify) in km.

(26) By what means do you transport your product or go about business

(a) Bicycle

(b) Okada

(c) Motor

(d) Head portrage

(e) Wheel barrow

(f) Others please (specify)

OTHER APIARY EXPENSES

(27) How much did you spend in (N) on.

Processing you beeproduct

Storing your beeproduct.

Transporting your beeproduct from hive site to market or your home.

Harvesting your beeproducts.

Installing the hives.

Controlling diseases/pet in the colonies etc.

Controlling swarms.

(28) What was the overall amount of money you spend to be into beekeeping?

(a) Less than N2,500

(b) N2,500 – N3,000

(c) N3,100 – N3,500

(d) N3,600 – N4,600

(e) Above 4000

(29) Which of the following management practices do you carry out in your farm and how often?

	Do you do it? Not at all	Always	Not always
(a)	Hive inspection		
(b)	Record keeping		
(c)	Swarm control		
(d)	Feeding		
(e)	Colony enlargement/ uniting		
(f)	Beeproduct harvesting by crub collection		
(g)	Baiting swarm		
(h)	Collection of colony from wild nest		

(30) How long does it take you to install each of your hive (a) 1 – 2 hrs (b) 2 – 3 hrs (c) 3 – 4 hrs. (d) above 4 hrs.

(31) How many times do you inspect your hive (a) once (b) two (c) more than twice in a month.

(32) Each inspection takes you how long (a) 1 – 2hrs. (b) 3 hrs. (c) 2 – 3hrs (d) 3 – 4 hrs.

	Do you do it?	**Always**	**Not always**	**Not at all**
(i)	Hive protection			
(j)	Supering hives			
(k)	Providing water for the bees			
(l)	Controlling bee disease/ pests			
(m)	Siting hive on tree branches or Hive stand			
(n)	Monitoring swarm			
(o)	Use of naked fire during harvesting			

(p)	Use of smoker during harvesting			
(q)	Use of chemical during harvesting			
(r)	Provision of conducive bee loving enviroment.			

(33) When and how often do you harvest your beeproduct?

(a) Monthly

(b) Every two months

(c) Once in six months (honey flow period)

(d) Twice in a season (honey flow period)

(e) Others please (specify).

(34) How many hours do you spend per harvesting period

(a) Less than an hour

(b) 1 – 2 hours

(c) 3 – 4 hours

(d) 5 – 6 hours

(e) Above 6 hours

(35) How many basins of beeproducts do you get per harvesting period of

(a) less than a basin

(b) 1 – 5 basin

(c) 6 – 10 basin

(d) 11 – 15 basin

(e) others please specify

(36) In which month of the year do you get the largest quantity of honey.

(a) Month of October

(b) Month of November

(c) Month of December

(d) Month of January

(e) Month of February

(f) Other please (specify)

(37) What period of the day do you find more conducive and more rewarding for harvesting.

In the day time

In the night

Others please (specify)

(38) How do you prepare your beeproduct for sale?

(a) Sold in combs

(b) Processed before sale

(c) Other please (specify)

MARKETING ARRANGEMENT

(39) Where do you sell your honey?

(a) In the market

(b) Farm / home

(c) Others please (specify)

(40) How far was the market from your house?

(a) less than 1 km

(b) 1 km – 2 km

(c) 3 km – 4 km

(d) others please (specify)

(41) To whom do you normally sell your products.

(a) Wholesalers, who buy in larger quantity

(b) Retailers who buy and sell is small quantity.

(c) Consumers who buy for their own use.

(d) Others please (specify)

(42) What was the measure for your beeproducts.

(a) Bottle

(b) Gallons

(c) Bucket

(d) Basins

(e) Others please (specify)

(43) How many quantities of beeproducts in basin did you sell during the honey flow of these periods?

1998.....

1999.....

(44) What was the selling price per basin in

1998.....

1999.....

(45) How did you arrive at the price which you sold your beeproduct? It was:

(a) Fixed by you arbitrarily

(b) Fixed in consideration of input costs and other apiary expenses incurred.

(c) Fixed based by market prevailing market price.

(d) Fixed through bargaining with customers.

(e) Others please (specify)

(46) Did you consider the price fair enough to make you increase the quantity of your harvest / supply?

(a) Yes

(b) No

(c) Do not Know

(47) What was the over all income made from the sale of beeproducts in the years.

1998.....

1999.....

(48) What was the average income made from the sale of the following years

1998.....

1999.....

(49) Were you able to balance up your expenses with revenue from sale of beeproducts in 1998, 1999?

(50) Did you have any surplus income after settlement of expenses?

(a) Yes

(b) No

(51) If the answer to question 50 is yes, How much was surplus in 1998, 1999

PROBLEMS OR CONSTRAINTS TO BEEKEEPING IN THE STUDY AREA

(52) What are the major problems you encounter in managing your beecolonies?

(a) High costs of beekeeping equipment and transportation.

(b) Bees are too aggressive to handle and they sting.

(c) No suitable environment to keep bee because of forest destruction by burning of bushes and clearing for farming and building.

(d) Honey yield is very poor.

(e) Poor prices for beeproduct at the local markets.

(f) Others please (specify)

(53) What do you think are the solution to the problems of beekeeping ?

Government to :

(a) Give you loans to expand your beekeeping operation.

(b) Send extension agents to train you in beekeeping

(c) Provide ready market for beeproducts.

(d) Instituting and promulgating bye- law decree to guide forest use.

(e) Expand and provide market facilities.

(f) Others please (specify)

(54) Are you satisfied with the way beekeeping and marketing of beeproducts are done in your area.

(a) Yes

(b) No

(55) Please suggest way to improve beekeeping and beeproduct marketing in your area.

Thanks.

QUESTIONNAIRE FOR HONEY WHOLESALERS AND RETAILERS

Please Tick ( ) for the correct answer or fill in detail as appropriate.

1. Name of market?_____

2.Name of town or Village?_____-----_____

3. Local Government Area? _____

4. Occupations?_____

5a. Primary Occupation_____

b. Secondary Occupation _____

6. Marital Status?_____

a. Married_____

b. Single _____

c. Divorced_____

d. Age?_____

Less than 20 years

21 – 30 years

31 – 40 years

41 – 50 years

Above 50 years

7. Family Size?_____

a. 1 – 5 pers

b. 6 – 10 pers

c. 11 – 15 pers

d. Others please (specify)

MARKETING ARRANGEMENT FOR HONEY AND BEEWAX (FARMERS' PRODUCTS:

8. What is a your direct source of honey supply from?

a. Own bee farm

b. Other bee keepers

c. Other honey buyers

d. Others please (specify)

9. What is the quality of the honey you buy

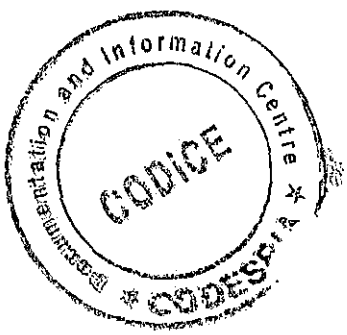
a. Very good quality

b. Good quality

c. Poor quality

d. Very poor quality

e. Average quality



10. Do you get enough quantity of honey for year business?

a. Yes

b. No

11. If the answer to question 10 is No, what is your reason for not getting enough?

a. High cost of honey

b. Do not have enough money to buy

c. Farmers do not supply enough

d. Others please (specify)

12. What quantity of honey do you actually buy each time?

a. Less than 5 basins

b. 5 – 10 basins

c. 11 – 15 basins

d. 16 – 20 basins

e. 21 – 25 basins

f. Above 25 basins

13. Where do you sell your honey?

a. In your home

b. In the market

c. At the place of purchase with little gain]

d. Others please (specify)

14. What is the measure of your honey for sale?

a. A bottle_____

b. A gallon_____

c. A 25 liters – big gallon_____

d. Others please (specify)

15. How much do you sell

Sell in bottles N_____

A gallon if you sell in gallon N_____

A 25 liter big gallons if you are a wholesales N_____

16. Give the average selling price of your honey in

YEAR	QTY (IN GALLON) 25 LITERS	PRICE (N)
1998		
1999		

17. How many 25 liter gallons do you get from a basin of honey?

a. One 25 liter gallon

b. 2 – 5 .25 liter gallons]

c. Others please (specify)

18. How did you arrive at the price at which you sell your honey?

a. Fix your price arbitrarily

b. Fix price is consideration of purchasing price and other expenses

c. Fix price based on market condition of supply and demand

d. Fix price through bargaining with buyers

e. Fix price by honey sellers associations

f. Others please (specify)

19. What quantity of honey in gallons did you by (25 liter gallon) on sell in the years?

YEAR		UNIT PRICE IN ₦
a. 1998	Gallons	
b. 1999	Gallons	

20. To which of the following group of honey sellers do you belong?

a. Wholesalers

b. Retailers

c. Consumers

d. Others please (specify)

B. MARKETING COSTS

21. How did you transport your honey to the place of sale?

a. By wheel barrow

b. Carry in on head by foot

c. By bicycle

d. Motor transport

e. Others please (specify)

22. What was the average monthly transport charged per gallon (including loading and off loading in the following years

YEARS	QTY IN GALLONS	COST IN ₦
1998		
1999		

23. What was the cost of an empty gallon in

1998 in ₦

_____

1999 in ₦

_____

24. Do you do any form of honey processing?

    a. Yes

    b. No

    c. Others please (specify)

25. If yes, what was the average monthly cost for processing in the year.

YEARS	TY IN GALLONS	COST IN ₦
1998		
1999		

26. What was the average buying price per a basin of honey bought in the years.

YEARS	QTY IN GALLONS	COST IN ₦
1998		
1999		

27. Do you belong to any associations of honey sellers?

    a. Yes

    b. No

c. Others please (specify)

28. If yes what is the name of your Association?

_____

29. How much is the Annual dues you pay in ₦_____

30. Is there any local rate you pay at your place of sale

a. Yes

b. No

c. Others please (specify)

31. If yes, how much is the pay per month in N_____?

32. What other type of costs did you run in N _____?

33. Do you pay any form of local government rate, tax at the place of purchase?

34. Are you satisfied with the system of honey marketing operating in your locality ?

a. Yes

b. No

c. Others please (specify)

35. Please suggest what should be done to improve money marketing in your area?

Thank you.

A modern Beehive hung on tree branch with chains at the Zoological Garden of University of Nigeria Nsukka

A modern Beehive elevated on bricks at the Zoological Garden of University of Nigeria Nsukka with termite attack causing the bees to abscond